# Environment Southland Independent Monitoring Programme

## Coastal Marine Area (CMA) Investigation Tiwai Point

Prepared for:

Environment Southland

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# Acronyms

| | |
|---|---|
| $^{o}$C | degrees Celcius |
| AEE | Assessment of Environmental Effects |
| bgl | below ground level |
| BTOC | below top of casing |
| BWC | bottom water column |
| CMA | coastal marine area |
| COC | constituents of concern |
| COPEC | contaminants of potential environmental concern |
| CSM | conceptual site model |
| DSI | Detailed Site Investigation |
| EC | electrical conductivity |
| EF | enrichment factors |
| GHD | GHD New Zealand Ltd. |
| GWCNZ | Groundwater Consultants New Zealand Ltd. |
| HMW | high molecular weight (PAHs) |
| HQ | hazard quotients |
| LMW | low molecular weight (PAHs) |
| MfE | Ministry for the Environment |
| NOD | North Outfall Drain |
| NZAS | New Zealand Aluminium Smelters Ltd. |
| NZHP | New Zealand Heritage Properties Ltd. |
| OC | organic carbon |
| PAH | polycyclic aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| PSD | particle size distribution |
| PSI | Preliminary Site Investigation |
| QA/QC | Quality Assurance/Quality Control |
| RPD | relative percent difference |
| SAP | Sampling and Analysis Plan |
| SAQP | Sampling and Analysis Quality Plan Summary |
| SOD | South Outfall Drain |
| TEQ | toxic equivalency quotient |
| TOC | total organic carbon |
| TPH | total petroleum hydrocarbons |
| TWC | top water column |
| SCL | spent cell lining |
| URS | URS New Zealand Ltd. |

## Units of Measure

| **Area** | |
|---|---|
| ha | hectare |
| $m^2$ | square metres |
| **Density** | |
| $kg/m^3$ | kilograms per cubic metre |
| **Electrical Conductance** | |
| µS/cm | microsiemen per centimetre |
| dS/m | decisiemen per metre |
| mS/cm | millisiemen per centimetre |
| mV | millivolt |
| **Length** | |
| µm | micrometre |
| cm | centimetre |
| km | kilometre |
| m | metre |
| mm | millimetre |
| **Mass** | |
| µg | micrograms |
| g | gram |
| kg | kilogram |
| mg | milligram |
| t | metric tonne |
| **Concentration by Mass** | |
| µg/kg | microgram per kilogram |
| mg/kg | milligram per kilogram |

| **Pressure** | |
|---|---|
| kPa | kilopascals |
| Pa | Pascals |
| **Temperature** | |
| °C | degrees Celsius |
| °F | degrees Fahrenheit |
| K | kelvin |
| **Velocity** | |
| m/s | metres per second |
| **Volume** | |
| µL | microlitre |
| cL | centilitre |
| $cm^3$ | cubic centimetre |
| GL | gigalitre |
| L | litres |
| $m^3$ | cubic metre |
| mL | millilitres |
| ML | megalitre |
| **Concentration by Volume** | |
| µg/L | microgram per litre |
| mg/L | milligram per litre |
| ppmv | parts per million by volume |
| ppbv | parts per billion by volume |

# Periodic Table

| Element | Symbol |
|---|---|
| Actinium | Ac |
| Aluminum | Al |
| Americium | Am |
| Antimony | Sb |
| Argon | Ar |
| Arsenic | As |
| Astatine | At |
| Barium | Ba |
| Berkelium | Bk |
| Beryllium | Be |
| Bismuth | Bi |
| Bohrium | Bh |
| Boron | B |
| Bromine | Br |
| Cadmium | Cd |
| Calcium | Ca |
| Californium | Cf |
| Carbon | C |
| Cerium | Ce |
| Cesium | Cs |
| Chlorine | Cl |
| Chromium | Cr |
| Cobalt | Co |
| Copernicium | Cn |
| Copper | Cu |
| Curium | Cm |
| Darmstadtium | Ds |
| Dubnium | Db |
| Dysprosium | Dy |
| Einsteinium | Es |
| Erbium | Er |
| Europium | Eu |
| Fermium | Fm |
| Flerovium | Fl |
| Fluorine | F |
| Francium | Fr |
| Gadolinium | Gd |
| Gallium | Ga |
| Germanium | Ge |
| Gold | Au |
| Hafnium | Hf |
| Hassium | Hs |
| Helium | He |
| Holmium | Ho |
| Hydrogen | H |
| Indium | In |
| Iodine | I |
| Iridium | Ir |
| Iron | Fe |
| Krypton | Kr |
| Lanthanum | La |
| Lawrencium | Lr |
| Lead | Pb |
| Lithium | Li |
| Livermorium | Lv |
| Lutetium | Lu |
| Magnesium | Mg |
| Manganese | Mn |
| Meitnerium | Mt |
| Mendelevium | Md |
| Mercury | Hg |
| Molybdenum | Mo |
| Neodymium | Nd |
| Neon | Ne |
| Neptunium | Np |
| Nickel | Ni |
| Nihonium | Nh |
| Niobium | Nb |
| Nitrogen | N |
| Nobelium | No |
| Oganesson | Og |
| Osmium | Os |
| Oxygen | O |
| Palladium | Pd |
| Phosphorus | P |
| Platinum | Pt |
| Plutonium | Pu |
| Polonium | Po |
| Potassium | K |
| Praseodymium | Pr |
| Promethium | Pm |
| Protactinium | Pa |
| Radium | Ra |
| Radon | Rn |
| Rhenium | Re |
| Rhodium | Rh |
| Roentgenium | Rg |
| Rubidium | Rb |
| Ruthenium | Ru |
| Rutherfordium | Rf |
| Samarium | Sm |
| Scandium | Sc |
| Seaborgium | Sg |
| Selenium | Se |
| Silicon | Si |
| Silver | Ag |
| Sodium | Na |
| Strontium | Sr |
| Sulfur | S |
| Tantalum | Ta |
| Technetium | Tc |
| Tellurium | Te |
| Tennessine | Ts |
| Terbium | Tb |
| Thallium | Tl |
| Thorium | Th |
| Thulium | Tm |
| Tin | Sn |
| Titanium | Ti |
| Tungsten | W |
| Ununoctium | Uuo |
| Ununpentium | Uup |
| Ununseptium | Uus |
| Ununtrium | Uut |
| Uranium | U |
| Vanadium | V |
| Xenon | Xe |
| Ytterbium | Yb |
| Yttrium | Y |
| Zinc | Zn |
| Zirconium | Zr |

# Executive Summary

Environment Southland (ES) commissioned an independent assessment of the Coastal Marine Area (CMA) surrounding the New Zealand Aluminium Smelter (NZAS) Tiwai Point aluminium smelter facility. This assessment was successfully completed by EHS Support New Zealand Ltd ("EHS Support") in January and February 2023, with supplementary work undertaken in early May 2023.

NZAS holds a suite of resource consents regulating its operation of the smelter facility, which includes consented discharge of contaminants into the marine environment adjacent to the facility. The purpose of the CMA monitoring completed by EHS Support was to obtain an understanding of the state of the environment in the CMA adjacent to the NZAS facility.

The assessment work comprised targeted investigation of key areas around the perimeter of the NZAS facility where the transport of contamination from the facility into the receiving environment is believed to be occurring or may have occurred historically. The key areas investigated comprised:

- Bluff Harbour downgradient of the north drain, west drain, and south drain (and associated foreshore areas).
- Foveaux Strait and Bluff Harbour adjacent to the NZAS Landfill (including the Haysoms Dross Storage area) and associated foreshore areas.
- Foveaux Strait downstream and adjacent to the Inalco and SCL pad areas and foreshore areas.

The CMA assessment has established a good understanding of the mechanisms (and complexities) by which contamination is migrating from the wider NZAS facility and into the broader receiving environment, has identified areas for further assessment, and opportunities for environmental improvement. The assessment has leveraged historic and recent environmental investigation work undertaken by NZAS. This work has provided an understanding of the on-site contamination conditions and contaminant discharges.

The key findings from the CMA assessment are as follows:

1. Sources of contamination exist within operational areas of smelter (as recorded in the NZAS detailed site investigation of the site and the landfill) that have generated wide-spread groundwater contamination that is discharging into the CMA.
2. The scale and nature of the contamination recorded in the CMA is less than expected given the age and extent of the NZAS operation(s). Potential adverse environmental effects may arise from contaminant discharges into Bluff Harbour, while potential effects within Foveaux Strait are likely to be less. The nature of the Bluff Harbour and Foveaux Strait receiving environments are different, however they both attenuate contaminant discharges to varying degrees.
3. The lateral extent of the groundwater contamination plume discharging from the landfill to Foveaux Strait is extensive (approximately 1 km wide) with the effects from this discharge currently being assessed through the re-consenting of the NZAS landfill.
4. Discharges of contaminants occur via the consented stormwater drains (above environmental screening values [ESV's]) posing potential chronic and acute effects to ecological receptors. The CMA assessment has not quantified the mass of the contaminant discharge (with the sediment discharge being carried out from the facility drains into the wider environment of Bluff Harbour).
5. Potential acute environmental effects occur during first flush stormwater events from the north drain with fluoride contamination potentially impacting ecological receptors including

fish and benthic invertebrates and aluminium contamination potentially impacting benthic invertebrates. Further work is warranted to identify if similar discharges exist at the west drain and south drain.

6. The CMA monitoring has shown there are first flush stormwater discharges from the north drain that extend beyond the mixing zones at concentrations greater than environmental screening values and consented limits. Sediment and pore water concentrations above environmental screening values extend beyond the mixing zones of the north drain and are not captured by the consent.
7. The results from the CMA assessment work suggest there are unlikely to be higher order or human health risks via contaminant bioaccumulation through the food chain. This determination requires further biological testing to provide a more affirmative conclusion.
8. Mass loadings and impacts to Bluff Harbour may have been exacerbated by drain sediment movement practices (currently undertaken as a Permitted Activity) where materials (including contaminated spoil) are spread above the low tide mark and may distribute sediment contamination further into the harbour than under normal depositional conditions. Further assessment work is required to assess this activity and the risks.
9. Groundwater discharges are occurring within the smelter domain and SCL pad areas that exceed groundwater environmental screening values. Whether this groundwater contamination discharge is posing a risk to Bluff Harbour and Foveaux Strait requires further study and will, in part, depend on cumulative effects of groundwater and stormwater/process water contamination discharges.
10. The scope of the CMA assessment was not able to fully assess the likely nature and extent of potential environmental effects within the CMA receiving environments down gradient of the landfill, Inalco area, and SCL pad area within Foveaux Strait. It is anticipated that complex geochemical processes will be occurring at the interface of the groundwater/leachate discharges and the receiving marine environment(s) at a greater distance/depth into Foveaux Strait than was achieved by the CMA work. This requires further consideration/work to assess potential risk(s) and is in part being addressed by the NZAS landfill consent application.
11. It is clear from the work undertaken that concentrations in various media exceed ecological screening values within the CMA to the west of the landfill (in Bluff Harbour). These effects are being assessed by the NZAS landfill consent application.
12. Soil contamination along most foreshore areas investigated recorded contaminant concentrations that could pose a potential terrestrial ecological risk (notably south and west drains, east landfill area, Inalco area, and SCL pad area).
13. The CMA assessment recorded similar contaminant concentrations in groundwater to the routine groundwater monitoring work undertaken by NZAS (in selected wells) and provides confidence in the integrity of this routine sampling work.
14. The CMA assessment of the stormwater discharge sampling suggests that the consent stormwater sampling is potentially under reporting contaminant concentrations beyond the mixing zone during certain flow conditions and does not address sediment or pore water contamination within the drains and broader receiving environment.
15. Given the ease of public access to Bluff Harbour and the discharge points for the stormwater drains measures should be implemented to warn the public of potential risk(s) associated with the discharge(s).
16. To improve the environmental performance of the smelter operations and reduce contaminant discharges, NZAS should focus on the following issues:
    a. Routine operation/housekeeping changes will yield improved stormwater quality and reduced groundwater contamination discharges.
    b. The establishment of retention/detention facilities that will facilitate the deposition of sediment prior to discharge to the receiving environment.

c. Improvements to waste handling and storage within the smelter domain (such as refractory bricks stored on an unsealed area and dust management) will yield improved stormwater quality and reduced groundwater contamination discharges.
d. Landfill capping will reduce groundwater contamination.
e. Improved maintenance of stormwater collection systems and focused/performance based environmental monitoring will yield improved stormwater quality. The drain mouth clearing process requires further assessment.

# 1 Introduction and Background

## 1.1 Introduction

EHS Support New Zealand Ltd ("EHS Support") has been retained by Environment Southland (ES) to provide technical assistance to support their management of the New Zealand Aluminium Smelters Ltd (NZAS) Tiwai Point manufacturing facility ("Site"). An independent assessment of the coastal marine area (CMA) that immediately surrounds the NZAS facility was identified as a key work task by ES in 2022 and EHS Support was commissioned to complete this work in late 2022. The CMA assessment has focussed on key areas where discharge(s) from the NZAS Site to the CMA may have occurred historically and/or could be occurring during current operations, namely:

- Downstream of the three stormwater drains (north, west, and south drains) that carry stormwater and process water from the smelter domain and discharge into the Bluff Harbour.
- Within Foveaux Strait and Bluff Harbour that abut and are downstream of the NZAS Landfill.
- Within Foveaux Strait that abuts and is downstream of the Inalco Processing Area (within the smelter domain) and Spent Cell Lining (SCL) Pad.

The locations of the CMA areas investigated are shown in **Figure 1**. Background locations (within Awarua Bay and Foveaux Strait) were also investigated, following discussions with ES on suitable locations, as part of the CMA assessment.

Environmental screening values (ESV's) were developed for various media to support the CMA assessment (as presented in **Appendix A**) and are discussed in **Section 5.2.1**.

This report presents the results from the independent CMA assessment and is structured as follows:

- Section 1– Introduction, Background and CMA Assessment Objectives.
- Section 2 – Site Setting. This section provides an overview of the environmental setting, Site history, and Site geology and hydrogeology.
- Section 3 – Initial Conceptual Site Model (CSM) and Legacy Environmental Investigations. This section presents an initial CSM for the NZAS facility and provides a review (based on spatial areas) of legacy environmental investigation and monitoring programmes.
- Section 4 – CMA Investigation Activities. This section summarises the field work programme.
- Section 5 – CMA Results. This section presents an overview of the field results and laboratory testing.
- Section 6 – CMA Results Discussion. This section describes and assesses the results against the screening values (SVs).
- Section 7 – Data Gaps and Uncertainties. This section highlights and discusses the key data gaps that still exist post completion of the CMA work and the uncertainties associated with the data.
- Section 8 – Revised Conceptual Site Model and Potential Risks. This section presents a revised CSM for the CMA area and considers (within the bounds of the study) the potential human health and environmental risks posed by the contamination.
- Section 9 – Smelter Management Issues. This section presents a range of options for improved environmental performance on the basis that independent advice has been sought.
- Section 10 – Summary and Conclusions.

- Section 11 – Limitations.
- Section 12 – Presents a summary of the key EHS Support staff and other support personnel involved with the CMA investigation.
- Section 13 – References.

This report is subject to the limitations presented in **Section 11**.

## 1.2 Background, Context, and CMA Assessment Objectives

Prior to and since operations commenced at the NZAS facility in 1971, NZAS has undertaken a range of environmental monitoring work on and off the Site to support resource consent applications, comply with resource consent conditions, and monitor environmental performance and discharges to the environment. It is understood that most of the results from this environmental assessment and monitoring work have been supplied to ES, and NZAS has recently made some of this information publicly available through their website.

In 2020, NZAS announced the potential closure of the smelter. To support this process, GHD New Zealand Ltd ("GHD") was retained by NZAS to undertake contaminated land assessment work within the smelter domain (excluding the NZAS Landfill, SCL pad, and CMA areas). The work and findings have been described in the following documents:

- NZAS Closure Preliminary Study. Contaminated Sites Preliminary Site Investigation Report (PSI). GHD. January 2021. (GHD, 2021a).
- NZAS Closure Preliminary Study – Sampling and Analysis Quality Plan Summary (SAQP). GHD. 7 April 2021. (GHD, 2021b).
- NZAS Closure Preliminary Study. Contaminated Sites Detailed Site Investigation Report (DSI). GHD. August 2021. (GHD, 2021c).

The SAQP was supplied to ES in April 2021 and the DSI was supplied on 11 August 2021. In late September 2021, EHS Support commenced a formal review of the SAQP and DSI which was supported by a site inspection in late 2021. EHS Support submitted the SAQP and DSI review report to ES on 13 September 2022 (EHS Support, 2022a).

The PSI, dated January 2021, is referenced in the DSI but was not supplied to ES with the DSI in August 2021. Rather, the PSI was supplied to ES in late February 2022; therefore, the review of the SAQP/DSI was undertaken without reference to the PSI. EHS Support has since reviewed the PSI and draft review findings were presented in the EHS Support report dated 21 April 2023 (EHS Support, 2023).

During the SAQP/DSI review, NZAS also supplied several historical contaminated Site investigation reports pertaining to the NZAS manufacturing facility, off-site environmental monitoring reports, and reports on waste disposal facilities (notably the landfill and the SCL waste pad). A number of these reports are referenced in the DSI. These reports were received by ES in late October 2021 and have since been reviewed by EHS Support. While historical investigation and compliance monitoring reports were available and reviewed, it should be noted that these data have not been supplied to ES in a single and comprehensive database which would enable a more holistic assessment of Site conditions, contaminant distribution, and historical trends.

These historical reports have provided invaluable information to support the assessment of Site contamination. The key findings from the review of the smelter domain PSI and DSI were as follows:

- The DSI was an initial contamination assessment of the manufacturing Site. The report stated that it aimed to provide an initial “snapshot” of the contamination status within the smelter domain. NZAS acknowledged that the DSI report provided a broad initial assessment of contamination within the manufacturing plant area and that additional investigation work would be required to support remediation of the Site and compliance with environmental regulations.
- The DSI (and the PSI to a lesser extent) did not focus on the NZAS Landfill and SCL pad areas or the CMA around the wider smelter facility (except for sediment sampling within the stormwater drains). This was noted as a critical data gap in the assessment of the wider facility.
- Most of the data contained in the legacy NZAS reports was not fully integrated into the DSI findings. This was also noted as a critical data gap and was needed to build a robust CSM for the wider Site area.
- An assessment of both discrete (point source) and passive discharges from the Site is required to determine mass loadings and potential risks in the receiving environment. This is particularly important for organic and inorganic constituents that have the potential for bioaccumulation and/or to bio-magnify.
- The assessment of human health and ecological risks needs to consider all sources, pathways, and exposure scenarios to provide a determination on the acceptable level of human and ecological risks. Furthermore, several of the constituents of potential concern are persistent and/or bio accumulative.
- Appropriate ecological screening criteria were needed to evaluate the significance of potential contaminant exposures to the receiving environment (terrestrial and aquatic).

The NZAS landfill holds a resource consent that expires on 8 December 2023 (Consent No: 202196). During pre-application meetings for this consent in December 2022 and January 2023 (and other ES/NZAS meetings), NZAS indicated that a significant amount of additional environmental investigation work was being undertaken on the wider NZAS facility and the CMA to better understand the nature and extent of contamination and potential effects. At the time of preparing the bulk of this report, while ES had requested these data from NZAS, other than high level summary data presented at meetings, the results from this work were not provided to ES. NZAS/GHD lodged their consent application for the landfill on 26 May 2023 (GHD, 2023). The assessment of environmental effects and supplementary documents have been reviewed and select data from these reports are included in this report.

To enable ES to fulfil its regulatory obligations, particularly to assist with managing the various NZAS resource consents and assessing potential off-site environmental and human health risks, ES identified the need to complete an independent assessment of the CMA surrounding the NZAS facility. The objectives of the independent CMA assessment are described in **Section 1.2.1**.

### 1.2.1 CMA Assessment Objectives

As noted above, NZAS historically invested heavily in comprehensive studies at the Site (principally in the 1990s and early 2000s). This work established a strong baseline understanding of constituent concentrations in the marine receiving environment. It is EHS Support’s understanding that no comprehensive assessment of the foreshore areas has been conducted to date (acknowledging that all the investigations commissioned by NZAS have not been sighted). Instead, studies have typically been conducted to support resource consent applications, with the most recent studies completed in 2001, 2005 and 2023 (Stevens and Barter, 2005; Depree, 2001; GHD, 2023). Findings from these legacy studies, compliance monitoring within groundwater monitoring wells around the landfill (reported in the Annual Reports submitted to ES), recent work completed by GHD and EHS Support and the GHD landfill consent application (GHD, 2023) indicate the presence of contaminants of potential environmental concern (COPEC) at concentrations above relevant and applicable criteria in Site media (i.e., soil, sediment, groundwater, and surface water). The presence and magnitude of these impacts indicates that further evaluations of potential ecological and human health risks (associated with historical and current facility operations at NZAS) are required.

In particular, the GHD investigations identified complete exposure pathways to aquatic and terrestrial receptors (GHD, 2021c). For the marine setting, this would be associated with direct contact toxicity or dietary exposure pathways of aquatic organisms to COPECs (benthic organisms [e.g., mussels, invertebrates] and pelagic organisms [e.g., fish], and semi-aquatic birds). In the foreshore, this would be associated with direct contact or dietary exposure pathways of terrestrial organisms to COPECs (e.g., plants, invertebrates, soil processes, and predominately birds). For some contaminants (e.g., polychlorinated biphenyls [PCBs]), indirect exposures associated with bioaccumulation and biomagnification within the food chain are also a concern.

Based on information supplied as part of the EHS Support review of the GHD investigation work and supplementary information supplied by NZAS, it has become apparent that a more robust and integrated assessment of Site sources, migration pathways, and receptors is needed in terms of pathway completeness and exposure assessment. To this end, EHS Support developed a programme of work for ES that would provide insight into the nature of the CMA receiving environment and concentrations of COPECs within key areas surrounding the NZAS facility.

The scope of the work for this study was defined in the EHS Support proposal dated 11 November 2022, and an investigation methodology was presented in the draft Foreshore and Intertidal Multi-Matrix Sampling and Analysis Plan (SAP) that was issued to stakeholders (including NZAS) for review in late November 2022 (EHS Support, 2022b).

The SAP was finalised and endorsed in early January 2023 and the field work programme was undertaken from mid-January through early February 2023. Supplementary field work was undertaken in early May 2023 in the areas of the north, west and south drains.

The key EHS Support objectives of the CMA programme were as follows:

- Provide an independent assessment of contamination conditions at key perimeter locations around the NZAS smelter complex with a focus on areas where contaminants may be transported into the receiving environment.
- Establish the concentration of COPECs within the receiving environment.
- Identify any potential environmental risks posed by the COPECs and potential human health risks, principally through food gathering.
- Identify opportunities for improved environmental operational practices within the smelter complex.
- Verify the integrity of the routine groundwater and surface water sampling work being performed by NZAS.

To address the above objectives, the CMA field programme comprised the following tasks and focussed on the key assessment areas presented in **Figure 2**:

- Conduct initial focused aquatic sampling of sediment, sediment pore water, and surface water in the intertidal areas of:
    - Bluff Harbour downgradient of the north drain, west drain, and south drain;

  - Foveaux Strait and Bluff Harbour adjacent to the NZAS Landfill (including the Haysoms Dross Storage area); and
  - Foveaux Strait downstream and adjacent to the Inalco area and SCL pad areas.
- Conduct initial focused soil sampling in foreshore areas adjacent to the assessment areas listed above.
- Collect coincident groundwater samples from NZAS groundwater monitoring wells adjacent to the key CMA areas and install data-loggers to gain temporal groundwater level and electrical conductivity data.
- Identify and assess a representative background of sediment, surface water, sediment pore water, and soil conditions. **Figure 3** displays the location of the background sampling areas relative to the CMA assessment area.

# 2 Site Setting

The following section summarises the environmental setting, Site history, and geological and hydrogeological conditions of the Tiwai Peninsula.

## 2.1 Environmental Setting

The Tiwai Peninsula lies approximately 20 km south of Invercargill and comprises a mass of beach ridges extending east from Tiwai Point. The peninsula encloses Awarua Bay and Bluff Harbour to the north from Foveaux Strait to the south as shown in **Figure 1** (attached).

South Port New Zealand Ltd is located close to the entrance of Bluff Harbour (directly west of the NZAS facility) with the large, low-lying eastern arm, Awarua Bay, immediately to the east of the promontory. The wider Bluff Harbour and Awarua Bay receive discharges from various agricultural and industrial operations, as well as wider and more general run-off from roads, residential areas etc.

The Peninsula covers an approximate area of 2,400 ha and typically lies at an elevation of approximately 5 m to 10 m above mean sea level. The width of the peninsula varies between approximately 0.5 km in the NZAS Landfill area (close to Tiwai Point) to approximately 2.25 km east of the smelter domain.

Many features within the peninsula (e.g., sand dunes, dune deflation hollows, shell barrier beaches, shingle beaches, coastal turfs, stable sand dunes, and coastal cliffs) are recognised as rare ecosystems (Williams, 2007). The wider estuary is also of high quality, high value, and a naturally rare ecosystem (GHD, 2021d).

Climatically speaking, the area receives generally consistent rainfall (which averages around 75 mm per month) with the predominantly westerly winds (GHD, 2021c). While the climate is considered coastal and moderated by surrounding oceans, cold fronts can result in cold conditions with snowfall at sea level considered rare.

The NZAS facility occupies several land parcels within the western part of the Peninsula as shown in **Figure 1** (attached) and summarised in **Table 2-1** below.

**Table 2-1 Summary of Land Ownership**

| Domain | Land Ownership | Legal Description | Area Ha (approximate) |
|---|---|---|---|
| Smelter Domain | NZAS Freehold Land | Lot 1 DP 13987 | 92 |
| NZAS Landfill, wider smelter surrounds and Spent Cell Lining (SCL) Pad | Rio Tinto Aluminium New Zealand (RTANZ) Freehold Land | Lot 1 DP 13988 | 313 |
| Wider Peninsula Area (east of the smelter facility) | RTANZ Leasehold Land from the Department of Conservation (DOC) | Section 1, Block XIV Campbeltown Hundred | 1,667 |

## 2.2 Site History

Tiwai Peninsula was used by Māori (pre-European settlement) for a range of activities, particularly mahinga kai (notably sealing) and stone working (New Zealand Heritage Properties Ltd (NZHP), 2022). By the early 1800s, whalers and sealers were also using the Peninsula. Post-European settlement, Tiwai Point and the wider peninsula area was used for farming and a poultry farm, along with the establishment of a quarantine station and hospital (NZHP, 2022).

EHS Support has not had access to NZAS records to establish the development history of the smelter facility; therefore, the summary presented below is principally taken from the GHD PSI (GHD, 2021a), Aurecon New Zealand Ltd.'s (Aurecon, 2020) report on Tiwai Point for Treasury, NZAS Remediation Infographic released in 2020 (NZAS,2020), NZAS Air Discharge Consent Assessment of Environmental Effects (AEE – NZAS, 2005a), and NZAS Landfill Consent AEE's (NZAS, 2003; GHD, 2023).

In the late 1960s, construction of the NZAS facility commenced, with the facility becoming operational in April 1971. The Manapōuri hydro-electric power station supplies power to the smelter, with the refined bauxite being transported to Tiwai Point from Australia. Water for the plant is extracted from a well field located east of the main manufacturing plant that is situated on Department of Conservation (DOC)-leased land.

It is understood that a former wetland area occupied the central and west areas of the smelter domain area and that this was excavated and backfilled with locally won soils (assumed). Historical aerial photographs of the smelter before and after construction are presented in **Appendix B** to show the extent of the legacy wetland area.

NZAS background information indicates that the manufacturing facility was developed in four stages:

- Stage 1 comprised establishment of the initial facilities.
- Stages 2 to 4 increased production by progressively expanding these facilities.

Stage 1 was completed in November 1971 and involved construction of the following:

- Wharf and ship unloading facilities and raw materials storage sheds.
- Green carbon plant, carbon baking furnace, and carbon rodding room.
- Construction of Potline No. 1 and the main stack; and
- Metal products casting facilities, maintenance workshops, and the main store.

Stage 2 (first facility expansion) involved construction of the first half of Potline No. 2. This was commissioned in October 1972. Stage 3 expansion involved the construction of the second half of Potline No. 2, plus the addition of another carbon baking furnace and an expansion to the metal products casting facilities. These facilities were commissioned in July 1976. Stage 4 work (third facility expansion) involved construction of Potline No. 3 commissioned in August 1983, and additions or alterations to facilities as follows:

- Extensions and additions to raw materials storage sheds.
- Additions to the green carbon plant
- Additional carbon baking furnace.
- Additions to the metal products casting facilities.
- Additions to ancillary services.

An upgrade to the NZAS facility in 1995/1996 involved the construction of Potline No. 4. Other additions or alterations to facilities included:

- Decommissioning of Carbon Baking Furnace No. 3, commissioning of Carbon Baking Furnace No. 4, and an additional casting facility in metal products.
- Conversion from use of solid pitch to liquid pitch.

- Addition of a dry scrubbing fume treatment system

At commencement of operations, the NZAS facility was producing approximately 150,000 tonnes/year of aluminium metal, with current production stated as being 335,405 tonnes/year in 2020 (NZAS website, 2023).

The NZAS Landfill is located southwest of the smelter domain as shown in **Figure 1** (attached) and covers an area of approximately 15.5 ha. It is understood that the landfill likely commenced operations in 1970 during construction of the smelter, with the landfill receiving wastes once the facility became operational. The NZAS landfill comprises a series of industrial “mono-cells”. The cells are unlined and there is no leachate collection; therefore, the site area has operated as a “dilute and disperse” landfill. Nominal capping of waste materials with natural soils and re-vegetation has occurred, except for the carbon cell which has been capped with an impermeable geo-membrane (NZAS, 2021b). NZAS terminated disposal operations at the landfill in 2022. Over its operational life, the landfill is understood to have received (but not limited to) the following wastes based on the AEE submitted for the 1995 and 2003 landfill consent applications (NZAS, 1995 and 2003):

- Anode butts.
- Asbestos-containing materials (disposed in a designated asbestos disposal area) and mineral fibre.
- Ash and clinker residues.
- Carbons fines and dross powder, including aluminium dross powder.
- Concrete, gravel, and other clean fill that cannot be reused.
- Floor sweepings.
- General non-classified wastes.
- Green waste.
- Iron slag and steel waste.
- Refractory bricks.
- Resistor coke.
- Pit cleanings with a high liquid content.

Other activities conducted within the confines of the landfill have included the bioremediation of hydrocarbon contaminated materials (historically) and truck washing. While historical documents have referenced potential PCB oil handling activities at the landfill, it has not been definitively determined that PCB oils have been handled and managed in the landfill. However, based on the age of the Site it is known that PCB-containing oils were probably used at the Site, as both a dielectric fluid (in transformers and rectifiers) and as hydraulic fluids. PCBs were recorded in the landfilled waste by GHD, as documented in their 2023 report.

In their historic consent applications for the landfill (NZAS, 1995 and 2003), NZAS described various Site operations/initiatives that were undertaken to minimise the disposal of Site-generated wastes to landfill through the reuse and recycling of materials such as anode carbon material, out of specification aluminium, bag house dust, refractory bricks, timber, and cardboard.

NZAS estimated that the landfill contains approximately 800,000 m$^3$ of waste, of which there is estimated to be 33,500 tonnes of dross residue and 100,000 tonnes of carbon fines (NZAS, 2022).

Abutting the eastern boundary of the NZAS Landfill is the Haysoms Dross Landfill Cell. This landfill comprises an engineered cell (unlined but capped and covered with an impermeable membrane in 2009-2010) it was originally constructed in 2003 to manage dross waste processed by a third party that went into liquidation. An agreement was reached between the local regulators, the Crown, and

NZAS to construct the on-site landfill cell. Aurecon 2020 estimated that 16,000 m$^3$ of waste is held within the cell.

SCL waste (generated from the spent cell lining) was initially stored (between the mid-1970s and 1992) in an uncovered manner on concrete pads located to the southeast of the smelter domain area shown in **Figure 1**. Leachate generated by the SCL was collected and treated for discharge to Foveaux Strait. Following issues with groundwater contamination originating from the SCL pads, the waste stockpiles were combined and the SCL stockpiles were capped. Since 1992, SCL waste has been stored in purpose-built sheds located in the southeast corner of the smelter domain. Periodically, SCL is transported overseas for recycling. Dross arisings are processed on Site. Dross residues that were bagged and stored off-Site previously were repatriated back to Site in 2021. Carbon fines are currently the only new material that is bagged and stored on-Site. NZAS estimates that approximately 220,000 m$^3$ of SCL waste is stored on-site (NZAS, 2022).

During the 1990s, processed aluminium dross waste (estimated at 21,000 tonnes) was stored in the landfill. Additions of processed dross in the landfill ended in the late 1990s.

NZAS has committed to the processing/treatment of SCL and dross wastes, and/or the export of these materials for a beneficial use. At the time of preparing this report, specific details concerning off-site transport of these wastes are unknown. It is understood that newly generated materials, including carbon fines, are bagged, and stored in containers at the Site. Following closure of the landfill in 2022, other waste materials from the NZAS facility are transported off-site to repositories, facilities, or organisations approved to handle such material for management and disposal.

## 2.3 Geology and Hydrogeology

### *2.3.1 Geology*

Published geological maps and geological assessments (Turnbull and Allibone, 2003; GHD, 2021d) of the Tiwai Peninsula area have recorded the following stratigraphic sequence underlying the NZAS facility:

- Quaternary aged unconsolidated beach deposits (principally comprising pea gravels (rounded quartz gravel) and sands).
- Greenhills Group Middle Permian aged intrusive comprising basalt, keratophyre, diorite, schist, and granite.

As noted in **Section 2.2**, the central area of the smelter domain previously comprised a wetland feature that is believed to have been excavated and infilled with locally won materials (i.e., pea gravel) during construction of the facility. Fill materials (while being difficult to distinguish from the in-situ natural soils) should be expected across much of the smelter operational area as noted in the GHD bore logs (GHD, 2021c). Inspection of the wider site area also suggests that extensive earthwork occurred during construction of the NZAS facility, which would have modified Site topography and near surface geology.

Drilling work by GHD for the DSI (GHD, 2021c) confirmed the reported geology and proved the superficial deposits to a depth of approximately 9.45 m below ground level (bgl). Due to the nature of the underlying soils (i.e., pea gravel) and the drilling technique employed to meet the investigation objectives, no significant structure/bedding within the underlying deposits was recorded on the GHD bore logs other than changes in geology. The bore logs from earlier investigation work undertaken in the 1990s (Woodward Clyde, 1994) recorded similar conditions.

In simple terms, the near surface geology underlying the NZAS facility area appears to comprise the following (Woodward Clyde, 1994; GHD, 2023):

- Landfill area – pea gravel and sand units with some silt and peat units typically extending 3m to 7.5 m bgl and underlain by the Greenhills Group.
- Smelter domain and SCL pad areas – interbedded pea gravel and sand units to approximately 6 m bgl, with gravelly sands extending from 6 m to 14 m bgl. At 16 m bgl and on, the geology becomes more poorly sorted, and sands become more cohesive with clay, silt, and pea gravel. The GHD logs note multiple, thin layers and inclusions of peat and organic soils (up to approximately 0.5 m thick).

It is understood that NZAS/GHD have undertaken a more in-depth geo-hydrogeological study of the Smelter facility area; however, at the time of writing this report, this information was not available.

During inspection of exposed beach deposits in the cliffs (approximately 3 m in height) fronting Bluff Harbour (between the north and south drains), EHS Support recorded bedding within the pea gravel units, with evidence of finer grained soils lying on top of coarser grained materials, iron oxide staining, and organic layers. Photographs of the beach deposits are shown in **Appendix C**.

Active sand dune and back-beach ridge fields comprised of sand and gravel are mapped along Foveaux Strait Beach that is located along the south side of the Smelter facility and the east area of the peninsula (GHD, 2021d). These are described as prograde beach ridges (Kirk and Lauder, 2000) and are shown schematically in **Figure 4**.

Drilling work within the NZAS well field area undertaken in the late 1970s recorded older sediments below the sands (at depths of approximately 16 m to 25 m bgl) that were comprised of clays, sandy mudstones, sandstones, and lignites (Groundwater Consultants New Zealand Ltd [GWCNZ], 1990). This unit extended approximately 65 m bgl and is believed to rest on the underlying Greenhills Group under the Smelter facility area.

The Greenhills Group forms the basement bedrock of the local area. The Greenhills Group crops at the southwestern end of the peninsula and along the northside of the landfill that abuts Bluff Harbour. In the early 1990s, drilling work typically recorded the Greenhills Group at depths of approximately 5 m bgl within the landfill area (Woodward Clyde, 1994; GHD, 2023). The Woodward Clyde bore log records indicate that the Greenhills Group is weathered to clay at the surface of this unit in certain areas. As noted above, the Greenhills Group was also encountered under the main peninsula area (NZAS well field area).

### 2.3.2 Hydrogeology

The superficial soils underlying the peninsula form a shallow, unconfined aquifer system. Within the Smelter domain area and areas to the east, two discrete water bearing units have been described – an upper pea gravel unit with high permeability and a lower sand unit with moderate to high permeability. Groundwater assessment work undertaken by GWCNZ in 1990 has shown that the underlying aquifer system is comprised of freshwater originating from rainfall recharge, with some seawater intrusion at the peripheries of the peninsula (GWCNZ, 1990). Groundwater flow along the peninsula appears to generally follow the axis of the landmass with groundwater flowing to the north and south/east, fluxing into both Bluff Harbour and Foveaux Strait.

There are several features across the peninsula that influence this CSM, as summarised below:

- Modifications to the original Smelter domain landform (i.e., the excavation and backfilling of the former wetland area) will have influenced groundwater flow patterns within this area of the Site.
- The large sealed/covered area of the Smelter domain will inhibit recharge to the underlying aquifer system. Leakage from reticulated stormwater pipes, high use water activities (such as wash facilities), and stormwater soakage areas will potentially create local areas of recharge.
- In the southern area of the peninsula (NZAS landfill area and further southwest), bedrock crops/sub-crops at a relatively shallow depth and is likely to influence the direction of groundwater flow in localised areas.
- The three main stormwater drains at the Site that carry stormwater and process water into Bluff Harbour are unlined and will recharge the underlying aquifer system.
- In the east area of the peninsula lies the NZAS well field that abstracts groundwater for use within the facility, which will influence groundwater levels and flow in this area of the Site.

Further discussion of the groundwater characteristics using the domain areas defined by GHD in their DSI is provided in the sections below.

#### 2.3.2.1 Smelter Domain Groundwater Characteristics

Groundwater within the Smelter domain area typically lies between 3m to 5m bgl (GHD, 2021c). Groundwater contours for the Smelter complex area have been presented in both Woodward Clyde (1994) and GHD (2021c) studies. Neither of these studies extensively measured groundwater levels over a period of time to understand the effects of impermeable cover, recharge from the stormwater drains, and/or tidal fluctuations. In general, the earlier Woodward Clyde groundwater contours provide a more convincing assessment of groundwater flow within the Smelter complex area shown in **Figure 5** and suggest that there is a groundwater trough within the central area of the Smelter domain with a groundwater flux to the west. Around the peripheries of the Smelter domain, groundwater flows towards Bluff Harbour and Foveaux Strait.

In 1994, Woodward Clyde noted that groundwater seeped on the Bluff Harbour Beach between the west and south drains. EHS Support studied the seeps that were visible at low tide during the recent field work programme and concluded that they were an expression of groundwater fluxing into Bluff Harbour. This flux was noted along much of the beach abutting the west area of the Smelter domain. The seeps were more visible/evident where depressions in the beach occurred.

#### 2.3.2.2 NZAS Landfill Groundwater Characteristics

Groundwater within the landfill area typically lies at about 5 m bgl. Groundwater contours prepared by Woodward Clyde (1994) URS New Zealand Ltd (URS, 2009) and GHD (2023) show groundwater fluxing to both the north/northwest into Bluff Harbour and to the south into Foveaux Strait in **Figure 6**. Groundwater modelling by GHD in 2023 estimates that 95 percent of recharge (groundwater and leachate) flows east into Foveaux Strait, with approximately 5 percent discharging north into Bluff Harbour. Groundwater travel times from the landfill to Foveaux Strait were estimated (by Woodward Clyde in 1994) at 75 m to 150 m per year, while slower travel times of approximately 9 m to 18 m per year were estimated for the discharge into Bluff Harbour.

#### 2.3.2.3 SCL Pad Groundwater Characteristics

Within the area of the SCL pad, groundwater has been recorded at depths of approximately 3 m to 5m bgl (Minenco Pty Ltd [Minenco], 1995) and flows in a southerly direction into Foveaux Strait.

Groundwater monitoring work undertaken by Woodward Clyde in the early 1990s and Minenco in 1995 indicate that the superficial units form two aquifer systems – an overlying pea gravel aquifer and a lower, more fine-grained sand aquifer. Woodward Clyde (1994) estimated that groundwater travel times in the pea gravel aquifer were approximately 510 m per year (+/-110 m). Within the finer grained unit, they were in the order of 33 m per year to 186 m per year.

# 3 Initial Smelter Conceptual Site Model and Legacy Environmental Investigations

## 3.1 Smelter Operations

An overview of the smelting process is presented below (principally taken from/adapted from the NZAS air discharge consent AEE [NZAS, 2005a]). Operational procedures associated with the environmental management of smelter have not been sighted but it is understood that NZAS uses a number of external certification schemes that requires NZAS to set objectives and targets that aim for continuous improvement (NZAS, 2005b).

NZAS produces primary aluminium metal from alumina ore using the Hall-Heroult reduction process. The NZAS facility includes four potlines and can produce approximately 350,000 tonnes of aluminium metal per year at full production. Molten aluminium is siphoned from the cells and transported in a molten state to a casting facility where it is held in a holding furnace. All metal produced is cast on-site into various sizes and forms (sows, tees, slabs, billets, and ingots). The facility operates 24 hours a day, 7 days per week, with approximately 60% of the cast metal shipped directly from the Site via the NZAS Wharf. The remaining metal is transported by truck off-Site. Most of the finished metal is exported.

Aluminium is created from alumina (refined bauxite ore sourced from Australia) using an electrochemical reduction process. NZAS receives supplies of the raw material, aluminium oxide, by ship at its deep-water pier. It is transferred to the plant by covered belt conveyor. Other raw materials include calcined petroleum coke, petroleum pitch and cast iron used in the manufacture of anodes, and aluminium fluoride and cryolite used in aluminium potlines.

Aluminium oxide is reduced to pure aluminium in carbon-lined, steel cells containing molten cryolite. Both anodes and cathodes are made of carbon. The replaceable carbon anodes, which are consumed during the smelting process, are made on-site by using petroleum coke, coal tar pitch (liquid), and reused anode material. The components are heated, mixed, and vibrated into blocks. These blocks are then baked in furnaces at temperatures of typically 1,100°C to 1,200°C. The cathodes are typically purchased from Japan or China. The refractory lining of the cells is also purchased externally.

The reduction process occurs in cells. Each cell consists of a carbon-lined steel shell acting as the cathode. The carbon-lined shell contains molten electrolyte (bath), which is a modified cryolite ($Na_3AlF_6$). Alumina is dissolved in this bath. Carbon anodes are suspended from superstructures above the cells and then immersed in the bath. A high electrical current flows between the anodes and the cathode, maintaining the cell and its contents at an operation temperature of approximately 970 degrees Celsius (°C), providing energy for the cell reaction. Anodes are consumed during the reduction process through a reaction with oxygen to form carbon dioxide; therefore, the anodes are replaced approximately every 25 days.

The cells are connected in an electrical series. The completed series is called a potline. NZAS has four potlines. Three of the four potlines contain 208 cells each, while the other potline contains 48 cells, resulting in a total of 672 cells; however, all the NZAS cells may not operate at any given time depending on availability of electrical energy or process requirements.

## 3.2 Waste Generation and Environmental Discharges

During the manufacturing processes, several key waste streams are generated that require management and operational practices, resulting in discharges of contaminants to the environment. Key discharges to the environment are shown schematically in the pictorial CSM presented in **Figure 7**. NZAS has several resource consents issued by ES that regulate the operation of the NZAS facility (**Table 3-1**). Compliance monitoring for the consents is undertaken by NZAS and reported to ES in an annual monitoring report (typically by 31 March the following year). These reports are posted on the NZAS website and typically comprise summary data. Field sheets, sampling methodologies, laboratory reports, and Quality Assurance/Quality Control (QA/QC) assessments are not provided.

**Table 3-1 NZAS Resource Consents**

| Consent Type/Discharge | Consent No. | Expiry Date |
|---|---|---|
| NZAS Landfill – to discharge contaminants onto or into land, including the Haysom's Dross Cell. | 202196 | 8 December 2023 |
| To discharge contaminants to the air from an aluminium smelter and related activities | 203378 | 6 June 2031 |
| To discharge treated effluent to the coastal marine area | 203379 | 6 June 2031 |
| Discharge treated sewage to land | 203376 | 6 June 2031 |
| Stormwater – discharge stormwater and process water (via North, West, and South Drains) to land and Bluff Harbour. | 203373 | 6 June 2031 |
| To occupy the foreshore/seabed with a discharge pipe for treated effluent | 203375 | 6 June 2031 |
| To discharge stormwater and process water to land in circumstances where it may enter water | 202727 | 8 October 2039 |
| To take and use groundwater for industrial supply | 202958 | 12 September 2040 |

### *3.2.1 Key Waste Streams*

There are several key waste streams that are generated at the Site, which contain impurities and/or COPECs at high concentration. Some of these, such as SCL and Dross, have been discussed above and were historically landfilled and/or are currently being stored/managed at the Site. SCL and Dross are significant fluoride sources that can contain cyanide, aluminium, and other inorganic impurities. Other waste materials generated on-site include:

- Alumina (under cell materials).
- Bath materials generated from the operation of the cells (sodium fluoride rich materials).
- Bricks/refractory from refurbishment of the carbon bakes.
- Floor sweeping from potlines and cast house which comprise a combination of waste materials unsuitable for reprocessing.
- Carbon dusts/coke from the rodding area, ball mills, and green anode mill.
- Cathodes that cannot be reprocessed at the Site and spent anode materials not suitable for recycling.
- Drain sediment (including materials from water separators, major open drains, and catch basins in operational areas of the Site).
- Dust collector bags.
- Furnace slag.

The materials include a broad range of potential contaminants from polycyclic aromatic hydrocarbon (PAH)s associated with the use of pitch to manufacture the cathodes and anodes, inorganic impurities (e.g., fluoride and cyanide), and alumina and reacted aluminium species (i.e., aluminium fluoride). In addition to wastes containing contaminants, a broad range of other solid waste streams are generated at the Site associated with operations. These include:

- Man-made mineral fibres (MMMF) – used to repair refractory cell walls in furnaces. MMMF is placed in a separate cell. Asbestos materials from small component insulation from the 1970s are double bagged and placed in a dedicated cell within the Landfill site in accordance with NZ regulatory authorities.
- Plastic materials.
- Paper/cardboard (non-recyclable).
- Reject bath materials not suitable for reprocessing.
- Rubber.
- Sand.
- Steel.
- Textiles.
- Timber.

In conjunction with the solid waste stream, a range of liquid wastes are generated from ancillary activities and repairs and maintenance. These include:

- Used oils.
- Liquid spillage (creosote and tar residues from the green mill).
- Hydraulic oils.
- Sludges and cleaning liquids from cooling tower maintenance activities.
- Condensate from compressors (where captured).
- Surplus (or contact) cooling waters from green mill and casting.
- Wash waters from pressure washing and steam cleaning operations.

All these wastes are stored, managed, treated, and disposed of by NZAS.

### *3.2.2 Operational Environmental Discharges*

Given the scale and nature of the smelter operation there are multiple activities (and opportunities) for release of contaminants to the environment during the manufacturing process. Based on typical smelter operations (and on the basis that EHS Support has not formally audited the facility) a summary of possible (and key) releases are listed below:

- Losses from alumina storage and transfer and raw material spillage.
- SCL management, including emissions from cell refurbishment activities, and the handling and storage of SCL.
- Air emissions and deposition from potlines (including roof vents and leaks from the fume system).
- Management of solid wastes within the smelter and rodding rooms where alumina (under cell material or surface spillage/floor sweeping/catchment basin solids) and off specification carbon are managed.
- Dross handling and storage from the casting operations.
- Storage and handling of solid wastes.
- Legacy polychlorinated biphenyl (PCB) management, including wastes from the rectifier yard, and historic disposal of PCBs/PCB oils.

### 3.2.3 Liquid Discharges

Stormwater generated within the Smelter domain is directed to three stormwater drains (north, west, and south drains) that discharge into Bluff Harbour and are consented through ES Consent No. 203373. It is understood that these drains receive stormwater flow from a reticulated stormwater system within the Smelter domain. There is also a stormwater discharge to ground in the southern portion of the power supply switchyard (Consent No. 202727).

The drains are unlined (having been excavated into the underlying pea gravel) and are equipped with an oil trap and weir structure at the point of discharge to the receiving environment. The south drain travels along the southern boundary of the Smelter domain area and discharges into a legacy wetland area (assumed to be part of the original wetland that pre-dated the NZAS facility) before discharging into Bluff Harbour. Other than this wetland feature and capture of sediment behind the weir structures, no other treatment is believed to be applied to the discharge of stormwater. Little or no information is available on how the drains are maintained; however, it understood that the outlets from the drains to the marine environment are subject to blocking by tidal deposition of pea gravel on the foreshore, and that these channels are routinely opened/diverted by the removal or disturbance of materials to allow the drains to function. This activity is allowed for under rule 7.4.2.1 of ES's Regional Coastal Plan for Southland (ES, 2013). This rule presents a series of Permitted Activity controls to comply with regarding the clearing/removal of spoil from the mouth area of the drains and that any excavated spoil is removed or spread over non-vegetated areas. ES records indicate that NZAS typically clear longshore drift material from the mouth of the north and west drains on average at least five times a year (averaged over the last five years).

Investigation work documented in Woodward Clyde (1995) indicates that the north drain has the largest catchment area (approximately 26 ha) and an estimated average stormwater inflow of 775 $m^3$/day. The south and west drains have smaller catchment areas of approximately 22.5 ha and 7.5 ha, respectively. The stormwater discharge from the Site will contact various industrial processes and activities and be contaminated with a range of COPECs. In addition, aerial deposition from the stack and the potline louvres (which are consented through ES Consent No. 203378) will also contribute to the contaminant load within the stormwater discharge.

The consent for the discharge of stormwater allows for the discharge of processed water, described as cooling, washing, and flushing water (up to 4,500 $m^3$/day) to land and the coastal marine area (Consent No. 203373). It is assumed that processed water includes contact and non-contact cooling water for metal casting and anode production. Dry scrubbers are used at the Site for gases (from the smelting process) that reacted with alumina, which is then fed back into the smelting process. The fume treatment system (dry scrubbers) do not use water as a scrubbing medium. Because of the unlined nature of the stormwater drains, there will be a loss of stormwater/process water to groundwater through soakage.

The stormwater discharge consent requires each drain discharge (for the three drains) to be sampled weekly and samples analysed for total suspended solids (TSS), fluoride, electrical conductivity (EC), and pH, while the edge of the mixing zone for each drain (which is 50 m from the shore and referred to as the coastal monitoring point) should be sampled weekly either side of high tide and at a depth of 0.3 m. The coastal monitoring samples are to be tested for fluoride, conductivity, and pH. The quarterly average of the coastal monitoring samples should not exceed 2 mg/L fluoride and any representative samples collected should not exceed 5 mg/L fluoride. The drain discharge samples should not exceed a TSS concentration of 30 mg/L.

Sewage from the Site is treated and applied to land. It is consented through ES Consent No. 203376. The NZAS sewerage system collects wastewater from various sources on the smelter Site, including toilets, washrooms, showers, laboratories, canteens, and kitchens. The NZAS sewage treatment plant provides a secondary treatment process. Solids from the treatment process are transferred off-site, while liquids are applied to land through infiltration.

## 3.3 Initial Conceptual Site Model

Given the nature of the environmental setting for the NZAS facility and mode of operation, the following initial contamination CSM is presented to provide a basis for the scope of the independent CMA investigation. The CSM described below, covering the whole of the smelter complex, is similar to the CSM presented in the GHD DSI (GHD, 2021c).

The operation of the NZAS manufacturing facility and storage of waste materials (notably the NZAS Landfill and SCL pad) have resulted in near surface soil contamination in select areas and shallow groundwater contamination that is migrating towards and into Bluff Harbour and Foveaux Strait. The nature and extent are detailed in the following documents that have been provided by NZAS:

- Smelter domain area – The GHD DSI (GHD, 2021c) provides a recent benchmark of contamination conditions within the smelter domain area. An earlier assessment of groundwater contamination within this area of the Site is presented in Woodward Clyde (1994).
- NZAS Landfill – NZAS has documented groundwater contamination conditions within the landfill area in their annual compliance reports (NZAS website 1995 – 2021). Summaries of landfill groundwater contamination conditions were also presented in URS (2009) and Woodward Clyde (1994).
- SCL pad – NZAS has presented a summary of their monitoring data in a 2021 report (NZAS, 2021a and 2021b) and historical data is presented in Woodward Clyde (1994), Minenco (1995), and the NZAS annual compliance reports (NZAS website 1995 – 2021).

Based on EHS Support's knowledge of smelting activities and the above investigation and assessment work on the NZAS facility, the key COPECs are:

- Fluoride (fluorspar, cryolite and bath materials).
- Cyanide (Total, weak acid dissociable [WAD], and free cyanide).
- PAHs and Total Petroleum Hydrocarbons (TPH – associated with the use of pitch or general oil and fuel storage and handling).
- Aluminium and reacted aluminium (aluminium fluoride).
- Metals impurities associated with the impurities present in alumina, and potential alloying of aluminium in the casting operations.
- Asbestos (associated with its historical use as insulation).
- PCBs associated with the historic presence in dielectric fluids and hydraulic oils.
- Dioxins and furans as a by-product from the manufacturing process.

At the time of preparing this initial CSM the GHD landfill assessment was not available (GHD, 2023). This has since been reviewed and where appropriate findings and investigation data are referenced in this report.

Key findings and considerations (particularly in how they relate to the assessment of the CMA) are described below.

### *3.3.1 Holistic Overview*

During the preparation of this report, NZAS did not provide all the results from their comprehensive groundwater assessment that is currently being conducted, nor have they integrated their historical and routine investigation/monitoring results into a holistic assessment of contamination at the facility. The results and findings of part of the groundwater assessment and other investigations into the landfill and foreshore were made available to ES through the 2023 NZAS Landfill Consent Application (Consent #202196; GHD, 2023). The primary COPECs associated with aluminium smelting operations are aluminium, fluoride, and cyanide. Based on its widespread use and presence in raw materials and wastes, as well as its high solubility, an iso-contour plan of shallow groundwater fluoride concentrations is presented in **Figure 8** for the combined NZAS Landfill, SCL Pad and smelter domain area to visualise the nature and extent of contamination at the NZAS facility. Additional iso-contours were produced for the smelter domain area for aluminium (**Figure 9**). The groundwater data is taken from NZAS Landfill leachate monitoring data (NZAS, 2021), the DSI (GHD, 2021c) and the SCL Groundwater Status Report (NZAS, 2021a). The fluoride iso-contour plan (**Figure 8**) is principally based on the DSI and NZAS groundwater monitoring data (the integrity of which [for select wells during the CMA assessment] was shown to be acceptable). The aluminium iso-contour plan (**Figure 9**) is based on the DSI data. Aluminium impacts are also widespread but its lower solubility under circum-neutral conditions limits its ability to define groundwater plumes emanating from the Site. Aluminium and its reacted forms are a COC, with aluminium fluoride particularly toxic to aquatic organisms at low pH.

These iso-contour plans provide a simple interpretation of what are very large and complex plume(s) of groundwater contamination. There will be multiple sources of fluoride and aluminium contamination entering the shallow groundwater system (with groundwater typically lying 3 m to 5 m bgl); however, it demonstrates where key groundwater contamination is currently known to be present within the smelter domain, NZAS landfill and SCL Pad areas as well as its proximity to the CMA. Similarly, groundwater patterns exist for other key COCs, namely PAHs (GHD, 2021c).

Investigation work in the SCL Pad area identified high contaminant concentrations at depth with the underlying aquifer system because of denser contaminated leachate being generated by the SCL. Additional work within the NZAS landfill areas have considered the generation of denser areas of groundwater contamination and the results from the smelter domain area have yet to be received.

### *3.3.2 NZAS Landfill Leachate Contamination*

The historical environmental assessment work on the landfill demonstrates that previously there would have been significant discharges of key COPECs to groundwater and into Foveaux Strait and Bluff Harbour. Because the landfill has been operated using a dilute and disperse management approach, groundwater contamination concentrations have declined significantly, particularly over the last 5 years (as a consequence of leaching of contaminants from the waste and an absence of a fully engineered landfill cap). These processes have recently been described and documented in the GHD 2023 landfill report (GHD, 2023).

Fluoride in the groundwater monitoring wells along the downgradient edge of the leachate plume entering Foveaux Strait (based on recent NZAS monitoring data [NZAS, 2021b]) are in the range of 0.15 mg/L and 57 mg/L, with most wells yielding concentrations above 20 mg/L. These wells are shown in the iso-concentration contours plan presented in **Figure 8**.

Based on the information currently provided by NZAS/GHD, they have concluded that various geochemical and physical processes will be occurring at the point of discharge to the marine environment that will mitigate any potential adverse effects. This work is currently under review as part of the landfill consent application.

Work undertaken in the early 1990s (Woodward Clyde, 1994), and more recently by GHD (in their 2023 landfill report), indicated that there was a greater level of groundwater flux into Foveaux Strait compared to Bluff Harbour, with the latter having reduced groundwater travel times. Given the differences between the two receiving environments, additional work is needed to address potential adverse effects in these areas. The potential may also exist for groundwater plumes (and a potentially denser sinking plume, as was noted in the SCL pad area) to exist within areas of the landfill.

In addition to the flux of groundwater/leachate discharging into Bluff Harbour and Foveaux Strait from the landfill, it is also conceivable (given the nature of the landfill) that there could be surface water overland flow discharges as well as windblown deposition of Site-related constituents entering the terrestrial environment abutting the landfill and the marine environment.

### *3.3.3 Smelter Domain*

The Smelter domain covers a large area (approximately 92 ha), much of which is covered with buildings and pavement. The GHD DSI indicates that there are multiple contamination sources within the Site areas that are leaching to groundwater, with the nature and distribution of contamination consistent with the nature of the manufacturing activities that are known to occur.

Large plumes of fluoride and aluminium groundwater contamination lie below the main manufacturing complex (**Figures 8** and **9**), with the contaminant concentrations declining as the plumes migrate towards Foveaux Strait and Bluff Harbour. The perimeter of the facility that abuts Foveaux Strait and Bluff Harbour is unsealed with recharge to the groundwater system also occurring in these areas. Key contamination areas identified include:

- Inalco area (which comprises dross treatment areas, SCL storage warehouses etc.).
- Refractory brick storage area.
- Washdown facility.

The nature and extent of the groundwater contamination plume described by the GHD DSI is an interpretation based on a limited distribution of groundwater monitoring wells and spot groundwater sampling events (GHD, 2021c). Groundwater monitoring of the smelter domain as part of the NZAS comprehensive groundwater assessment has been completed, however, all of this data have not been made available to ES. To fully understand the significance of the discharges, additional work may be needed including (but not limited to) assessment of temporal changes in constituent concentration levels, influence of tidal effects, recharge from the stormwater drains, and quantification of mass fluxes (especially for bioaccumulative contaminants) into the receiving environment.

The GHD soil and groundwater contamination data (GHD, 2021c) and summary iso-contour groundwater contamination plans (**Figures 8 and 9**) suggest there could be a potential groundwater to marine water discharge risk from the following COPECs:

- Fluoride
- Aluminium
- PAHs

A key discharge (and probably the discharge with the highest mass loading) from the smelter domain to the marine receiving environment is the discharge of stormwater and process water via the north, west, and south drains (their locations are shown in **Figure 1**). It is likely that several mechanisms could be occurring at the point of discharge from the drains to Bluff Harbour, in that:

- Surface water discharges will occur daily at the north and west drain (regardless of rainfall events) because these drains also discharge process water. The south drain does not consistently discharge to the coastal marina area.
- Stormwater events, particularly "first flush" events after dry periods, have the potential to discharge a significant mass of contaminants in both surface water and sediment. This has previously been documented by NZAS in the 2005 Drain Discharge Consent Application AEE, which cites a study by Bioresearches (1995) indicating that "fluoride concentrations increased significantly in the first flush wet weather samples" (NZAS, 2005a).
- The drains will recharge the shallow groundwater system along their length, particularly at the point of discharge where water is held behind the weir structures.

As a consequence, depending on the nature of the mouth of each drain (at the point of discharge) and the immediate receiving environment, there could be a complicated mix of sediment and pore water contamination from the deposition of sediment entrained in the stormwater, pore water contamination from the flux of contaminated groundwater (either derived from the wider smelter complex or recharge from the drains), impacted surface water from stormwater, groundwater impacts, and partitioning from sediment into surface water. This is further complicated by the potential for stratified contamination of the marine surface water as a lens of fresh stormwater discharges over denser marine waters and partitioning between phases over time.

The nature, concentration, and distribution of sediment and pore water contamination downgradient of north and west drain outfall areas are influenced by the work NZAS undertakes to maintain each drain opening, in particular the extent of excavation and re-distribution of contamination. The south drain is not routinely excavated.

### *3.3.4 SCL Pad Area*

The SCL pad covers an area of approximately 1.5 ha and serves as a repository for some of the legacy SCL waste. The SCL pad is capped with an engineered impermeable membrane that was installed in 1992 to prevent leachate generation. It is located approximately 70 m to 80 m from the Foveaux Strait beach. Leachate generated by the pad is collected, treated, and discharged to Foveaux Strait. Leaching from the SCL pad has historically created a plume of leachate contamination (principally contaminated with fluoride, cyanide, and ammonia) that is migrating towards and discharging into Foveaux Strait. Work undertaken by Woodward Clyde in the early 1990s (Woodward Clyde, 1994) identified that the leachate being generated due to contaminant concentrations was denser than the surrounding freshwater groundwater and receiving marine water; therefore, the leachate created a denser plume of contamination within the lower sand aquifer in addition to contamination of the upper pea gravel aquifer. NZAS has adopted an attenuation management approach to the SCL pad leachate plume based on a remedial options assessment completed by Minenco in 1995 and based on approval granted by Environment Southland on 11 October 1995. NZAS routinely monitors key groundwater monitoring wells to ensure contaminant concentrations are declining and not posing an effect through attenuation in the receiving environment.

The most recent NZAS SCL pad monitoring data is from December 2020 (NZAS, 2021) and recorded the following contaminant concentrations within the SCL pad area and dune area (70 m to 80 m from the pad).

- SCL pad area – Shallow groundwater (pea gravel aquifer) yielded a maximum fluoride concentration of 39 mg/L and total and free cyanide concentrations of 2.8 mg/L and 0.17 mg/L, respectively. Deeper groundwater in the sand aquifer yielded a fluoride concentration of 1.5 mg/L and total and free cyanide concentrations of <0.25 mg/L and <0.01 mg/L, respectively.
- Dune area – Shallow groundwater (pea gravel aquifer) yielded a fluoride concentration of 0.7 mg/L and total and free cyanide concentrations of 0.808 mg/L and <0.01 mg/L. Deeper groundwater in the sand aquifer yielded a fluoride concentration of 12 mg/L and total and free cyanide concentrations of 24 mg/L and 0.016 mg/L, respectively.
- Deeper groundwater in the dune area sand aquifer has concentrations of fluoride and free cyanide that are above the EHS Support ESVs of 1.5 mg/L and 0.002 mg/L, respectively.

The NZAS monitoring data indicate that while contaminant concentrations in the groundwater plume discharging from the SCL pad have reduced significantly over the years, there is still an ongoing discharge into the Foveaux Strait beach area.

# 4 CMA Investigation Activities

The independent CMA investigation was carried out in accordance with the SAP (EHS Support, 2022c). A detailed overview of the field activities can be found in **Appendix D**. The field work programme included:

- Groundwater elevation and EC monitoring.
- Groundwater sampling from selected NZAS monitoring wells.
- Collection of surface, sub-surface, and deep sediment samples in the CMA and background areas.
- Soil sampling in the foreshore and background areas.
- Collection of surface water at varying depth intervals with co-located pore water samples.

**Figure 2** illustrates the CMA investigation sampling locations. **Figure 3** illustrates the sampled background locations relative to the CMA sampling locations, with **Figures 11 and 12** indicating background sampling locations. Field sample logs are provided as appendices for the following matrices:

- **Appendix E** – Groundwater.
- **Appendix F** – Sediment bore logs.
- **Appendix G** – Surface water and pore water field forms.

## 4.1 CMA Scope

The field programme included an assessment of sediment, pore water, surface water, and groundwater in the key assessment areas (**Figure 2**, attached). **Appendix D** details the activities completed as part of this investigation. Deviations from the SAP are summarised in **Section 4.5**. The objectives of the field programme included:

- Conducting initial focused sampling of sediment, pore water, and surface water in the intertidal area of:
    - Bluff Harbour downgradient of the north, west, and south drains.
    - Bluff Harbour and Foveaux Strait adjacent to the NZAS Landfill and Foveaux Strait adjacent to the Haysoms Dross Storage area.
    - Foveaux Strait downgradient and adjacent to the Inalco area and SCL pad areas.
- Conduct initial focused soil sampling in foreshore areas adjacent/upgradient to the assessment areas.
- Identify and characterise representative background sediment, surface water, pore water, and soil conditions (two locations – Awarua Bay [inner harbour] and Foveaux Strait).

Surface water, pore water, soil, and sediment samples were successfully collected from the north, south, and west drains, west and east landfills, Inalco and SCL pad areas, and background areas. Final sampling locations are displayed in **Figure 2, 11, and 12**.

Surface water and pore water samples were collected during outgoing tidal periods along the Awarua Bay (including background stations), Bluff Harbour, and Foveaux Strait coastlines (including background stations). Surface water samples along Awarua Bay and Bluff Harbour were collected at the top (TWC) and bottom (BWC) of the water column. Surface water samples along Foveaux Strait were collected at one depth interval (approximately 0.1 m below water surface) due to the high energy environment and observed mixing that occurs in the CMA along Foveaux Strait. Pore water samples were collected at one depth interval (0.1 m depth). Surface water sampling was generally undertaken during dry weather, the exception to this being collection of the aqueous samples collected from the west drain during a period of inclement weather (sustained precipitation with high energy tidal fluctuations), and a first flush event captured from the north drain (refer **Section 4.5**).

Sediment samples were collected at three depth intervals (0-0.1 m, 0.1-0.5 cm, and 0.5-1 m) at each sample station along Awarua Bay (including background stations) and Bluff Harbour to evaluate risk to aquatic receptors and to assess whether legacy deposition had occurred. Sediment samples along Foveaux Strait (including background stations) were only collected at surface intervals due to the higher energy environment of the Foveaux Strait that would limit fine grain deposition and minimise the historical deposition that could accumulate at depth. Sediment samples were collected during low or outgoing tidal periods along the Awarua Bay, Bluff Harbour, and Foveaux Strait coastlines. Soil samples were collected at one depth interval per sample station (0-10 cm) in the foreshore area adjacent/upgradient to the CMA assessment areas or background area.

## 4.2 Previous Independent Assessment Work

Following review of the DSI, ES and EHS Support completed two observation events (14-15 February 2022 and 21-22 February 2022) of supplementary field work that GHD was undertaking on the smelter domain. The observation events witnessed groundwater, surface water, and sediment sampling. During this field work, EHS Support collected duplicate samples of select media and these were submitted to an alternate accredited laboratory for inter-lab comparison testing. The results from these observation events and inter-laboratory testing were presented in the EHS Support letter report dated 30 March 2022 (EHS Support, 2022d).

## 4.3 Investigation Reconnaissance and Preliminary Groundwater Assessment

EHS Support undertook an initial appraisal and reconnaissance of the CMA area on 10 November 2022 and met with NZAS to discuss Site access and logistics for the CMA work programme. This work was used to support development of the SAP.

In late December 2022, data loggers (water level and EC) were installed in key groundwater monitoring wells that lie on NZAS and DOC land: monitoring wells A51, A53, A56, L_MW_B18, and MW 4/5, located on the Foveaux Strait side of the Site, and monitoring wells A63, E_MW_B7, and I_MW_B1 located adjacent to inner harbour CMA sampling locations. Well locations are provided on **Figure 2**. The loggers were removed in early January 2023, the wells gauged with an EC probe and groundwater samples were collected for laboratory analysis. Results from the data logger deployment are provided in **Appendix E** and discussed in **Section 6.4**.

## 4.4 CMA Investigation Timeline and Logistics

The bulk of the independent CMA work programme was undertaken between 16 January and 3 February 2023. Prior to undertaking the field work, approvals were obtained from NZAS to access their land. The work was completed in accordance with an archaeological management plan prepared by NZHPL in late 2022 (NZHPL, 2022). The EHS Support field work was stewarded by NZHPL as needed to ensure that archaeologically sensitive areas were protected. Supplementary assessment work was undertaken in the area of the stormwater drains on 3 and 4 May 2023. Photographs of the some of the field work practices are presented in **Appendix C**.

## 4.5 Deviations to the 2022 CMA SAP

Deviations to the in-field work associated with the 2022 CMA SAP (EHS Support, 2022c) were minimal and additive to the initial CMA scope, including the collection of additional information to better understand conditions within the CMA during baseline and “first flush” stormwater conditions. Field deviations included:

- Stormwater samples were collected from the north drain during a “first flush” event (on 2 February 2023). “First flush” samples were collected after 48 hours of no precipitation followed by a precipitation event.  The receiving estuary water body was flat/calm (no waves) at the time of first flush discharge. The National Institute of Water and Atmospheric research (NIWA) monitoring station for this area malfunctioned and therefore was unable to provide accurate rainfall information.
- Apparent groundwater seeps were identified in the CMA between the west drain and south drain. Water quality parameters were recorded for apparent seeps and a sample was collected from the area with the greatest volume of discharge. Samples were collected at low tide.
- Shallow groundwater was collected in the north and west drains from 0-10 cm bgl using the same protocol for collecting pore water. Water quality parameters were recorded for each sample collected. Samples were collected with no overlying water in areas adjacent to previously collected pore water samples.
- Test pit transects from the north and west drains were excavated to document the lateral extent of possible impacts (visible staining) to the shallow subsurface CMA environment. Sediment samples were collected intermittently and analysed for PAHs, fluoride, and cyanide (**Figure 10**).
- Tidal levels did not drop to a safe level to collect a sediment core from 100 m downgradient of the west drain outfall; however, a surface interval sediment sample was collected along with pore water and surface water at this location. An additional sediment core was collected 75 m from the west drain outfall to characterize the spatial distribution of constituents in the receiving environment.
- Sediment samples collected at south drain (SOD)-01 were not analysed at the deep sediment interval (50-100 cm) due to cancelled analysis by the laboratory.
- Surface water was collected for one depth in the south drain due to a limited amount of overlying water during the outgoing tide.
- Select sediment samples were analysed for particle size distribution (PSD), PCBs, and dioxins/furans.
- Supplementary surface water and pore water samples were collected downstream from the three stormwater drains on 3 and 4 May 2023.

# 5 CMA Results

## 5.1 Introduction

This section summarises the field observations and results from the independent CMA monitoring programme and presents a discussion of the results collectively (for the various media sampled) based on the key sample locations.

The laboratory analysis of the CMA assessment sampled media was undertaken by a combination of Eurofins New Zealand Ltd (bulk of the laboratory testing) and Watercare Laboratory Services Ltd (based in Auckland). Both laboratories are IANZ accredited. The laboratory data was generally provided in electronic format and so it is not included in the report.

The results and findings from the field and laboratory QA/QC assessment is provided in **Appendices E, F, G, H,** and **I**.

A summary of the analytical results from the CMA investigation are provided as attached tables by matrix:

- Summary of Results by Area and Matrix – **Table 1.**
- Comparison of Soil Analytical Results to Ecological Screening Values – **Table 2.**
- Comparison of Sediment Analytical Results to Ecological Screening Values – **Table 3.**
- Comparison of Groundwater Analytical Results to Ecological Screening Values **Table 4.**
- Comparison of Pore Water Analytical Results to Ecological Screening Values – **Table 5.**
- Comparison of Surface Water Analytical Results to Ecological Screening Values – **Table 6.**
- First Flush Hazard Quotients and Enrichment Factors – **Table 7.**
- Surface Water Supplemental Sampling – **Table 8.**
- Pore Water Supplemental Sampling – **Table 9.**
- Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors – **Table 10.**
- Test Pits Sediment Samples Hazard Quotients and Enrichment Factors – **Table 11.**
- Laboratory Comparison of Fluoride Detections in Groundwater, Pore Water, and Surface Water – **Table 12.**

The constituent results for the key samples locations (separated into sampled media) are presented in the following attached figures:

- Awarua Bay Background – **Figures 11a – 11c.**
- Foveaux Strait Background – **Figures 12a – 12c.**
- North Drain – **Figures 13a – 13d.**
- West Drain – **Figures 14a – 14d.**
- South Drain – **Figures 15a – 15d.**
- Landfill Assessment Area – **Figures 16a – 16c.**
- Inalco Assessment Area – **Figures 17a – 17c.**
- SCL Pad Area – **Figures 18a – 18c.**
- Sub-surface Aqueous– **Figure 19 – 20.**
- Groundwater – **Figure 21.**

Cross sections along each line of the sample stations used in the investigation of the north, west and south drains showing fluoride concentrations for surface water and pore water are presented in **Figure 22**.

To aid with interpretation of the results, select constituent concentrations recorded across aqueous investigation media are shown together graphically in the following attached figures:

- Aqueous analytical results compared to ESVs - **Figures 23-27.**

## 5.2 Application of Screening Values

To assess the environmental quality of the sediment, groundwater, marine surface water, and pore water samples collected during the CMA investigation the constituent concentrations have been compared to available environmental effects thresholds.

**Appendix A** presents the environmental effects thresholds utilised for the different media sampled. The term threshold is a general term that can include standards (a legally enforceable value), criteria (a standard in the Clean Water Act in the United States), and guidelines (a threshold which typically has no regulatory status). Although guidelines, such as those produced by legacy ANZECC (2000) (which have been replaced by ANZG, 2018), are included in Regional Plans/Water Plans issued by Regional Councils and therefore have regulatory status..

The threshold values utilised originate from a range of national and international sources. In general, the groundwater thresholds represent the 80th percent level of species protection (ANZG, 2018) and the marine surface water and pore water typically represent the 95th percent level of species protection (ANZG, 2018). The marine surface water thresholds are being applied to the immediate near shore surface water and pore water that exists in the area where aqueous discharges from the NZAS facility typically occur. Higher quality thresholds would need to be applied to marine waters that lie further out within Bluff Harbour and Foveaux Strait.

To provide guidance for the extensive number of contaminants of concern involved in the CMA study, these differences are recognised and are discussed in **Appendix A**. It is important to note that the values for particular media, such as marine surface water, may include guidance developed using different processes. A hierarchical process was followed in assessing the thresholds used (e.g., similar to that presented in MfE, 2011). To simplify the presentation of the various types of environmental thresholds used in this report, they are collectively referred to as Environmental Screening Values (ESVs).

A summary of the methodology used to derive the soil eco ESVs is also included in **Appendix A**.

The focus of the CMA assessment has been on ecological risk. Human health risk issues have principally been considered through uptake within the food chain for a range of COPECs that may bioaccumulate (namely dioxin/furans, PCBs, and PAHs). This assessment is presented in **Appendix J**. A simple Tier 1 human health risk comparison of the data for the terrestrial soils (collected from the foreshore study areas) has been made against the recreational Soil Contaminant Standards developed for the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (MfE, 2012), namely arsenic, cadmium, chromium, lead, mercury, and PAHs (benzo(a)pyrene toxic equivalency quotient [TEQ]). Aluminium concentrations have been conservatively compared to the USEPA Regional Screening Levels for a residential setting (7,700 mg/kg) because recreational values are not available. Fluoride concentrations have been compared to the Canadian Council of Ministers of the Environment (CCME, 2023) recreational health risk concentration (400 mg/kg). The eco ESVs are lower than the human health risk screening criteria and so if applied will be protective of human health.

### 5.2.1 Comparison to Screening Values and Background

Hazard quotients (HQ) and enrichment factors (EF) have been used to describe the magnitude of exceedance relative to the media specific ESVs and background concentrations, respectively, and are explained below.

- HQs were calculated for constituents by dividing the recorded concentration by the respective SV. For example, the recorded sediment concentrations are divided by the sediment screening values presented in Appendix A. An HQ greater than 1 indicates an exceedance of the ESV and therefore constitutes potential risk to ecological receptors from exposure to site media. The SVs generated are typically for chronic situations/exposure, hence an HQ greater than 1 suggests a potential chronic risk. While acute SVs have not been generated, it could be assumed that an HQ greater than 10 would suggest that significant effects could arise from prolonged exposure.
- EFs were calculated for constituents by dividing the mean detected concentrations by the mean of the detected background concentration by matrix. For example, the mean of the contaminant concentrations in the sediment samples collected from the areas of the drains in Bluff Harbour have been divided by the mean of the Awarua Bay background concentrations. The EF value provides a relative indication of site related concentrations relative to a background area. An EF of greater than 1 for a particular constituent in a specific medium would indicate that mean concentrations in the CMA assessment area are greater than the mean concentrations in the associated background (i.e., mean pore water aluminium concentrations in the north drain would be compared to mean pore water aluminium concentrations in the Awarua Bay background area). Hence an EF greater than 1 may serve as an additional line of evidence for site related contamination. It may also suggest that further investigation may be required, especially if the constituent does not have an ESV.

Matrix results from CMA sample locations along the Bluff Harbour were compared to Awarua Bay background area means. While matrix results from CMA sample locations along the Foveaux Strait were compared to Foveaux Strait background area means. **Table 5-1** identifies the background area that CMA assessment areas were compared to.

**Table 5-1 Background Areas used for Comparison to CMA Assessment Area Media**

| Background Area | CMA Assessment Area |
|---|---|
| Awarua Bay Background | North Drain |
| | West Drain |
| | South Drain |
| | West Landfill |
| Foveaux Strait Background | East Landfill |
| | Inalco Area |
| | SCL Pad |

## 5.3 Background Locations

CMA assessment background areas were identified in Awarua Bay and along the Foveaux Strait (**Figure 3**). The locations were principally selected on the similarities in the nature of the receiving environments being investigated in the independent assessment (as noted in **Table 5-1**) and distance from the NZAS smelter (that was considered beyond the likely range of atmospheric deposition from the NZAS main stack).

### 5.3.1 Awarua Bay Background Location (BAB)

The Awarua Bay inner harbour background location lies within the eastern end of the Bay, comprised of a low energy tidal flat environment (south of Awarua Bay Road), and is located approximately 9 km northeast of the smelter. The background sampling areas are shown on **Figure 3** (attached) and the background sample locations are shown in **Figure 11a-11c**. A photograph of the background location is shown in Photograph 4 presented in **Appendix C.**

Sediment samples collected from the sample stations showed the sediment to comprise fine to coarse sand, with coarse gravels visible at surface (proved to a depth of 1 m bgl). The tidal flat area was hard packed. Limited organic material was observed within the sediment bores (confirmed by TOC analysis, which returned TOC concentrations of 0.3% or less in sediment samples).

Soil samples were collected from the foreshore area, upgradient from the water and sediment sampling locations. Evidence of marine life (invertebrates [crabs], snails, fish) were observed during sampling.

The Awarua Bay background surface water and pore water samples recorded a small number of ESV exceedances (for dissolved compounds), notably:

- Copper and arsenic in pore water at one sample station (BAB-03), recording concentrations of 0.023 mg/L and 0.006 mg/L, respectively.
- Copper in surface water at one sample station (BAB-01) recording a concentration of 0.004 mg/L.

The majority of the sediment samples recorded trace element concentrations below the ESVs and often below the laboratory limit of reporting (LOR). Trace concentrations of aluminium, arsenic, cadmium, chromium, cobalt, copper, lead, nickel, and zinc were recorded. The maximum mercury concentration of 0.05 mg/kg.

Select sediment samples from the Awarua Bay background area were submitted for analysis of dioxins and furans. The dioxin and furan analysis generally yielded non-detect concentrations except for two compounds, 1.2.3.4.6.7.8-HpCDD and 1.2.3.4.6.7.8-HpCDF (which recorded maximum concentrations of 3.3 pg/g and 2.1 pg/g, respectively). These compounds were detected in concentrations less than what was observed in on site-media collected from within the main assessment areas as part of this investigation. An assessment of the dioxin and furan results is provided in **Appendix J**.

The foreshore soil samples recorded constituent concentrations that were below the ESVs except for boron at two locations, recording concentrations of 10 mg/kg and 14 mg/kg. Aluminium soil concentrations ranged from 2,700 mg/kg to 3,100 mg/kg (below the ESV) and soil pH ranged from 6 to 6.4. Trace concentrations of PAHs were recorded in the background soils with maximum low and high MW PAH concentrations of 0.05 mg/kg and 2.43 mg/kg being recorded, respectively.

The background soil concentrations recorded similar trace element concentrations to median background concentrations presented on the LRIS Database for this site area (namely for arsenic, cadmium, copper, chromium, lead, nickel, and zinc).

GHD collected background data for the NZAS 2023 landfill consent application (**Appendix K**; GHD, 2023) from a similar background location to the EHS Support Awarua Bay background location. The GHD data recorded similar background COPEC concentrations to EHS Support, with some of the differences likely to be a result of LOR and laboratory or collection methods.

### *5.3.2 Foveaux Strait Background (BFS)*

The Foveaux Strait background location was located approximately 25 km east of the smelter and comprised a moderate to steeply sloping coastal surf beach (moderate to high energy environment). Sediment samples comprised surficial predominantly coarse beach sands with no observed organic material (reported TOC as non-detect or at the detection limit of 0.1%). The background sampling areas are shown on **Figure 3** and the background sample locations are shown in **Figures 12a-12c**. A photograph of the background location is shown in Photographs 1, 2 and 3 presented in **Appendix C.**

Soil samples were collected from the rear fore dune area elevated above water and sediment sampling locations. No bird or marine life was observed during sampling works.

The Foveaux Strait background samples (for surface water, pore water, and sediment) recorded a small number of ESV exceedances, notably:

- Aluminium in surface water and pore water at all three sample stations, recording concentrations of between 0.16 – 0.99 mg/L and 0.21 – 1.1 mg/L, respectively.
- Cobalt, copper, free cyanide, and zinc in surface water and pore water in at least one of the sample stations recording maximum concentrations of 0.002 mg/L, 0.002 mg/L, 0.005 mg/L and 0.01 mg/L, respectively.

Sediment samples were not submitted for dioxin and furan analysis from the Foveaux Strait background area.

The foreshore soil samples recorded constituent concentrations that were below the ESVs. Aluminium soil concentrations ranged from 1,900 mg/kg to 2,100 mg/kg (below the ESV) and soil pH ranged from 7.6 to 7.8. PAH concentrations in background soils were below the laboratory reporting limits.

The background soil concentrations recorded similar trace element concentrations to median background concentrations presented on the LRIS Database for this site area (namely arsenic, cadmium, copper, chromium, lead, nickel, and zinc).

## 5.4 Bluff Harbour – Overview North, West and South Drains

Contaminant concentrations across the sampled media generally decreased from each drain outfall to beyond the edge of the consented mixing zone. Contaminant concentrations for sediment, surface water, and pore water were typically greatest in the most upgradient locations at or immediately below the drain outfalls (**Figures 2** and **22**). This suggests that the risk to aquatic receptors in the receiving environment may be greatest in the most upgradient areas near the outfalls (notably within the allowable mixing zone); however, exceedances of sediment and aqueous phase ESVs in the north drain and west drain were also recorded downgradient of the outfalls, towards the edge of the mixing zones (**Figure 22**), indicating that there is potential for risk to aquatic receptors within the full receiving environment for these drains.

The key contaminants of concern noted from the drain discharges generally reflect the activities being undertaken within the respective drain catchments. The north drain and west drain CMA environments are characterised by detections of inorganic elements (including metals and fluoride) as well as PAHs above ESVs. These compounds were detected in both aqueous (surface water and pore water) and solid phase (soil and sediment) media. The south drain was observed to be consistently disconnected from the CMA and therefore presents a different discharge profile. The south drain CMA environment had less detections of site related contaminants above ESVs than the north drain or west drain. However, the south drain can be characterised by detections of several metals, fluoride, and isolated individual PAH compound detections above ESVs.

The north drain discharge is distinguished from other drain discharges by rainfall-based discharge observed during the investigation. Concentrations of site-related constituents in surface water discharged from the north drain during the so-called “first flush” of rainfall events were orders of magnitude greater than non-rainfall conditions. Several constituents including dissolved aluminium and fluoride were recorded orders of magnitude above their respective ESVs immediately upgradient of the outfall as well as beyond the mixing zone (100 m from the outfall). Further discussion of the implications of the first flush event are provided in **Section 5.4.3**.

Drain maintenance and clearing of tidal deposition downgradient of the drain outfalls occur frequently – namely the north and west drains. Clearance within the drains (upgradient of the weir) occurs less frequently at a rate of every 5 years in the south drain and every 3 years in the west drain. The north drain has not been cleared upgradient of the weir within the last 25 years. At the time of preparing this report, ES records indicate that the NZAS drain mouth areas have been cleared four times in 2023. These clearings occurred between the initial CMA investigation in January/February 2023 and the May 2023 sampling. The frequent redistribution of depositional sediment from the drains that occurred in early 2023 is likely to have removed or dispersed the sampling locations that were assessed during the initial CMA investigation. Additional surface water and pore water samples were collected in May 2023 following intermittent clearing work. The results of the supplemental sampling and implications of the NZAS clearing activities in each drain area is summarised in the sections below.

## 5.5 Bluff Harbour – North Drain

### *5.5.1 North Drain Setting*

The north drain comprises a series of straight channels that stretch back into the north area of the smelter and as described in **Section 3**, it has the largest catchment of the three stormwater drains (estimated to comprise an area of approximately 26 ha). A drainage weir and separator arrangement is located approximately 150 m upstream from the drain outfall and is set within an incised channel (estimated to be 5 m deep). The drain discharges onto the beach and foreshore and is bounded either side by foredunes. Photographs of the north drain location are shown in Photographs 21, 22, 23, 24, 25 and 26 presented in **Appendix C**.

The north drain discharges Site-related process and stormwater from areas that include the pot-rooms, dry scrubbers and carbon rodding area, and compressor house # 2. The north drain also contains stormwater and process water from the northern part of the power supply, reduction lines, fume scrubbing area, north and west side of the change house. It has been reported that water received by the north drain is likely to contain fluoride and particulates (including alumina dust) (GHD, 2021c).

The north drain sampling location typically comprises a low energy (inner harbour) beach/tidal flat environment. This environment can transition to a higher energy environment based on weather conditions. Surface water flow was consistently observed from the drain during the course of the January/February 2023 and May 2023 sampling activities, with the drain depth/flow appearing to be primarily dependent on the tidal state, with increased flow observed during and immediately following a rainfall event. The tidal flats were exposed approximately 150 m from the drain discharge point at low tide.

Sediment samples were collected via cores from the shallow beach leading into tidal flats and the tidal flat. Sediment comprised sand and gravel with particle size distribution analysis on selected samples recording an average of >53% weight/weight >2 mm sized sediment. The sediments contained very little organic material (with the exception of sample NOD-SE-04-0.1-0.5 cm (TOC of 27%) and sample NOD-SE-05-0.1-0.5 cm [NOD of 6.3%]), with TOC results typically less than 0.6%. Cawthron (2005) mapped this area of Bluff Harbour as gravel field, with the CMA sampling confirming the documented mapping. The tidal flat area was hard packed during the early 2023 sampling event. During additional sampling in May 2023, the drain areas from the discharge point and over 100 m into the tidal zone had had been mechanically cleared/opened (by excavator) with sediment appearing to have been pushed to the sides of the drain and spread out across the tidal flats within the mid to low tide zone, and surface sediment very soft underfoot (**Appendix C**).

Stockpiled materials (coarse sand/gravel) understood to result from historical cleaning events downgradient of the drain outfall were present against the bank immediately north and south of the drain. Dark grey/black staining was observed in sediments along and adjacent to the drain mouth (extending out into the CMA and laterally in both directions [west and east] from the drain mouth). The beach at this location abuts onto a vertical bank, with soil samples collected from surface at the top of bank, elevated a few metres above the beach/tidal flat area. Evidence of marine life (invertebrates [crabs], snails, and fish) were observed during both the January/February and May 2023 sampling events.

A significant increase in surface water flow was observed in the north drain during a ‘first flush’ event on 2 February 2023 (**Section 4.5**), with a freshwater lens recorded on top of seawater and extending over 100 m from the drain outfall discharge during this event.

### *5.5.2 North Drain Investigation Results*

Discharge of Site-related surface water and sediment contamination was documented in the DSI (GHD, 2021c) and the supplemental EHS Support work undertaken in early 2022 also documented elevated contaminant concentrations in the drain (water and sediment). The conditions documented during the CMA assessment were similar to and expand on the earlier studies.

The CMA assessment results are presented in following attached figures:

- **Figure 13a** and **13b** – Solid matrices (soil and sediment).
- **Figure 13c –** Aqueous matrices (surface water and pore water).
- **Figure 13d** – May 2023 resampling event.
- **Figure 22** – Aqueous matrices along the line of the sampling stations.
- **Figures 23 – 27** – Aqueous matrices shown schematically.

The distribution of Site-related constituents within the receiving environment is observed through the north drain drainage sequence (from the outfall to the edge of the consented mixing zone and beyond) and appears to occur principally due to the discharge of stormwater. Stormwater discharge from the north drain carries total and dissolved constituents from the Site, which have accumulated in sediment. The area sampled, particularly close to the drain outfall, is likely to have been disturbed by the NZAS maintenance activities.

A "first flush" stormwater event was monitored during the CMA assessment. The results from this event are detailed on **Figure 13c** (attached) and the results are described separately in **Section 5.4.3**.

The media contamination downgradient of the drain outfall is characterised as follows.

#### 5.5.2.1 Surface Water

The surface water is characterised by concentrations of aluminium, boron, copper, and fluoride yielding HQ's above 1. Concentrations of arsenic, cadmium, cobalt, manganese, nickel, and zinc were recorded below their respective ESVs, but all above background (i.e., EF>1). The contaminant concentrations during normal flow/discharge conditions (non-storm event) were reasonably well mixed within the water column within the receiving environment (as defined by the bottom and top of water column concentrations – both for Site derived contaminants and chloride [indicative of marine water]).

The key ESV exceedances within the surface water were as follows (and shown schematically in **Figures 22-27**):

- Aluminium exceedances of the ESV were noted extending from the drain outfall out to sample station NOD-4 (concentration of 0.09 mg/L – some 100 m from the drain outfall; **Figure 23**).
- Copper exceedances of the ESV were recorded extending to sample station NOD-5, yielding a maximum concentration of 0.005 mg/L (HQ's of 3.8 for copper at NOD-05, respectively; **Figure 25**).
- Fluoride above the ESV was recorded at the drain outfall (maximum 2.04 mg/L, HQ = 1.4; **Figure 26**).

#### 5.5.2.2 Sediment

The north drain receiving environment is a low energy environment and allows for the accumulation of sediment discharged from the north drain throughout the drainage receiving environment. The CMA investigation suggests that the bulk of the sediment is likely to be discharged into wider Bluff Harbour (given the low % of fine-grained sediment in the immediate area of the north and west drain outlets).

The concentration of Site-related constituents in sediment were typically greatest near the outfall of the drain and reduced with distance into the foreshore area. There was an increase in the fluoride sediment concentrations at sample stations NOD-04 and 05 (100 m and 125 m from the drain outfall), which may be influenced by a combination of groundwater fluoride and disturbance of the sediments by NZAS.

ESV exceedances of arsenic, cadmium, lead, nickel, and zinc were recorded at the drain outfall (NOD-01 at surface). Exceedances of nickel in the surface sediments persisted to monitoring station NOD-05 (125 m downstream of the drain outfall).

Additional exceedances of ESVs in sediment in the north drain include total PAHs and select PAH compounds. The PAH sediment contamination was generally confined to the surface sediment (down to a depth of 0.1 m) and in the immediate drain outfall area. The concentration of total PAHs (the detected sum of the USEPA priority list of 16 PAHs) exceeded the ESV in the surface sediment of the north drain outfall and the 100 m location at NOD-04.

Select north drain sediment samples were also analysed for PCBs, dioxin/furans, and TPH given the nature of the catchment (i.e., potential contaminant load) that discharges into the drain (both historically and currently). Non-detect concentrations of PCBs and TPH were recorded in all samples tested. Dioxin-like PCBs were detected in north drain sediment. The dioxin and furan analysis yielded detectable concentrations. An assessment of the dioxin and furan results is provided in **Appendix J**.

#### 5.5.2.3 Pore Water

The north drain outfall pore water is characterised by exceedances of ESVs of aluminium (**Figure 23**), arsenic (**Figure 24**), copper (**Figure 25**), cobalt, fluoride (**Figure 26**), and iron. Exceedances of ESVs were observed in pore water for boron, copper, and fluoride with exceedances for fluoride still being recorded 125 m from the drain outfall (sampling station NOD-05) and beyond the consented mixing zone. This situation is shown schematically in **Figure 22** (attached).

Exceedances of ESVs were noted within the north drain pore water as follows:

- Copper and fluoride concentrations yielded HQs >1 from the drain outfall (NOD-01) out to sample station NOD-05 (located 125 m from the drain outfall). In particular, fluoride concentrations of 8.89 mg/L and 4.22 mg/L, above the ESV, were being recorded 100 m and 125 m from the drain outfall, respectively (**Figure 25** and **Figure 26**).
- Aluminium concentrations with HQs > 1 were recorded from the north drain outfall extending to sample station NOD-04 (100 m from the drain outfall), with cobalt and iron yielding HQ values greater than 1 immediately downstream of the drain outfall (NOD-02; **Figure 23**).

#### 5.5.2.4 Foreshore Soils

The foreshore soils typically recorded trace elements and PAHs at low concentrations and below the ESVs. A fluoride concentration of 210 mg/kg was recorded at one sample location (NOD-SO-03) which was the only COPEC recorded on the foreshore soils above the ESVs. The north drain foreshore soils yielded contaminant concentrations below the human health screening levels.

### 5.5.3 North Drain First Flush Investigation Results

First flush data from the north drain recorded high concentrations of constituents at or near the point of acute toxicity for select trace elements. This combined with more extensive sediment and pore water concentrations in and around the discharge location provides indications that impacts to ecological communities (presence and abundance as well as bioaccumulation) are potential concerns. Photographs from the first flush event (Photographs 27, 28, 29 and 30) and presented in **Appendix C**.  First flush events have previously been documented by NZAS in the 2005 Drain Discharge Consent Application AEE, which cites a study by Bioresearches (1995) indicating that “fluoride concentrations increased significantly in the first flush wet weather samples” (NZAS, 2005a).

During the first flush event sediment was discharged from the north drain and deposited at each sample station in the north drain sequence. Surface water samples collected from the north drain during this event recorded constituents up to 100 m from the outfall at concentrations orders of magnitude greater than under normal baseline discharge conditions (**Table 7**; **Figure 13c, Figure 22 and 23**), in particular:

- Dissolved aluminium concentrations in surface water collected at TWC in NOD-04 (100 m from the outfall) were 19 mg/L and non-detect under first flush and baseline conditions, respectively (**Figure 23**).
- Fluoride concentrations in surface water collected at the TWC in NOD-04 were 23.4 mg/L and 0.95 mg/L during first flush and baseline conditions, respectively (**Figure 26**).
- Dissolved concentrations of copper, cobalt, and nickel in the first flush samples were observed to exceed their respective ESVs in north drain surface water 100 m from the outfall. Except for copper, these constituents did not exceed their respective ESVs under baseline conditions, further illustrating the potential risk associated with episodic precipitation-based discharge events.

The flushing effect observed at the north drain indicates that a source area for fluoride, aluminium, copper, cobalt, and nickel is present upgradient of this drainage feature.

### 5.5.4 North Drain Additional Sampling Investigation Results

Additional pore water and surface water samples were collected during May 2023 following a clearing performed downgradient of the drain outfall on the north drain. Clearing activities occur multiple times during the year in the drains. The 2023 clearings would have modified the environment that was originally sampled during the CMA investigation. A comparison to the initial CMA investigation results is presented in **Table 8** and **Table 9** for surface water and pore water, respectively. Data is presented spatially on **Figure 13d**. Photographs of the north drain area post the clearing work are presented in **Appendix C** (Photographs 33, 34, 35 and 36).

Pore water samples collected after the NZAS clearing activities were comparable for aluminium in resampled locations. Pore water copper and fluoride concentrations at the north drain outfall (NOD-01) in May 2023 were an order of magnitude less than samples collected during the initial CMA investigation sampling. Copper in pore water at NOD-04 (100 m downgradient) was not detected in the May 2023 sampling; however, it was detected above the ESV in the initial CMA sampling.

Trace method analysis for PAHs in pore water samples collected in May 2023 identified several PAH compounds that were detected above the ESV in pore water. Select PAH compounds are presented on **Figure 13d**.

The May 2023 surface water dissolved aluminium concentration at NOD-01 was nearly double the preliminary CMA investigation result. Surface water fluoride concentrations in the north drain outfall were below the ESV during the May 2023 sampling. There were no detections of PAH in surface water during the May 2023 sampling.

## 5.6 Bluff Harbour – West Drain

### 5.6.1 West Drain Setting

The west drain comprises a short length of straight channel (approximately 100 m in length) that is assumed to connect to the reticulated stormwater system in and around the carbon bake area. The west drain collects storm water and process water from the green carbon area, carbon bake area, reconstruction area, stores laydown area, change house, HFO and liquid pitch storage area, and administration building area. A drainage weir and separator arrangement is located at the start of the drain approximately 100 m upstream from the drain outfall and is set within an incised channel (approximately 5 m deep). The drain discharges onto the beach and foreshore that is bounded either side by foredunes. Waste concrete beams and mined dunnite rock have been placed at the mouth of the drain to reduce erosion.

The west drain sampling area typically comprises a low energy (inner harbour) beach/tidal flat environment. This environment can transition to a higher energy environment based on weather conditions. Surface water flow was observed from the drain during the course of January/February 2023 and May 2023 sampling works, with the drain depth/flow appearing to be primarily dependent on the tidal state, with increased flow observed during a rainfall event.

The tidal flats were exposed over 100 m from the drain discharge point at low tide. Sediment samples were collected via cores from the shallow beach leading into tidal flats and the tidal flat. Sediment was comprised gravels with some sand and limited organic material (TOC <0.5 %). Cawthron (2005) mapped the downgradient Bluff Harbour area as gravel field, with the CMA sampling confirming the documented mapping. The tidal flat area was hard packed during the early 2023 sampling event.

During additional sampling conducted May 2023 the drain area from the high-water zone to the mid-tidal zone had been mechanically cleared/opened with sediment appearing to have been pushed to the sides of the drain or spread out across the beach/tidal flats within the mid tide area, and surface sediment soft underfoot. Apparently stockpiled materials (coarse sand/gravel), understood to result from historical drain cleaning events is present against the bank immediately north of drain. Dark grey/black staining was observed in sediments along and adjacent to the drain.

The beach at this location abuts onto a vertical bank (foredunes), with soil samples collected from surface at the top of bank, elevated a few metres above the beach/tidal flat area. Birds and evidence of marine life (invertebrates [crabs], snails, fish) were observed during the sampling events.

Photographs of the west drain area post the clearing work are presented in **Appendix C** (Photographs 14 through to 20).

### *5.6.2 Investigation Results*

Discharge of Site-related surface water and sediment contamination was documented in the DSI (GHD, 2021c) and the supplemental EHS Support work undertaken in early 2022 also documented elevated contaminant concentrations in the drain (water and sediment). CMA investigation sampling occurred in the west drain during a period of light but sustained precipitation. The high energy conditions in the receiving environment (large waves) were likely responsible for greater proportion of mixing than would be expected during baseline conditions of discharge (i.e., non-precipitation event).

The results are presented in following attached figures:

- **Figure 14a** and **14b** – Solid matrices (soil and sediment).
- **Figure 14c** – Aqueous matrices (surface water and pore water).
- **Figure 14d** – May 2023 resampling event.
- **Figures 23 – 27** – Aqueous matrices shown schematically.

The distribution of Site-related constituents within the receiving environment is observed through the west drain drainage sequence (from the outfall to the edge of the consented mixing zone and beyond) and appears to occur principally due to the discharge of stormwater and site-related process water. The area sampled, particularly close to the drain outfall, is likely to have been disturbed by the NZAS maintenance activities.

The media contamination downgradient of the drain outfall is characterised as follows:

#### 5.6.2.1 Surface water

The surface water in the west drain is characterised by concentrations of aluminium, boron, copper, fluoride, iron, and zinc exceeding their respective ESVs and yielding HQ's above 1. Concentrations of arsenic, manganese, and nickel were recorded below their respective ESV, but above background (i.e., EF>1). The concentrations recorded from samples collected during investigation activities were well mixed within the water column (as defined by the TWC and BWC concentrations – both for Site derived constituents and chloride, indicating the mixing of ocean water and less saline water being discharged from the drain). Samples were collected in the west drain during a period of light, but continuous rainfall. The resulting receiving environment was subjected to high energy wave fluctuations, which could serve as the primary mechanism for mixing.

The key ESV exceedances within the surface water were as follows:

- Aluminium, boron, copper, fluoride, iron, and zinc exceedances of the ESVs were noted extending from the drain outfall out to sample station WOD-5 (yielding maximum concentration of 0.76 mg/L, 6 mg/L, 0.01 mg/L, 1.4 mg/L, 1.1 mg/L, and 0.014 mg/L –100 m from the drain outfall, respectively; **Figure 23**, **Figures 25**-**27**).
- Fluoride above the ESV was recoded at the drain outfall (maximum 2.87 mg/L). **Figure 22** (attached) presents the aqueous fluoride concentrations along the line of the sampling stations.

#### 5.6.2.2 Sediment

The sediment contaminant concentrations were typically greatest at the drain outfall and concentrations were observed to decrease with distance from the outfall into the foreshore area. ESV exceedances of fluoride were recorded in the sub-surface (0.1-0.5 m depth) and deep (0.5-1 m depth) sediment samples at station WOD-04 (75 m from the drain outfall) – yielding a maximum concentration of 460 mg/kg). PAH ESV exceedances extended out to sample station WOD-04 (75 m from the drain outfall). Trace element concentrations above background, yielding EFs >1, were recorded for cadmium and zinc.

Select west drain sediment samples were also analysed for PCBs, dioxin/furans, and TPH given the nature of the catchment (i.e., potential contaminant load) that discharges into the drain (both historically and currently). Non-detect concentrations of PCBs and TPH were recorded in all samples tested. Dioxin-like PCBs were detected in West Drain sediment. The dioxin and furan analysis yielded detectable concentrations. An assessment of the dioxin and furan results is provided in **Appendix J**.

#### 5.6.2.3 Pore Water

The pore water in the west drain is characterised by elevated concentrations of copper, iron, and zinc with HQ>1 values recorded in the drain outfall. HQ values >1 for copper and iron were still being recorded 100 m from the drain outfall (sampling station WOD-05).

Exceedances of ESVs were noted within the west drain pore water are as follows:

- Copper, iron, and zinc concentrations yielded HQs >1 at the drain outfall (WOD-01) with concentrations observed to decrease towards sample station WOD-05 (located 100 m from the drain outfall). Boron in pore water slightly exceeded the reference value 25 m from the outfall (WOD-02).
- Iron and copper concentrations with a HQ>1 were recorded extending to sample station WOD-05 (100 m from the drain outfall).

#### 5.6.2.4 Foreshore Soils

The foreshore soils typically recorded trace elements at low concentrations and below the ESVs. Trace concentrations of individual PAHs were recorded in both foreshore soil samples, with both the LMW and HMW ESVs being exceeded (maximum concentrations of 60.6 mg/kg and 3.46 mg/kg being recorded, respectively). The west drain foreshore soils yielded contaminant concentrations below the human health screening levels.

### 5.6.3 West Drain Additional Sampling Investigation Results

Additional pore water and surface water samples were collected during May 2023 following a clearing downgradient of the west drain outfall. As described above, clearing activities occur multiple times during the year in the drains. The 2023 clearings would have modified the environment that was originally sampled during the CMA investigation. A comparison to the initial CMA investigation results is presented in **Table 8** and **Table 9** for surface water and pore water, respectively. Data is presented spatially on **Figure 14d**.

Pore water samples collected after the NZAS clearing activities were comparable for aluminium in resampled locations (non-detect; however, at different detection limits). Pore water copper concentrations at the west drain outfall (WOD-01) in May 2023 were an order of magnitude less than samples collected during the initial CMA investigation sampling. Copper in pore water at WOD-04 (75 m downgradient) was not detected in the May 2023 sampling; however, it was detected above the ESV in the initial CMA sampling at WOD-05 (100 m from the outfall). Fluoride was detected above the ESV in pore water sampled from WOD-01 (4.26 mg/L), however was detected below the ESV in the initial CMA sampling (0.7 mg/L).

Trace method analysis for PAHs identified several PAH compounds that were detected above the ESV in pore water in each of the May 2023 sampled locations. Select PAH compounds in exceedance are shown on **Figure 14d**.

The May 2023 surface water trace element concentrations (including aluminium, copper, and fluoride) at WOD-01 were orders of magnitude less than the preliminary CMA investigation results. Surface water fluoride concentrations in the north drain outfall were above the ESV during the initial CMA sampling but were observed below the ESV in samples collected during the May 2023 sampling. There were detections and ESV exceedances of individual PAHs in surface water during the May 2023 sampling at WOD-01 in both the TWC and BWC locations.

## 5.7 Bluff Harbour – South Drain

### 5.7.1 South Drain Setting

The south drain discharges into what is believed to be part of a natural wetland that lies south of the jetty/conveyor (as noted in **Section 3**). The drain is approximately 0.5 km long and runs along the south side of the site, with the weir/separator arrangement lying southwest of the alumina store.

The distance from the weir to the drain outfall that discharge onto the beach/foreshore is approximately 300 m and the drain outfall is bounded either side by foredunes.

The south drain sampling location is typically a low energy (inner harbour) beach/tidal flat environment. This environment can transition to a higher energy environment based on weather conditions. Bedrock outcrops within the tidal area west of the drain location. No surface water flow was observed from the drain during the January/February 2023 or May 2023 sampling events. The tidal flats were exposed over 100 m from the drain discharge point at low tide. Photographs of the south drain area are presented in **Appendix C** (Photographs 11 and 12).

Sediment samples were collected via bores in the tidal flat area and comprised hard packed fine gravel at surface, with gravels with sand recorded at depth, close the discharge point. Limited organic material was recorded within the sediment (TOC <0.5%). Cawthron (2005) mapped the downgradient Bluff Harbour area as gravel field grading to firm sand and mud, with the CMA sampling confirming the documented mapping. The south drain beach / tidal flat area abuts onto a vertical bank, with soil samples collected from surface at the top of bank, elevated a few metres above the beach/tidal flat area.

Evidence of marine life (invertebrates [crabs], snails, fish) were observed during the sampling event.

### 5.7.2 *Investigation Results*

Discharge of Site-related surface water and sediment contamination was documented in the DSI (GHD, 2021c) and the EHS Support work undertaken in early 2022 also documented elevated contaminant concentrations of site related constituents in the receiving environment of the drain (water and sediment). CMA investigation sampling occurred during a period when the south drain was hydraulically disconnected from the receiving environment (i.e., no flow from the south drain was observed). The south drain does not likely exhibit direct connectivity to the receiving environment under baseline conditions (i.e., no precipitation or atypical discharge occurring).

The results are presented in following attached figures:

- **Figure 15a** and **15b** – Solid matrices (soil and sediment).
- **Figure 15c** – Aqueous matrices (surface water, pore water, and apparent groundwater seep).
- **Figure 15d** – May 2023 resampling event.
- **Figures 23 – 27** – Aqueous matrices shown schematically.

The distribution of Site-related constituents within the receiving environment was not observed as clearly in the south drain as it was in the north or west drain. The lack of direct connectivity also suggests the influence of other site related discharge (i.e., west drain discharge or discharge from the landfill) that may be observed in the mixing zone of the south drain.

GHD as part of the NZAS 2023 landfill consent application (GHD, 2023) collected surface water, sediment, and beach groundwater (similar to the EHS Support pore water samples) from sample stations close to the south drain outfall (**Appendix K**). The GHD sampling was not as comprehensive as the EHS Support work undertaken in this area, while GHD tested for a wider range of determinants. The GHD work recorded similar contaminant concentrations to those recorded by EHS Support. Of note was the PFAS testing which recorded compounds below the LORs for sediment and beach groundwater and surface water.  GHD also collected a south drain surface water sample (exact sample location is unknown) which recorded fluoride and aluminium concentrations of 4.8 mg/L and 1.97 mg/L, respectively which are above the ESVs.

The media contamination downgradient of the drain outfall is characterised as follows:

#### 5.7.2.1 Surface water

The surface water in the south drain is characterised by concentrations of boron and copper exceeding their respective ESVs in at least one location and yielding HQ's above 1. Concentrations of aluminium and arsenic were recorded below their respective ESV, but above background (i.e., EF>1). The concentrations recorded from samples collected during investigation activities were well mixed within the water column (as defined by the TWC and BWC concentrations – both for Site derived constituents and chloride). Chloride concentrations of surface water samples in the south drain mixing zone were approximately at background ocean concentrations of chloride, further highlighting the lack of a fresh water source due to a lack of connectivity of the south drain to the receiving environment.

The key ESV exceedances within the surface water were as follows (see **Figures 23-27)**:

- Boron exceedances of the ESVs were noted extending from the drain outfall out to sample station SOD-4. Surface water boron concentrations exceeded the ESV at each station in both TWC and BWC locations.
- Copper was detected and exceeded the ESV in one location in the south drain (SOD-02).

#### 5.7.2.2 Sediment

The sediment contaminant concentrations were typically greatest at the drain outfall and concentrations were observed to decrease with distance from the outfall into the foreshore area. ESV exceedances were only observed at south drain station SOD-03, approximately 60 m from the drain outfall. An ESV exceedance of fluoride was recorded in the sub-surface (0.1-0.5 m depth) sediment sample at station SOD-03 – yielding a maximum concentration of 570 mg/kg). PAHs were only detected at sample station SOD-03 in the surface interval with a PAH ESV exceedance at sample station SOD-03 in the surficial layer (0-0.1 m). Trace element concentrations above background, yielding EFs >1, were recorded for cadmium and zinc.

Select south drain sediment samples were also analysed for PCBs, dioxin/furans, and TPH given the nature of the catchment (i.e., potential contaminant load) that discharges into the drain (both historically and currently). Non-detect concentrations of PCBs and TPH were recorded in all samples tested. Dioxin-like PCBs were detected in South Drain sediment. The dioxin and furan analysis yielded detectable concentrations. An in-depth assessment of the dioxin and furan results is provided in **Appendix J**.

#### 5.7.2.3 Pore Water

The pore water in the south drain is characterised by elevated concentrations of aluminium, boron, iron, and zinc. Exceedances of ESVs were noted within the south drain pore water are as follows:

- Aluminium, boron, iron, and zinc concentrations yielded HQs >1 at the drain outfall (SOD-01) with concentrations observed to decrease towards sample station SOD-04 (located 100 m from the drain outfall).

#### 5.7.2.4 Apparent Groundwater Seep

An apparent groundwater seep ("seep") was also noted flowing from the beach mid-way between the south and west drains and this was sampled during the CMA assessment (**Figure 15c**, attached, and Photograph 11 in **Appendix C**). Water quality parameters were recorded for the water flowing from the bank and a sample was collected for analysis.

The seep recorded a fluoride concentration of 1.56 mg/L (above the ESV and ANZECC 80% equivalent). The chloride concentration in the seep was 350 mg/L, which is above the chloride concentrations recorded in wells I_MW_B1 and E_MW_B7 (52 mg/L and 97 mg/L, respectively and also elevated relative to groundwater) but below a typical sea water concentration of about 19,000 mg/L. The seep recorded trace element concentrations below the laboratory limits of reporting (**Table 10**).

#### 5.7.2.5 Foreshore Soils

The foreshore soils typically recorded trace elements at low concentrations and below the ESVs, except for fluoride and zinc. Trace concentrations of individual PAHs were recorded in both foreshore soil samples, with both the LMW and HMW ESVs being exceeded (maximum concentrations of 314 mg/kg and 26.55 mg/kg being recorded, respectively). The south drain foreshore soils yielded contaminant concentrations below the human health screening levels, except for PAHs (recording a BaP TEQ above the screening value).

### *5.7.3 South Drain Additional Sampling Investigation Results*

Additional pore water samples were collected during May 2023. A comparison to the initial CMA investigation results is presented in **Table 8**. Data is presented spatially on **Figure 15d**.

Results from pore water samples collected in May were distinct from the initial CMA sampling results. Pore water copper concentrations from samples collected in May 2023 were detected in both locations whereas the initial CMA investigation samples were non-detect at the reporting limit. Additionally, fluoride concentrations in the most upgradient station (SOD-01) were observed above the ESV (3.1 mg/L). There is no comparable fluoride data for this station from the CMA investigation.

There were no detections of PAHs in south drain pore water using trace method analysis.

## 5.8 Bluff Harbour Drains Groundwater

The original SAP for the CMA investigation identify key NZAS groundwater monitoring wells adjacent to the CMA sample locations that were to be sampled. However, because NZAS was undertaking their own CMA/groundwater assessment, EHS Support’s ability to assess the groundwater conditions adjacent to the three drains was constrained by groundwater monitoring well access. During the course of the CMA assessment groundwater monitoring was undertaken in the following two groundwater monitoring wells (with access provided by NZAS):

- Monitoring Well I_MW_B1 – located midway between the north and west drain. The well is located inland from the drains, lying approximately 250 m and 400 m from the weir structures for the north and west drains, respectively.
- Monitoring Well E_MW_B7 – located close the west drain. The well is located approximately 100 m from the coast and approximately 50 m from the west drain weir structure.

The groundwater monitoring data for the two wells is summarised as follows:

- Well I_MW_B1 – groundwater levels were typically recorded at approximately 3.5 m below top of casing (BTOC) and showed some tidal influence (but not as pronounced or cyclical as would be expected). Groundwater EC fluctuated between approximately 275 and 325 µS/cm.

- Well E_MW_B7 – groundwater levels were typically recorded at approximately 3.4 m BTOC and showed minor tidal influence (potentially dampened by the presence/head of water held within the west drain). Groundwater EC fluctuated between approximately 275 and 325 µS/cm, with groundwater electrical conductivity measurements showing good evidence of tidal influence. Increases in groundwater EC were often noted following rainfall events (increasing from 300 to 325 µS/cm).

The aluminium concentrations recorded in the two wells exceeded the groundwater ESVs, yielding concentrations of between 0.63 and 1.6 mg/L. The concentration of total iron in in I_MW_B1 was also above  the groundwater ESV (0.3 mg/L), yielding a concentration of 67 mg/L. Dissolved iron in I_MW_B6 was recorded as 61 mg/L.

Trace element concentrations of arsenic, chromium, copper, fluoride, manganese, vanadium, and zinc were above laboratory detection limits in the groundwater sampled (but not necessarily in both wells).

Aqueous sub-surface samples were collected in the north and west drain beach areas under low tide (no-overlaying surface water) conditions (**Figure 19** and **Figure 20**). These samples were thought to be representative of groundwater fluxing into the marine environment. The chloride concentrations measured suggest that the north drain samples were likely to be sea water (yielding chloride concentrations of 20,000 to 21,000 mg/L), while the samples collected from the west drain recorded chloride concentrations of 6,900 and 11,000 mg/L indicating that the water sampled likely comprised co-mingled groundwater, sea water, and pore water. As such, constituent concentrations in these samples were conservatively screened against the 95% ESVs (**Table 10**).

The detection of several constituents including fluoride, aluminium, manganese, nickel, and zinc in the sub-surface aqueous samples collected suggest contributions from more than one source including upgradient groundwater (**Table 10**, attached). Of particular note was the fluoride concentration recorded at sample location NOD-4, approximately 100 m downstream from the mouth of the north drain that recorded a concentration of 9.37 mg/L (yielding a HQ >1).

Similarly, as described in **Section 5.7.2.4**, a groundwater seep was noted between the west and south drains that also suggests a flux of groundwater contamination into Bluff Harbour.

## 5.9 NZAS Landfill Overview – West Landfill (WLF) and East Landfill (ELF)

For the purpose of the CMA investigation, the NZAS landfill assessment area was subdivided into two assessment areas: the west landfill (WLF – Bluff Harbour) and east landfill (ELF – Foveaux Strait). The landfill assessment areas are documented locations for local fish and shellfish gathering activities and are therefore considered important pathways where both human health and ecological impacts may occur.

Contaminant concentration profiles between the WLF and ELF varied across the sampled media. Contaminant concentrations for sediment, surface water, and pore water samples collected as part of the CMA investigation were typically greatest in the WLF sample stations (**Figures 16a-16c**) compared to the ELF area (Foveaux Strait beach). However, potential limitations in the investigation scope (in particular the ability to target the zone of groundwater discharge to the marine environment [within Foveaux Strait]) means higher contaminant concentrations may occur within the Foveaux Strait beach area than those recorded during the CMA assessment.

The initial results suggest that the risk to aquatic receptors in the receiving environment may be greatest in the lower energy environments within Bluff Harbour; however, given that the majority of the landfill leachate contamination plume flux discharges to the east to Foveaux Strait (GHD, 2023; Woodward-Clyde 1994), further work is warranted to determine the exact nature of the discharge (i.e., emergence of contamination in the receiving environment). This assessment is currently being performed by NZAS/GHD as part of the landfill consent application.

The key contaminants of concern noted from the landfill reflect the composition of the waste disposed of within the landfill and can be characterised as follows:

Trace element concentrations in groundwater from the ELF monitoring wells exceeded ESVs for several constituents including fluoride, aluminium, and iron (**Table 1**). Concentrations of trace elements in exceedance of ESVs were proportional to data provided by NZAS in the 2023 landfill consent application and historical monitoring results (**Appendix K**; GHD, 2023).

PAHs were primarily detected in the east landfill soil and west landfill sediment reflecting the nature of the activities that occur with the catchment for this portion of the landfill including run off and aerial deposition from landfill stages associated with storage of PAH containing materials including refractory bricks, and process-related oils disposed of in the landfill (NZAS, 2023).

As of the publication of this report, NZAS and GHD have submitted a 5-year consent application for the landfill (GHD, 2023). The landfill consent application contained a revised hydrologic conceptual site model (HCSM) for the NZAS landfill and surrounding areas. The HCSM provided additional insight into the dynamics of the landfill groundwater contamination plumes and concentrations of COPECs in various media in the receiving environment. A summary of this information is incorporated (where appropriate) into the findings below.

### 5.9.1 NZAS Landfill Setting

The NZAS landfill sits on the western end of Tiwai Peninsula and comprises multiple cells that have been filled with site generated wastes that have been closed, levelled, and contoured in stages (NZAS, 2023). The landfill is effectively comprised of a series of mono-cells each containing different wastes. The cells are unlined and only two cells have been completed with an engineered cap. To the east of the landfill lies the Haysoms Dross Landfill Cell (**Section 2.1**) which comprises a separate landfill equipped with an engineered cap.

A registry of the waste contained in each stage is provided in the NZAS 2023 Landfill consent application (NZAS, 2023) and is summarised in **Section 3.2**. Leachate generated by the landfill is a documented source of contamination to the downgradient areas (GHD, 2023; URS, 2009), with the majority of the leachate fluxing into Foveaux Strait and a minor volume of leachate discharging into Buff Harbour.

The WLF and ELF sampling locations are characteristic of the conditions within Bluff Harbour and along the Foveaux Strait beach, respectively. The WLF area sampling area is generally a low energy beach/tidal flat environment with the facility wharf and conveyor immediately north of the beach. Bedrock outcrops within the west beach area and significant outcrops occur at the southwest end of the ELF beach (i.e., Tiwai Point). The ELF area sampling location comprised a moderate to steeply sloping coastal beach (intermediate energy environment). Photographs 8 and 10 in **Appendix C** show the ELF and WLF sampling areas.

## 5.9.2 *Investigation Results*

The results from the CMA assessment of the WLF and ELF areas are presented in following attached figures:

- **Figure 16a** and **16b** – Solid matrices (soil and sediment).
- **Figure 16c** – Aqueous matrices (surface water and pore water).
- **Figures 23 – 27** – Aqueous matrices shown schematically.

The media contamination within the WLF and ELF receiving environments are characterised as follows:

### 5.9.2.1 Surface Water and Pore Water

The surface water within the ELF sampling area (Foveaux Strait) generally recorded concentrations of most COPECs below the LOR. Fluoride and chloride concentrations were typical of ocean water (suggesting that the elevated fluoride concentration groundwater contamination discharging from the landfill is not occurring at surface within the area of the sampling locations). Trace concentrations of arsenic (maximum concentration 0.001 mg/L) were recorded in the surface water. The pore water samples yielded similar contaminant concentrations to the surface water samples. As a result, there were no exceedances of the ESVs in either surface water or pore water.

The GHD 2023 investigation work (**Appendix K**; GHD, 2023) recorded similar contaminant concentrations at their Foveaux Strait sample stations for surface water and beach groundwater (similar to the EHS Support pore water samples) to the EHS Support investigation results. The GHD investigation work was spatially more extensive, and the laboratory testing covered an expanded constituent list. Some of the differences in concentrations recorded between EHS Support and GHD work can be potentially attributed to differences in laboratory precision. Trace concentrations of barium, boron, lithium, and molybdenum were recorded in the GHD surface water samples (**Appendix K**; GHD, 2023).

Generally, constituents measured in surface water and pore water samples collected from within Bluff Harbour (WLF) yielded greater concentrations than Foveaux Strait. This suggests there is less dilution occurring within the Bluff Harbour environment (lower energy environment) and that the discharge of groundwater contamination into the harbour is likely occurring relatively close to the foreshore.  Fluoride concentrations were typical of marine waters except for the pore water sample collected from sample station WLF-02 which recorded a concentration of 1.45 mg/L (just below the ESV). Boron concentrations in both surface water and pore water at sample station WLF-01 were above the reference value (concentrations ranging between 5.6 mg/L and 7.1 mg/L).

As with the ELF area, the GHD investigation work for the WLF area was more spatially and analytically comprehensive than the investigation activities completed by EHS Support. The GHD 2023 investigation recorded compounds in surface water and beach groundwater above the LORs and ESVs (**Appendix K**; GHD, 2023), including:

- Aluminium (dissolved) – beach groundwater recorded a maximum concentration of 1.97 mg/L.
- Boron – surface water and beach groundwater recorded maximum concentrations of 5.08 mg/L and 4.69 mg/L, respectively.
- Copper – surface water and beach groundwater recorded maximum concentrations of 0.0042 mg/L, and 0.006 mg/L, respectively.
- Fluoride – beach groundwater recorded a maximum concentration of 10.9 mg/L.

A number of other compounds were recorded by GHD at detectable concentrations for which ESVs were not developed by EHS Support, including molybdenum, and vanadium.

#### 5.9.2.2 Sediment

The ELF sediment samples comprised surficial predominantly coarse beach sands with limited organic material (reported TOC up to 3.3 %). Because of sampling constraints (i.e., high energy beach environment), only near surface (surface to 0.1 m depth) samples were collected. Minimal bird and marine life were observed during sampling works.

Sediment contaminant concentrations were typically very low in the ELF sediments, with all COPECs (where detected) recording EF's less than or just above 1 (yielding similar concentrations to background). Of note was the sediment pH which ranged between 9 and 9.2 (alkaline) at all three sediment sampling stations.

The "CMA" sediment samples collected by GHD as part of the landfill consent application on Foveaux Strait beach (ELF area) recorded similar COPEC concentrations to the EHS Support investigation results (GHD, 2023). GHD sediment samples were predominately collected at surficial intervals (0 m-0.1 m), with deeper sediment samples (0.1 m-0.5 m) at select sample stations. Some of the determinant concentration differences are likely to result from differences in precision between the two laboratories used. Higher sediment fluoride concentrations were recorded by GHD (maximum 1,400 mg/kg, recorded at 0.5 m depth) (**Appendix K**; GHD, 2023). Sediment pH results from the GHD investigation were approximately more neutral (6.9-8.3) than results from the EHS Support investigation.  The reason for this pH variation is not apparent.

The EHS Support WLF sediment samples were collected via bores from the tidal flat area and comprised a mix of coarse and finer grained materials at surface. Sediment cores comprised sands with fine grained silt and peat (TOC up to 46%) layers. Particle size distribution analysis on two selected samples indicated less than 6% weight/weight (wt/wt) over 2 mm in size indicating generally finer grain deposition than observed in other assessment areas. Cawthron (2005) mapped the downgradient Bluff Harbour area as gravel field grading to firm sand and mud. The CMA sampling confirmed the documented mapping. Soil samples were collected inland from the beach, slightly elevated above the beach / tidal flat area. Evidence of marine life (invertebrates (crabs), snails, fish) were observed during the sampling event.

The concentration of Site-related constituents in the WLF sediment were typically greatest at depth (i.e., in the sub-surface and deep intervals). The WLF assessment area is a low energy environment and allows for the accumulation of sediment (acknowledging that the weather conditions can create a high energy environment).

ESV exceedances of fluoride and mercury were recorded in the west landfill area.  Additional exceedances of ESVs in sediment in the west landfill include select PAH compounds. PAHs were detected primarily in the sub-surface and deep interval. WLF-02, located downgradient of potential overland flow paths from the landfill was observed to have the greatest concentration of PAH detections and exceedances. In particular dibenz(a,h)anthracene recorded a HQ of 105.

Select sediment samples from the WLF area were also tested for PCBs and TPH and the results yielded concentrations below the LORs (**Appendix H**).

The GHD sediment samples within the WLF area were collected in a similar manner as described above for the ELF area (GHD sediment samples were predominately collected at surficial intervals [0 m-0.1 m], with deeper sediment samples [0.1 m-0.5 m] at select sample stations). The GHD work recorded similar COPEC concentrations to the EHS Support investigation in the surface sediment samples with elevated concentrations (above the 80th percentile of GHD background) for fluoride and manganese recorded in two samples (**Appendix K**; GHD, 2023). Select WLF sediment samples were also analysed for PCBs and dioxin-like PCBs. Non-detect concentrations of PCBs were recorded in all samples tested. There were isolated detections of dioxin-like PCBs in the WLF sediment. A detailed assessment of these results is provided in **Appendix J**.

#### 5.9.2.3 Foreshore Soils

The ELF foreshore soils typically recorded COPECs at low concentrations and below the ESVs, except for arsenic and fluoride which recorded maximum concentrations of 13 mg/kg and 570 mg/kg, respectively. Concentrations of individual PAHs were recorded in all foreshore soil samples, with both the LMW and HMW ESVs being exceeded (maximum concentrations of 72.2 mg/kg and 4.78 mg/kg being recorded, respectively).

The WLF foreshore soils typically recorded COPECs at low concentrations and below the ESVs, except for fluoride which recorded maximum concentrations of 210 mg/kg. Trace concentrations of individual PAHs were only recorded in one of the foreshore soil samples, with the LMW and HMW concentrations lying below the ESVs.

The landfill foreshore soils yielded contaminant concentrations below the human health screening levels except for a fluoride concentration recorded in one sample in the ELF area (570 mg/kg).

#### 5.9.2.4 Landfill Groundwater

NZAS made available four groundwater monitoring wells within the landfill area for EHS Support to monitor during the CMA work, as listed below:

- Monitoring Well A63 – located north of the landfill and lying approximately 200 m east of the west landfill CMA sampling area and 300 m west of the south drain sampling area.
- Monitoring Wells A51, A53, and A56 – located within the foredune area (above Foveaux Strait beach) east and downgradient of the landfill.

The groundwater monitoring data for the wells is summarised as follows:

- Well A63 – groundwater levels were typically recorded at approximately 1 m BTOC and showed no real tidal influence. Groundwater EC was typically in the order of 520 µS/cm.
- Well A51 – groundwater levels were typically recorded at approximately 3.5 m BTOC and showed minor tidal influence. Groundwater EC fluctuated between approximately 520 and 640 µS/cm, with groundwater electrical conductivity measurements showing good evidence of tidal influence.
- Well A53 – groundwater levels were typically recorded at approximately 4.5 m BTOC and showed minor tidal influence. Groundwater EC fluctuated around 1,100 µS/cm, with groundwater EC measurements showing good evidence of tidal influence.
- Well A56 – groundwater levels were typically recorded at approximately 4 m BTOC and showed minor tidal influence. Groundwater EC reduced from approximately 1,700 µS/cm to 1,200 µS/cm over the monitoring period, with groundwater EC measurements showing good evidence of tidal influence.

The wells east of the landfill recorded elevated aluminium (maximum 2.7 mg/L), fluoride (maximum 19.2 mg/L), and iron (maximum 7.8 mg/L) concentrations and exceeded the 80% ANZECC equivalent criteria (**Table 4; Figure 21**). While Well A63 only recorded an iron concentration above the 80% ANZECC equivalent criteria.

## 5.10 SCL Pad (SCL) and Inalco (ISA)

As with the Foveaux Strait background location, the Inalco and SCL Pad CMA sampling areas comprised a moderate to steeply sloping coastal beach (sampling locations shared the same beach). Sediment samples comprised surficial predominantly coarse beach sands with limited organic material (reported TOC up to 3.3 %). Soil samples were collected from the rear foredune area elevated above water and sediment sampling locations. Minimal marine life was observed during sampling works. Photographs 5 and 6 in **Appendix C** show the SCL pad CMA area and Photograph 8 shows the Inalco sampling area.

### *5.10.1 Investigation Results*

The Inalco area samples were collected downgradient (approximately 200 m) of the Inalco storage area, which contains the diesel trailer storage area, Inalco facility and bagged goods store, cooling stacks, SCL storage sheds, former external storage area, and former cell bottom/aluminium swarf and cathode bar laydown areas. Potential pathways associated with this area include leaching of soil contamination to groundwater, migration of contaminated soils or dusts via stormwater to the south drain and aeolian transport of dust and particulates.

The SCL pad is a known area of discharge of Site-related constituents including cyanide and fluoride (NZAS, 2021a). NZAS maintains a consented discharge of treated effluent from the effluent treatment plant into the Foveaux Strait. No wet material is currently stored in the SCL pad; however, there are documented historical discharges of SCL pad leachate. Groundwater monitoring of the SCL pad area is undertaken by NAZS and the contamination is managed by the capacity of the SCL pad area to dilute and attenuate concentrations of leachate naturally.

The results are presented in following figures by matrix and area. Attached figures by area and matrix are presented as follows:

Inalco Area (ISA):

- **Figure 17a** and **17b** – Solid matrices (soil and sediment).
- **Figure 17c** – Aqueous matrices (surface water and pore water).

SCL pad (SCL):

- **Figure 18a** and **18b** – Solid matrices (soil and sediment).
- **Figure 18c** – Aqueous matrices (surface water and pore water).

The distribution of Site-related constituents within the receiving environment is observed along the Foveaux Strait and is subjected to mixing from the high energy environment present. Distribution of constituents appears to occur principally due to the discharge of stormwater and groundwater from the lnalco Area and SCL Pad.

The media contamination downgradient of the assessment areas is characterised as follows.

#### 5.10.1.1 Surface Water

There were no surface water ESV exceedances within Foveaux Strait and down gradient of the Inalco area and minimal exceedances of ESVs in the surface water from downgradient of the SCL Pad. Surface water ESVs for aluminium and boron were exceeded downgradient of the SCL Pad and concentrations of zinc was recorded below its respective ESVs, but above background in the SCL pad area (i.e., EF>1).

#### 5.10.1.2 Sediment

There were no exceedances of ESVs in the sediment in the assessment areas along Foveaux Strait (Inalco or SCL Pad areas). Concentrations of arsenic and vanadium were recorded below their respective ESVs, but above background in both assessment areas (i.e., EF>1). Fluoride was observed below the ESV but greater than background in the SCL Pad area. Sediment PAH concentrations were below the LOR in both assessment areas.

#### 5.10.1.3 Pore Water

There were minimal exceedances of ESVs in pore water from the assessment areas along Foveaux Strait. Pore water downgradient of the SCL Pad was observed to exceed the ESV for boron. Concentrations of zinc were recorded below their respective ESVs, but above background in the SCL Pad area (i.e., EF>1).

#### 5.10.1.4 Foreshore Soils

The foreshore soils down gradient of the Inalco area typically recorded COPECs at low concentrations and below the ESVs, except for arsenic and LMW and HMW PAHs, recording maximum concentrations of 9.8 mg/kg, 30.1 mg/kg, and 3.02 mg/kg, respectively.  Similarly, the foreshore soils down gradient of the SCL Pad typically recorded COPECs at low concentrations and below the ESVs, except for arsenic, fluoride and HMW PAHs, recording maximum concentrations of 8.5 mg/kg, 7,300 mg/kg, and 14.92 mg/kg, respectively. The Inalco area foreshore soils yielded contaminant concentrations below the human health screening levels, while the SCL pad area recorded an aluminium (12,000 mg/kg) and fluoride (730 mg/kg) concentrations above the risk screening values.

### 5.11 Inalco Area and SCL Pad Groundwater

One groundwater monitoring well (Well L_MW_B18) downgradient of the Inalco Area was monitored during the CMA work programme. The groundwater monitoring data for this well is summarised as follows:

- Groundwater levels were typically recorded at approximately 4.5 m BTOC and showed minor tidal influence. Groundwater EC fluctuated between 455 µS/cm to 475 µS/cm over the monitoring period. The groundwater EC monitoring showed evidence of tidal influence.
- Trace element concentrations of arsenic, boron, copper, fluoride, and iron above laboratory detection limits were recorded in the groundwater sampled from this well.

One groundwater monitoring well (Well 4-5) downgradient of the SCL Pad was monitored during the CMA work programme. The groundwater monitoring data for this well is summarised as follows:

- Groundwater levels were typically recorded at approximately 4 m BTOC and showed no real tidal influence. Groundwater EC declined from about 900 µS/cm to 500 µS/cm over the

monitoring period. The groundwater electrical conductivity monitoring showed evidence of tidal influence.
- Elevated aluminium concentrations were recorded that exceeded the groundwater ESV.
- Due to laboratory issues, fluoride was not re-analysed at this location and is therefore not discussed as part of these results.

# 6 CMA Results – Summary Discussion

The independent CMA assessment collected groundwater, surface water, pore water, sediment, and soil samples in the assessment areas downgradient from and adjacent to the NZAS aluminium smelter located on Tiwai Point. Co-located surface water, pore water, and sediment samples were collected within the assessment areas to provide multiple lines of evidence to evaluate ecological risk in the receiving environment (**Figure 2**). Pore water samples were collected at the same interval as surface sediment samples to better understand the potential risk to aquatic receptors for constituents without ESV in sediment (i.e., fluoride and aluminium). Samples were compared to the ESVs derived in **Appendix A**. Exceedances of ESVs varied by sample matrix and location. Discussion on the exposure conditions and identified COPECs in each environmental matrix and assessment area is provided in the sections below.

## 6.1 Smelter Domain Drains

### *6.1.1 Distribution of COPECs in the Mixing Zones*

Site-related COPECs including fluoride, aluminium, and trace metals exceeded ESVs in sediment, surface water, and pore water in discharge areas downstream of each of the three drains. The frequency of detection and frequency of ESV exceedances were greatest downstream of the north drain. Under baseflow discharge conditions (i.e., normal operating conditions), exceedances of aluminium, fluoride, and other trace metals occurred in pore water and surface water immediately below the outfall and up to 100 m downgradient. Based on the frequency and magnitude of exceedances of the ESVs, risk to aquatic receptors in the drains is primarily driven by fluoride, aluminium, and select trace metals. This is based on the frequency and magnitude of exceedances of the ESVs in pore water, surface water, and surface sediment, where it is most likely that aquatic receptors will be exposed.

The north drain receiving environment is generally a low energy environment and allows for the accumulation of sediment discharged from the north drain throughout the drainage receiving environment. The CMA investigation suggests that the bulk of the sediment is likely to be discharged into wider Bluff Harbour (given the low % of fine-grained sediment in the immediate area of the north and west drain outlets). This was observed particularly during the first flush event when sediment was discharged from the north drain and deposited at each sample station in the north drain sequence. Surface water samples collected from the north drain outfall during the first flush event showed that COPECs were present up to 100 m from the outfall at concentrations orders of magnitude greater than under baseline conditions (**Table 7**; **Figure 13c**), in particular:

- Dissolved aluminium concentrations in surface water collected at TWC in NOD-04 were 19 mg/L and non-detect under first flush and baseline conditions, respectively.
- Fluoride concentrations in surface water collected at TWC in NOD-04 were 23.4 mg/L and 0.95 mg/L during first flush and baseline conditions, respectively.
- Dissolved concentrations of copper, cobalt, and nickel in the first flush samples were observed to exceed their ESVs in north drain surface water 100 m from the outfall. Except for copper, these constituents did not exceed their respective ESVs under baseline conditions, further illustrating the potential risk associated with episodic precipitation-based discharge events.
- The highly elevated concentration of aluminium and fluoride recorded during the first flush event in the north drain could cause acute effects and result in mortality from fluoride (fish and benthic invertebrates) and aluminium (benthic invertebrates).

The flushing effect observed at the north drain outfall indicates that a source area for fluoride, aluminium, copper, cobalt, and nickel is present upgradient of this drainage feature.

Aqueous sub-surface samples were collected in the north drain beach area under low tide (no-overlaying surface water) conditions at NOD-03 and NOD-04, 50 m and 100 m from the outfall, respectively (**Figure 19**). The detection of several constituents including fluoride, aluminium, manganese, nickel, and zinc in the sub-surface aqueous samples collected suggest the contributions from more than one source likely including sea water, pore water, and upgradient shallow groundwater (**Table 10** and **Figure 22**). As such, constituent concentrations in these samples were conservatively screened against the 95% ESVs (**Table 10**).

West drain surface water discharge concentrations of fluoride exceeded the ESV in both the TWC and BWC positions at the drain mouth and 75 m out from the drain mouth (with mixed concentrations above and below the ESV recording at the in between sampling stations). Dissolved aluminium concentrations in west drain surface water exceeded the ESV at each location within the drainage receiving environment (up to 100 m from the drain mouth). Dissolved concentrations of copper and zinc were observed to exceed their respective ESVs in the west drain surface water discharge, indicating the presence of a source area upgradient in the drainage feature. There was one detection and exceedance of a PAH compound observed across the Site. Benzo(a)anthracene at the TWC position of WOD-01 (outfall location) exceeded the ESV with a HQ of 222. This result aligns with the historical record of PAHs detected in the west drain.

Additional exceedances of aqueous ESVs include boron, copper, iron, and zinc in pore water collected at WOD-01 (west drain outfall location) and WOD-02 (25 m downgradient). Detections of these metals in the west drain were greater than background pore water (EF >1). Manganese concentrations in pore water were generally greater than surface water. The magnitude of difference in detections of manganese in pore water and not surface water suggests contributions from a different source, including upgradient groundwater. This is further substantiated by the concentration of manganese in sub-surface aqueous samples collected at the WOD-01 location under low tide (no-overlaying surface water) conditions (**Figure 20**). Fluoride, iron, aluminium, and zinc were also observed to exceed their respective ESVs in the sub-surface aqueous samples collected adjacent to WOD-01 and WOD-02.

Concentrations of fluoride in the south drain assessment area surface water were similar to background fluoride concentrations in the Awarua Bay background area with EFs less than or equal to 1. Exceedances of aqueous ESVs in the south drain included aluminium, cadmium, copper, and zinc. Dissolved copper exceeded the ESV in surface water at SOD-02 in the TWC position. South drain discharge dissolved copper was greater than background (EF >1). Most aqueous exceedances in the south drain discharge were observed in pore water. Based on the minimal discharge observed from the south drain outfall to the receiving environment, it is possible that the principal source of constituents in this assessment area is not the drain outfall and could be groundwater.

A groundwater seep was identified north of the south drain discharge. Water quality parameters were collected along with a seep sample to determine the potential source areas of this volume discharging directly to the CMA. Analytical results from the seep sample indicated fluoride concentrations above the ESV. The chloride concentration from the seep (350 mg/L) was less than observed ocean water (approximately 19,000 mg/L) suggesting that it was groundwater discharging from an upgradient area. As such, constituent concentrations in the seep sample were screened against the 80% ESVs (**Table 10**).

The south drain outfall exhibited minimal connectivity to the receiving environment during the field investigation under variable tidal conditions. It is likely that discharge from the south drain only occurs during precipitation events. There was continuous connectivity from the north drain and west drain to the receiving environment under variable tidal conditions (with these drains likely to be receiving a steady discharge of process water). Discharge was observed to flow from the west drain towards the south drain assessment area. Further work is recommended to constrain the effects of discharge events on the receiving environment, including:

- Quantifying the contributions of the south drain relative to the west drain discharge to the receiving environment of Bluff Harbour.
- Constraining the magnitude of COPEC discharge during flushing events within the receiving environments of the drains.

### 6.1.2 Fresh Water Lens

Surface water samples in the discharge areas from the drains were collected at two depths in the TWC and BWC to assess the potential for a freshwater lens to occur during discharge events. The presence of a freshwater lens in the drains has been documented in the application and AEE associated with the 2005 discharge consent for the drains (NZAS, 2005a). The AEE cites a report by Bioresearches (1995) that documented the presence of distinct, buoyant freshwater on the water surface and notes that the current consent requirements for sampling in the drains may not fully capture the presence of freshwater discharge from the drains in the receiving environment (NZAS, 2005b).

Chloride was used as a tracer to determine if there was a freshwater lens discharging from the drains into the mixing zone. Chloride concentrations in ocean water range from approximately 19,000 to 20,000 mg/L (Millero et al., 2008). There is not sufficient evidence to suggest an appreciable difference in concentrations from the top and bottom of the water column during normal operating conditions; however, there is evidence to suggest that during stormwater discharge events, a freshwater lens is present within the receiving environment mixing zone. A first flush surface water sample was collected immediately following a precipitation event in north drain.

Surface water collected upgradient from the north drain outfall had a chloride concentration of 36 mg/L. Surface water samples collected 100 m from the outfall immediately following a precipitation event had chloride concentrations of 3,600 mg/L and 20,000 mg/L at TWC and BWC, respectively. The difference between TWC and BWC chloride concentrations suggests the presence of a freshwater lens is occurring because of discharge from the drain. This variability in chloride concentrations was not observed during baseline conditions.

West drain surface water discharge samples collected during a precipitation event did not provide clear evidence that a freshwater lens was present throughout the mixing zone; however, this may in part be due to weather conditions at the time of sampling (strong onshore winds and waves present). Chloride concentrations in the west drain sequence ranged from 13,000 mg/L at the outfall to 20,000 mg/L at the edge of the mixing zone. The gradient from brackish water to marine water appears to occur within proximity of the outfall. Chloride concentrations are approximately representative of marine waters between 25 m and 50 m from the outfall.

It is likely that a freshwater lens is present within the mixing zone of the drains during greater than baseline discharges (with minimal wave action); however, under baseline conditions, there is not sufficient evidence to support the presence of a freshwater lens in the mixing zones of the drains.

### 6.1.3 Foreshore Soils

Soil samples were collected in the foreshore area upgradient of the smelter domain drains to better understand the potential pathways for Site-related constituents to discharge into the CMA. Soil samples targeted apparent areas of deposition from clearing activities downgradient of the drain outfalls and apparent overland flow paths.

Soil constituents in exceedance of ESVs were similar between all drains. LMW/HMW PAH compounds (as sum of detected PAH compounds) were observed to exceed the ESV for soils in the west drain and south drain. This is consistent with the understanding of Site-related activities in the upgradient areas of the foreshore. Fluoride was the only constituent observed to exceed the soil ESVs in the north drain. Fluoride and zinc were also observed to exceed the ESV in south drain soils. PAH sum exceedances of soil ESVs were the greatest in magnitude. The presence of exceedances of ESVs for fluoride, zinc, and PAHs suggests that there are potentially complete pathways from the Site to the CMA receiving environment foreshore areas.

Soil conditions met the narrative conditions outlined in **Appendix A** for aluminium, therefore aluminium concentrations in CMA assessment soils were compared to background aluminium concentrations. Aluminium concentrations were marginally greater than background aluminium concentrations in the drains; however, soil pH at these locations was within the narrative range for insolubility of aluminium in soils; therefore, there is minimal potential for risk associated with aluminium in soils in the foreshore area upgradient of the drains.

There are several constituents in soil that did not exceed or have a ESV in the foreshore area of the drains. Several of these constituents had concentrations greater than background concentrations. These constituents include arsenic, total chromium, cobalt, copper, iron, nickel, titanium, and vanadium. Further assessment is warranted to determine the potential for risk associated with these constituents with respect to environmental receptors.

The foreshore soils in the drains areas of the smelter complex were below the human health risk screening values, except for the PAHs within the south drain area.

## 6.2 Landfill

### 6.2.1 CMA Assessment Area

Co-located surface water, pore water, and sediment samples were collected from within the CMA of the WLF and ELF assessment areas to better constrain the distribution of Site-related constituents being discharged into the receiving environment, primarily from landfill leachate. Sediment samples were collected at surface, sub-surface, and deep intervals in the WLF to evaluate risk to aquatic receptors and to assess whether legacy deposition had occurred. Sediment samples in the ELF were only collected at surface intervals due to the high energy environment of the Foveaux Strait that would limit fine grain deposition and minimise the historical deposition that could accumulate at depth.

Surface water and pore water samples were collected to assess potential exposure conditions to organisms that may be present in the receiving environment. Surface water was collected at the TWC and BWC in the WLF area (Bluff Harbour). Surface water was collected at one interval in the ELF because of the high energy conditions in Foveaux Strait. Pore water samples were collected at the same interval as surface sediment samples to better understand the potential risk to aquatic receptors for constituents without ESVs in sediment (i.e., aluminium).

Exceedances of Site-related COPECs ESVs were observed in sediment and pore water in the WLF and pore water in the ELF. Boron exceeded the ESVs in pore water in the WLF and there were several exceedances of ESVs in sediment, including fluoride, mercury, and several PAH compounds. The greatest magnitude of ESV exceedances were observed for PAHs in west landfill sediment. Mercury was detected in the deep sediment interval of WLF-02 (West Landfill) at a concentration of 0.38 mg/kg (HQ = 2.5). West landfill sediment mercury concentrations were greater than background concentrations (EF > 1). There were no other exceedances of sediment ESVs in the east landfill or west landfill CMA; however, several constituents were observed at concentrations greater than background concentrations (EF >1) in CMA assessment media.

ELF sediment trace elements including arsenic, iron, manganese, and vanadium were observed at concentrations greater than background (EF >1). The greatest magnitude of difference between the background and East Landfill was observed for arsenic. The EF for arsenic in East Landfill sediment was 2.8. West Landfill sediment metals including aluminium, cadmium, total chromium, copper, iron, lead, manganese, nickel, titanium, vanadium, and zinc were observed at concentrations greater than background with EFs ranging from 1.1 to 1.9. The greatest EF was observed for cadmium and lead in west landfill sediment. Given that these constituents did not exceed an ESV yet were identified at concentrations greater than background sediment, additional work is recommended to constrain the potential for ecological risk of these constituents relative to background concentrations.

There were no detections of total recoverable fluoride in the east landfill sediment; however, soluble fluoride was detected at concentrations in the east landfill and were greater than background with EFs ranging from 2.6 to 18. The greatest concentration of soluble fluoride was observed at ELF-02, which is downgradient of NZAS landfill groundwater monitoring well A54. A54 was not sampled as part of this investigation; however, available records for this monitoring well (NZAS, 2021) indicate that concentrations of fluoride range between 5.8 mg/L and 25 mg/L, with the most recent available data showing concentrations of 20 mg/L and 21 mg/L in 2020. Pore water in the ELF had concentrations of fluoride at or below background concentrations in the range of known concentrations of sea water. This would suggest that upgradient sources of fluoride are discharging at lower depths or are dispersing immediately upon discharge into the CMA.

Total recoverable fluoride was detected in WLF sediment in WLF-02 at the surface and deep sediment intervals. The WLF-02 deep interval sediment exceeded the ESV for total recoverable fluoride (HQ = 1.1). Total recoverable fluoride in WLF sediment was greater than background with an EF of 1.3. The soluble fluoride concentration observed in the deep sediment sample at WLF-02 was proportionally greater than the surface sediment interval soluble fluoride concentration. Soluble fluoride was not detected in background sediment; therefore, no comparison was made to background. Concentrations of soluble fluoride in the ELF and WLF suggest that the phase of fluoride that would interact directly with aquatic receptors is present at concentrations greater than background. Future work is recommended to determine the potential effect that soluble fluoride concentrations in sediment would have on receptors in the receiving environment.

### *6.2.2 Foreshore Soils*

Soil samples were collected in the east and west landfill locations to better understand the potential pathways for Site-related constituents to discharge into the CMA. Soil sample locations targeted visible overland flow pathways from the landfill.

Soil constituents in exceedance of ESVs were distinct between east and west landfill samples. Arsenic, total recoverable fluoride, and LMW/HMW PAH compounds were observed to exceed the ESV for soils in the east landfill. Fluoride was the only constituent observed to exceed the soil ESVs in the west landfill. The magnitude of east landfill fluoride detections and exceedances was greater than west landfill detections.

The presence of arsenic, fluoride, and PAH compound concentrations in exceedance of ESV suggests that there are potentially complete pathways from the landfill to the CMA receiving environment to the east. Further investigation is warranted to determine the potential pathways from the landfill to the west.

Soil conditions met the narrative conditions outlined in **Appendix A** for aluminium; therefore, aluminium concentrations in CMA assessment soils were compared to background aluminium concentrations. Aluminium concentrations were marginally greater than background aluminium concentrations in west landfill locations WLF-SO-03 and WLF-SO-03. The concentrations of aluminium in east landfill soils were up to 3.3 times greater than background concentrations; however, soil pH at these locations (5.7 to 7.1 in the east landfill and 5.9 to 7.6 in the west landfill) were within the narrative range for insolubility of aluminium in soils. Further assessment is warranted to determine the potential for risk associated with aluminium in soils in the east landfill.

There are several constituents that did not exceed or have an ESV in east or west landfill soils with concentrations greater than background concentrations. These constituents include cadmium, total chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, titanium, vanadium, and benzo(a)pyrene TEQ. Several PAH compounds were observed at concentrations above background concentrations. Further assessment is warranted to determine the potential for ecological risk associated with these constituents.

The foreshore soils in the landfill area were below the human health risk screening values.

## 6.3 Inalco Area and SCL Pad

### *6.3.1 CMA Assessment Area*

Samples collected in the Inalco and SCL pad areas were predominately sediment samples based on the understanding of transport pathways from the upgradient areas to the CMA and the high energy nature of the Foveaux Strait. Surface water and pore water samples were collected at selected sediment locations in each area (**Figure 2**) and at one depth interval to assess the potential risk to aquatic receptors immediately downgradient of the Inalco storage yard and the SCL storage pad. Pore water samples were collected to assess potential exposure conditions to organisms that may be present in the receiving environment and were collected at the same interval as surface sediment samples to better understand the potential risk to aquatic receptors for constituents without ESVs in sediment (i.e., fluoride and aluminium).

There were minimal exceedances of ESVs in the CMA assessment areas of the Inalco and SCL Pad areas. Dissolved aluminium exceeded the ESV for surface water at SCL-02 with a HQ of 1.2; however, the concentrations observed at this assessment area were less than background surface water concentrations (EF <1). The zinc concentration in surface water was greater than background (EF >1). Boron was observed to exceed the ESV in SCL pad pore water and surface water. The SCL pad area pore water boron concentration was 2.8 times greater than background concentrations. SCL pad surface water boron concentrations were of approximately the same magnitude greater than background.

There are several constituents that did not exceed or have a ESV in the Inalco or SCL Pad areas. Several of these constituents in sediment, pore water, and surface water were observed at concentrations greater than background concentrations. Magnesium, and zinc were each observed at concentrations greater than background (EF >1) in the aqueous phase. Calcium and copper were observed at concentrations greater than background in pore water. Calcium and magnesium are approximately within known background concentrations of sea water and are marginally greater than Site background concentrations. Further assessment is warranted to determine the potential for risk associated with copper to aquatic receptors.

Arsenic and vanadium in sediment were observed at concentrations greater than background in both Inalco and SCL areas. Total recoverable and soluble fluoride were observed at concentrations greater than background in the SCL pad area. Further assessment is warranted to determine the potential for risk associated with these constituents to aquatic receptors.

### *6.3.2 Foreshore Soils*

Soil samples were collected in the Inalco and SCL pad areas to better understand the potential pathways for Site-related constituents to discharge into the CMA from upgradient Site locations.

Soil constituents in exceedance of ESVs were similar between the Inalco and SCL pad samples. Arsenic and LMW/HMW PAH compounds were observed to exceed the ESV for soils in the Inalco and SCL pad area soils. Total recoverable fluoride was observed to exceed the ESV in SCL Pad soils at SCL-SO-01 (HQ = 1.3) and SCL-SO-02 (HQ = 44). HMW PAH compounds were observed to have the greatest magnitude of exceedance in the Inalco area with HQs ranging from 4.4 to 8.2. Arsenic concentrations in soil were observed to exceed the ESV (HQs ranging from 1.2 to 1.7) and were greater than background concentrations (EFs ranging from 1.9 to 2.8). The presence of arsenic, total recoverable fluoride, and PAH compound concentrations in exceedance of ESVs suggests that there are potentially complete pathways from upgradient Site features to the CMA receiving environment to the south. Total recoverable fluoride concentrations in the SCL Pad were the greatest magnitude observed across Site soils sampled during the CMA assessment. The distribution of fluoride in the SCL Pad area highlights the heterogeneity of soils in the area and warrants additional investigation into the spatial distribution of fluoride concentrations in soil.

Soil conditions met the narrative conditions outlined in **Appendix A** for aluminium; therefore, aluminium concentrations in CMA assessment soils were compared to background aluminium concentrations. Aluminium concentrations in SCL pad soils were less than or equal to background aluminium concentrations, except for SCL-SO-02, which had an aluminium concentration of 12,000 mg/kg, six times greater than background soil concentrations. Inalco area soil samples had aluminium concentrations ranging from 2,700 mg/kg to 5,200 mg/kg. The EF for Inalco area soil aluminium was 2; however, soil pH at these locations (5.8-6.3) were within the narrative range for insolubility of aluminium in soils. Further assessment is warranted to determine the potential for risk associated with aluminium in soils in the Inalco and SCL pad areas.

There are several constituents that did not exceed or have a ESV in east landfill or west landfill soils with concentrations greater than background concentrations. These constituents include cadmium, total chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, titanium, vanadium, and zinc. Further assessment is warranted to determine the potential for ecological risk associated with these constituents.

The foreshore soils in the Inalco and SCL pad were below the human health risk screening values, except for the aluminium in the SCL pad area.

## 6.4 NZAS Groundwater Monitoring Wells

Groundwater samples were collected from selected monitoring wells to provide collated / concurrent groundwater contamination data for the CMA assessment, and to verify the integrity of the routine groundwater being performed by NZAS. Results from the groundwater sampling completed as part of this investigation are generally within the historical range of available data for landfill monitoring wells received in 2021 and data published in the DSI (NZAS, 2021; GHD 2022) indicating NZAS groundwater monitoring results are likely to be representative of site conditions.

EC monitoring results in particular suggest tidal flux is likely to be occurring, with limited co-incident groundwater level change likely due to the highly permeable nature of the aquifer(s). Three landfill monitoring wells were sampled as part of this investigation to provide context to the groundwater discharge that is occurring from the landfill leachate into the CMA. Groundwater samples collected from monitoring wells A51, A53, and A56 confirm previous investigation and reporting results from 2020 indicating that groundwater leachate is still discharging into the Foveaux Strait and that concentrations have not decreased substantially.

# 7 Data Gaps and Uncertainties

The independent CMA assessment aimed to provide ES with a targeted assessment of key areas of the wider NZAS smelter complex that were potentially impacted by historic and current discharges of contamination. As noted in **Section 1** through to **Section 3**, a large amount of background data pertaining to the Site (that had been provided by ES and NZAS) was used to support development of the SAP for the CMA assessment.

Having completed the CMA assessment, a number of data gaps and uncertainties have been identified that should be addressed by further assessment work (whether that is undertaken by NZAS, ES or others). Environmental investigations are iterative in manner and the need for supplemental investigation is to be expected. A summary of key data gaps and uncertainties is presented below in terms of general findings and then specific issues relating the CMA work.

## 7.1 General Findings

The scope of the CMA assessment evolved through discussions with ES and NZAS staff and was principally informed by the review of the DSI (as detailed in EHS Support 2022c). In undertaking the CMA assessment and following interpretation of the collated data, several data gaps were identified that constrained the assessment and that need to be addressed in the future to provide a fuller assessment of potential impacts to the CMA. A number of these issues remain and are described below:

- A key data gap identified in the DSI review was the absence of an integrated hydrogeological CSM of the wider smelter complex. The iso-contour plans developed from this assessment (**Figures 8** and **9**) aimed to highlight this issue, but the integration of other hydrogeology data (for example data collected by GHD) was beyond the scope of the CMA work. It is understood that GHD is preparing this for NZAS. The absence of detailed information on groundwater flow direction, groundwater elevations, hydraulic connectivity between the stormwater drains (and other surface water features), and geological and structural controls on groundwater flow (such as bedrock influences within the landfill areas, presence different aquifer systems etc.) was an impediment to the design and implementation of the CMA assessment. The recent consent application and AEE submitted for than landfill (GHD, 2023) has assisted with and provided a more integrated assessment across the wider facility and landfill complex.
- The DSI review also identified the lack of integration of historical environmental data for the wider smelter complex as a data gap. The absence of integrated data also constrained the CMA assessment because this data is a critical step in defining trends and potential risks (from COPEC's and spatial areas). In addition, a lot of the historic monitoring data for the smelter Site is presented without supporting information on sampling methodologies, well construction information etc. This situation created a level of uncertainty with respect to the integrity of this historical monitoring data. The CMA work has validated (as far as was possible) that the NZAS groundwater monitoring work is producing credible results. Whereas the surface water sampling work down gradient of the stormwater drain discharges suggests that the NZAS stormwater sampling work is likely to be under reporting the concentration of COPECs within in the discharge (particularly given that only indicator parameters are monitored).

- While the CMA assessment has been able to characterise contaminant concentrations in various media at key locations, the absence of groundwater flux data and hydraulic data for the drains has constrained the ability to assess the mass flux of contaminant discharges. In turn this has limited the ability to assess environmental impact, particularly cumulative effects, and the potential for bioaccumulative effects based on loadings to the receiving environment.
- Project constraints (such as timeline, budget, access etc.) impacted the CMA assessment in that:
    - A “one off” sampling event was undertaken with limited ability to collect temporal data except for the groundwater monitoring well datalogger information and additional surface water and pore water data downstream of the drains in early May 2023.
    - The availability of NZAS groundwater monitoring wells, in which co-incident groundwater data could be collected relative to CMA assessment work, was constrained because of groundwater monitoring work being undertaken by NZAS.
    - Initial detection limit constraints for select compounds (particularly PAHs) caused by the laboratory created some uncertainty on the level of potential impact from these contaminants. Additional samples were collected to determine the distribution of PAHs using trace methods in May 2023 which assisted with resolving this data gap.

## 7.2 Fluoride Results

A critical uncertainty to the analytical resolution of samples collected as part of this investigation involved the initial erred analysis and subsequent reanalysis of aqueous fluoride. Fluoride is a known COPEC for this Site; therefore, results for this constituent are subject to additional scrutiny. It was apparent that the original results delivered by the initial testing laboratory did not accurately analyse fluoride in the aqueous phase. Investigation into this matter by the laboratory determined that aqueous marine (ocean) samples were not pre-treated as is required by the method. Upon confirmation of this error, aqueous fluoride samples were re-analysed by a second laboratory. Samples that were subject to re-analysis were out of the recommended hold time for fluoride.

Fluoride is a conservative element in natural waters and there is a low probability that fluoride concentrations would significantly change from sample collection to the time of re-analysis by second laboratory. The second laboratory provided comment that fluoride is relatively stable beyond the standard 28 days hold time and indicated they had confidence in the reported results. Therefore, it was recommended that the discussion around fluoride concentrations in samples collected as part of this investigation reference the re-analysis results by the second laboratory that were pre-treated for marine waters. Aqueous fluoride results considered in this reporting are the re-analysis results by the second laboratory. The additional marine water sampling undertaken in early May 2023 were consistent with the earlier data and validates the integrity of the fluoride laboratory test results used in the report (recording concentrations that are within a similar range).

## 7.3 Boron Screening Assessment

The evaluation of boron in pore water and surface water yielded results ranging from non-detect to 9.2 mg/L across the CMA investigation areas. Non-detect values for boron in marine water are not expected given that boron concentrations in normal seawater typically range from 4.5 to 5.1 mg/L (ANZECC & ARMCANZ, 2000; Howe, 1998), and this provides uncertainty to the analytical resolution associated with the aqueous boron results.

ANZG does not currently have a promulgated DGV for boron in marine waters that could be adopted as the screening criteria in pore water and surface water. Therefore, an appropriate approach to assessing boron in the CMA investigation areas is to adopt a regionally representative background value of 5.1 mg/L (ANZECC & ARMCANZ, 2000). This value is appropriate for screening level assessments, but since it is not a promulgated risk-based value, exceedances of this value do not necessarily indicate the presence of unacceptable risk.

Multiple robust, risk-based ecological criteria currently exist for boron in freshwater settings with guideline values around 7.5 mg/L. Some examples include 7.2 mg/L (Michigan DEQ, 2021; USEPA Region IV, 2018), 7.6 mg/L (Illinois EPA, 2012) and 7.7 mg/L(Indiana DEM, 2013). Each of these guideline values are considered Tier I final chronic values and have strong technical support based on peer reviewed toxicity data compiled from numerous studies. Given that boron is less toxic in marine environments than freshwater environments the CMA investigation results for boron are not likely to represent an unacceptable risk to aquatic receptors. It is expected that a promulgated marine water guideline value for boron would be greater than the background value of 5.1 mg/L and greater than the robust freshwater guideline values ranging from 7.2 to 7.7 mg/L..

## 7.4 Detection Limits

Several aqueous phase analytes that were measured as part of this investigation were compared to ESVs that were greater than the detection limit achieved by the laboratory. Analytes in the aqueous phase with laboratory detection limits greater than their respective ESVs are summarised in **Table 7-1** below.

**Table 7-1 Summary of Aqueous Phase Constituents where Detection Limits are Greater than ESVs**

| Analyte | Laboratory Detection Limit (µg/L) | ESV (µg/L) |
|---|---|---|
| ***Metals*** | | |
| Cyanide (Free) | 5 | 4 |
| ***PAHs*** | | |
| Benzo(a)anthracene | 1/0.1 | 0.018 |
| Benzo(b)fluoranthene | 1/0.1 | 0.06 |
| Benzo(g,h,i)perylene | 1/0.1 | 0.012 |
| Benzo(k)fluoranthene | 1/0.1 | 0.06 |
| Dibenz(a,h)anthracene | 1/0.1 | 0.01 |
| Indeno(1,2,3-c,d)pyrene | 1/0.1 | 0.012 |

Table Notes:
Laboratory detection limits presented 1/0.1 – first laboratory (January 2023 data)/second laboratory (May 2023 data)

Solid phase analytes had detection limits that were generally greater than the ESV, except for several individual PAH compounds. The detection limit for in soil and sediment was 0.03 mg/kg for each PAH compounds except for naphthalene, which has a detection limit of 0.1 mg/kg. PAHs were additionally assessed as the sum of PAH.

**Table 7-2 Summary of Solid Phase Constituents where Detection Limits are Greater than ESVs**

| Analytes | Laboratory Detection Limit (mg/kg) | Sediment ESV (mg/kg) |
|---|---|---|
| Acenaphthene | 0.03 | 0.00671 |
| Acenaphthylene | 0.03 | 0.00587 |
| Dibenz(a,h)anthracene | 0.03 | 0.00622 |
| Fluorene | 0.03 | 0.0212 |
| Indeno(1,2,3-c,d)pyrene | 0.03 | 0.017 |
| Naphthalene | 0.1 | 0.0346 |

Concentrations that are detected above the reported detection limits for the analytes listed in **Table 7-1** and **Table 7-2** are confirmed exceedances of their respective ESV; however, for results that are non-detect at the given reporting limits, there is uncertainty as to their concentration in relation to the ESV value.

Given that the detection limits are greater than ESVs, it is not possible to determine if the concentration of a non-detected result is truly an exceedance. Non-detect results for the analytes listed in **Table 7-1** and **Table 7-2** should not be considered as exceedances.

# 8 Revised Conceptual Site Model and Potential Risks

The CMA assessment work has provided greater insight into the mechanism and concentration of COPEC's that are being transported from the smelter operation and into the environment surrounding the facility. The area surrounding the smelter includes sensitive coastal, foreshore and aquatic habitats with access to the public for recreational and food gathering activities. A broad range of sensitive receptors exist in this setting including the public and aquatic, terrestrial and avian receptors.

Set out below is a revised summary CSM for the areas investigated during the CMA assessment and consideration of environmental and human health risks in the areas investigated.

## 8.1 Smelter Domain

The CMA assessment work did not focus on the smelter domain and so the CSM for this area remains unchanged from the discussion presented in **Section 3.3.3**. The principal contaminated areas, denoted by their original names from the GHD DSI report, are as follows and the key COPECs are fluoride and aluminium:

- Zone B – Inalco Yard.
- Zone C – Southern Yards.
- Zone D – Solid Storage and Wharf.
- Zone F – Carbon.

The location of these impacted areas correlates with the soil results for the CMA foreshore areas and documented areas of groundwater contamination within the smelter domain (detailed in the DSI). It is understood that NZAS has undertaken additional groundwater contamination investigation works to further assess the extent of this contamination. This work will hopefully better define the flux of groundwater contamination discharging into Bluff Harbour.

## 8.2 Foreshore Areas

The foreshore areas adjacent to the CMA investigation locations principally comprised dunes lying at approximately 5 m AMSL. These areas were subject to a limited surface soil sampling exercise with granular soils (sand and pea gravel) encountered having variable vegetative cover. The sample locations, given the smelter history, are likely to lie within areas modified by historic earthworks, but according to GHD (2021d) they have high to very high vegetation and habitat ecological value.

Each of the areas investigated yielded elevated concentrations of COPEC's, typically comprising aluminium, fluoride, and PAHs. The key impacted areas were adjacent to the south and west drains, downgradient of the east landfill area, downgradient of the Inalco area, and downgradient of the SCL pad.

The COPEC concentrations observed in foreshore soils, when compared to the terrestrial ESV's (**Table 1**), suggest that the contamination potentially poses effects to plants, soil invertebrates, and soil microbes and could result in growth, reproduction, soil process and survival impacts (with impacts varying based on contaminant). Each of the areas investigated yielded soils with a pH that was typically near neutral to acidic (ranging between 5.5-7.8) indicating that aluminium is not likely to be mobile and therefore not likely to be readily bioavailable (**Table 2**).

There is unlikely to be significant public access to these areas while the site continues to operate, and so these soils are unlikely to pose a public human health risk. The soil contamination will be contributing (to some degree) to the downgradient groundwater contamination particularly given the soil fluoride concentration exceed the soil leaching to groundwater ESVs presented in **Table 2**.

The smelter processes that have generated the contaminated soil have not been assessed as part of the CMA assessment. However, the contaminant sources are likely to comprise a mix of historic stormwater run-off and overland flow, dust blow from the wider facility (either historic or current), and/or atmospheric discharge from the process stacks (either historic or current) and fugitive emissions from the louvered roofline vents.

Additional investigation work is required to better characterise the nature and extent of the soil contamination and additional ecological and human health risk assessment may be needed (above the use the terrestrial eco ESVs and Tier 1 human health risk criteria) to characterise the risk. Regardless, it is considered likely that some form of mitigation will be needed to address the risks posed by the contamination.

## 8.3 Bluff Harbour and Stormwater Drain Discharges

The discharge areas for the three stormwater drains within Bluff Harbour were the key focus for the CMA assessment work given the known significant mass of the contaminant discharged from smelter stormwater drains.

Along the edge of the smelter domain that abuts Bluff Harbour (between the north drain and south drain) shallow groundwater within the underlying pea gravel aquifer discharges into the Harbour. The shallow groundwater system lies at a depth of approximately 3 m to 4 m bgl and is tidally influenced (based on in well EC measurements and groundwater level data – **Appendix E**). A combination of the NZAS, DSI and EHS Support data indicates there is a flux of groundwater contamination migrating towards and potentially discharging to the Harbour, with this evidenced by the groundwater seeps noted between the west and south drain. The apparent groundwater seep was observed during the CMA investigation (**Figure 2** and **15c**, attached). Water quality parameters and samples were collected from this location and at other locations along the beach. Fluoride concentrations from the samples collected were noted to exceed the aqueous ESV suggesting that fluoride laden groundwater is discharging directly to the Harbour (**Table 11** and **Figure 15c**). The fluoride concentration recorded in the seep is higher than was recorded in the nearby groundwater monitoring wells (**Figure 21**).

The stormwater and facility process water discharging into the Bluff Harbour (via the three stormwater drains) is derived from a large catchment (with the north drain having the largest catchment of 26 ha) with the discharge carrying a variable contaminant load. These discharges are consented. The drains are unlined and contaminated water will infiltrate/discharge to groundwater along their length (which is also consented). Depending on the invert of the base of each drain length and the local groundwater elevation there may be areas where the drains also receive groundwater.

The three drains are equipped with weir structures that control flow and retain sediment. Given the proximity of the weir structures to the north and west drain outlets to Bluff Harbour (i.e., lying some 150 m and 40 m, respectively upstream from the high tide mark/drain mouth) then it is likely that the head of retained drain water will recharge shallow groundwater in the vicinity of each drain mouth. Slightly different conditions are likely to occur within the south drain because this discharges to a wetland feature before discharging to Bluff Harbour (with the recharge occurring upstream of the wetland).

At the discharge areas for the north and west drains there could be a flux of combined contaminated groundwater and recharged contaminated drain water entering the CMA along with the discharge from the drains (water and sediment). This assumption is partly evidenced by the lower chloride concentrations recorded within the drain mouth of the west drain and fluoride sub-surface aqueous data for the north drain (**Figures 19** and **20,** attached). A similar situation is likely to occur at the south drain discharge point. However, observations during the EHS Support CMA assessment work indicates that the north and west drains flow/discharge regardless of rainfall events (assumed to reflect process water discharges), while the south drain seems to flow only during storm events.

Bluff Harbour is a relatively shallow water body immediately abutting the smelter domain, with the high tide mark typically lying some 10 m from the dunes/foreshore and the low tide mark extending some 100 m to 150 m out from the high tide mark. The area of the south drain is more sheltered by Tiwai Peninsula.

The Harbour substrate adjacent to the north and west drains is mapped as a gravel field (Cawthron, 2004), while the substrate adjacent to the south drain is mapped as a gravel field grading to firm sand and mud between high and low tide marks. The CMA assessment work confirmed the Cawthron mapping and has shown the sediment in the area of the north and west drains (down to a depth of 1 m) and was typically comprised of gravel with sand that contained minimal TOC in the south and west drain. North drain TOC concentrations were generally comparable to the west and south drains, with the exception of two sub-surface sediment samples that were 27% and 6.3% TOC.

The absence of fine-grained material in the sediment downgradient of the drain outlets (particularly the north and west drains) suggests the sediment discharged from the drains is not necessarily accumulating in the immediate receiving environment. Rather, sediment is being carried further out into the wider Bluff Harbour. This situation was noted by Cawthron in their 2005 summary (Cawthron, 2005).

The COPEC's discharging from the drains reflect the catchments they drain within the smelter complex, as summarised below:

- North Drain – process and stormwater from areas including the pot-rooms, dry scrubbers and carbon rodding area, and compressor house # 2. The north drain also receives the greatest influence of surface water from unsealed on-site drainage areas.
- West Drain – stormwater runoff from the pitch store (contains SCL), green carbon, carbon rodding, coke store and carbon bake. Additionally, the west drain receives process water from the anode cooling and ball mill cooling circuit. It is understood that historically higher concentrations of PAHs are likely to have been discharged via this drain (Cawthron, 2005) but changes in the pitch (pencil pitch to liquid pitch) likely reduced PAH loading to this drain.
- South Drain – stormwater from the metal yard, workshops, castings/logistics area, and the alumina store. This drain also receives process water from the castings/logistics products area. The south drain runs adjacent to the southern boundary of the NZAS smelter and abuts the Inalco storage area.

The combined flux of contamination into the CMA at each drain mouth has created an area of sediment and pore water contamination that extends from the outfall to beyond the approximate edge of the consented mixing zone. The width of the sediment/pore water contamination plume originating from the drains cannot accurately be defined given the scope of work completed and the possibility of concurrent groundwater discharge from the upgradient areas near the Site. The absence of organic material within the receiving sediment may account for the lower-than-expected PAH concentration recorded.

NZAS routinely excavate and re-distribute accumulated spoil from the mouth areas of each drain (to allow the drain flow/discharge). ES records indicate that the removal work typically occurs five times a year (averaged over the last five years) (dependant on gravel movement in bay). The soil/sediment excavation is undertaken as a Permitted Activity through ES's rule 7.4.2.1 in the Regional Coastal Plan. The scale of the disturbance was noted during the CMA monitoring event completed in May 2023 and indicates that disturbance may extend some 100 m or more below high tide mark but not beyond the low tide mark (**Appendix C**). It should be noted that improvements to stormwater and sediment management/treatment upstream of the drains would likely reduce the amount of contaminated sediment deposited in the CMA that is available to be spread during these routine maintenance activities.

The process of maintenance of these drains and the potential spreading of contaminated sediment from the drains into the broader receiving environment increases the size of the potential exposure area and potential effects on aquatic and benthic receptors. These sediment spreading activities within the north drain appear to have spread aluminium and fluoride rich materials outside of the regulated mixing zone for the drain and critically result in uncertainty as to whether the nature and extent of impacts have been adequately defined.

Marine surface water monitoring during normal flow conditions generally encountered an even distribution of contaminants throughout the marine water column (top and bottom of the water column). However, even during minor rainfall events, a more buoyant freshwater layer was found to form on the marine water body and carry a contaminated layer out some 100+m from the drain mouth (as evidenced in the north drain recording a fluoride concentration of 26.4 mg/L from the drain mouth). The Cawthron review (Cawthron, 2005) noted a similar outcome but also during calm conditions.

During first-flush stormwater events (as was recorded during the CMA assessment on 2 February 2023 in the north drain) a contaminant load greater than previously assessed during baseline conditions was recorded entering the CMA. The first flush discharge extended approximately 250 m from the drain mouth.

The consented discharge from the drains is premised on an allowable mixing zone (extending 50 m from each drain mouth), relying on dilution and dispersion to mitigate effects within downgradient marine water. The consent monitoring focusses on measuring sub-surface marine water concentration indicator parameters (pH, EC, and fluoride) at the edge of the mixing zone 2 hours either side of high tide. The consent requires the quarterly average fluoride concentration at the edge of the mixing zone not to exceed 2 mg/L and the spot fluoride concentration not to exceed 5 mg/L.

The CMA assessment work recorded contamination in surface water beyond the mixing zone (at concentrations that exceeded the ESV) downgradient of the north drain outfall during a rainfall event at 23.4 mg/L and 4.21 mg/L in the top and bottom of the water column (NOD-04), respectively. The pore water concentrations recorded during the CMA assessment work also recorded fluoride concentrations above of the ESV in the north drain up to 100 m from the drain mouth. The west and south drain pore water concentrations were below the fluoride ESVs at the time of this investigation.

In terms of assessing environmental and human health risk from the drain discharges the CMA assessment sampling work indicates the following:

- Exceedances of ESVs were recorded in all drain discharges and in the immediate receiving environments (for surface water, sediment, and pore water) and may pose potential chronic environmental effects. A broad range of direct effects could occur including decline in population (associated with impaired reproduction and /or mortality and avoidance) and indirect effects from the bioaccumulation/biomagnification of contaminants in the food chain.
- The first flush stormwater discharge events carry a significant mass of contaminant into the marine environment. Potential acute environmental effects occur during first flush stormwater events from the drains (as evidenced in the north drain) with fluoride contamination potentially impacting fish and benthic invertebrates and aluminium contamination potentially impacting benthic invertebrates.
- Initial assessment work (based on the EHS Support sampling results) suggests that human health risks from bioaccumulation through the food chain (via fish and shellfish gathering and consumption) are not likely to occur (when considering PAH, PCB, and dioxin/furan uptake within sediment). However, additional work is warranted to confirm these initial findings. A technical summary is presented **Appendix J**.
- Given the ease of public access to Bluff Harbour and the discharge points for the stormwater drains (particularly the north and west drains) measures should be implemented to warn the public of potential risk(s) associated with the discharge(s). While the human health risks have not been quantified in terms of water and sediment contamination within the drain discharge areas, it is noted that the concentration of aluminium and fluoride recorded during the first flush event in the north drain are an order of magnitude greater than the New Zealand drinking water standards (Water Services Regulations, 2022) and could pose a potential risk (following the screening recommendations presented in the Australian Government National Health and Medical Research Council Guidelines for Managing Risks in Recreational Water, 2008).

Monitoring the discharge(s) from the drains is complex because of the variable composition of the discharge (volume and contaminant load) and the nature of the receiving environments (tide, current, wind etc.). The current consent spot/grab sampling aimed to provide a pragmatic sampling solution to verify performance of the mixing zone, however, this sampling approach appears to be under reporting the contaminant concentrations. Similar conclusions were raised by Cawthron in their 2005 review. In addition, the current consent conditions and monitoring only focuses on marine surface water and does not include pore water which considers potential effects on benthic biota.

The CMA assessment has identified areas and opportunities for environmental improvement that would be in keeping with certified management systems that are believed to be used by the smelter facility. Some of the areas for improvement could be implemented outside of the current consenting regime. The key issues that warrant further consideration are listed below:

- More focused environmental monitoring to understand the mass of the contaminant discharge (flow monitoring and concentration), first flush events, and performance of the mixing zone (monitoring on an ebb tide and the direction of flow).
- Targeted sampling of fish and shellfish tissue is recommended to provide a dataset that is robust enough to enable the direct assessment of fishing and shellfish gathering on human health. This assessment would determine the potential risks of consumption on the general population and sensitive components of the population (for example children) as well as

determine (if applicable) the maximum number of fish and shellfish meals that could be consumed before potential deleterious effects.

- Supplemental shoreline sampling is needed to better define the potential extent of impacts from the drain maintenance activities and provide data to inform a risk assessment. As part of this sampling, it is recommended that benthic surveys be conducted to support development of the detailed ecological risk assessment recommended above.
- Assessment of improved operational practices to reduce contaminant load being discharged and treatment options.

## 8.4 Landfill Area

The initial CSM for the landfill (**Section 3.3.2**) indicated that most of the landfill leachate generated by the landfill cells is discharging into Foveaux Strait (96%), with minimal discharge to the Bluff Harbour (4%). Based on the NZAS data there is variable concentration leachate discharging into both Foveaux Strait and Bluff Harbour. Recent work completed by GHD as part of the NZAS Landfill consent application AEE (GHD, 2023) reiterates these findings. However, the AEE suggests that the majority of the leachate plume has discharged from beneath the landfill. There is not adequate evidence to suggest that the plume has dissipated to the extent implied in the AEE. A separate report will be filed with ES with a comprehensive review of the findings of the Landfill consent AEE.

The CMA assessment work has investigated both receiving environments, with the work within the Foveaux Strait beach constrained by the nature of the beach and the practicality of completing the investigation work.

The Foveaux Strait beach area downgradient of the landfill (ELF) comprises an exposed steep intermediate energy environment (with a large tidal range), with the beach being formed from pea gravel. While the Bluff Harbour receiving environment (WLF) comprises a low energy shallow harbour environment, with the sediment sampling work encountering fine grained sediment with a high TOC content (up to 46%).

The sediment and pore water sampling within the ELF area generally yielded no concentrations that exceeded an ESV. While the WLF sediment and porewater sampling yielded concentrations of fluoride, boron, mercury, and several PAH compounds that exceeded their respective ESV. Sediment collected in the East Landfill was observed to have concentrations of Site-related COPECs including arsenic, iron, manganese, and vanadium at concentrations greater than background (EF >1). West Landfill sediment metals including aluminium, cadmium, total chromium, copper, iron, lead, manganese, nickel, titanium, vanadium, and zinc were observed at concentrations greater than background with EFs ranging from 1.1 to 1.9.

The scope of the CMA assessment was not able to conclusively assess the nature and extent of potential environmental effects within the receiving environments down gradient of the landfill within Foveaux Strait. It is clear from the work undertaken that concentrations in various media exceed ESVs to the west of the landfill (in Bluff Harbour) which potentially triggers the need for further assessment.

The elevation at which groundwater/leachate contamination is discharging into the Foveaux Strait beach is unknown because relative groundwater elevation data for the NZAS wells located along the line of dunes behind the beach has not been sourced. Groundwater monitoring of selected NZAS wells located immediately downgradient of the landfill indicates that groundwater along the dune area lies between 1-4 m bgl. However, there is currently only limited data on the nature of the leachate flux into Foveaux Strait and Bluff Harbour. Data gaps included the following (but not limited to):

- Vertical profile of the leachate plume, in particular whether a denser high concentrate leachate plume is migrating along the pea gravel bedrock interface (as has been experienced at the SCL pad).
- The influence of the underlying bedrock profile on groundwater/leachate flow directions.
- It is anticipated that complex geochemical processes will be occurring at the interface of the groundwater/leachate discharge and the receiving marine environment. It was beyond the scope of the CMA assessment to fully characterise these processes, however understanding these processes will be critical in further assessing potential adverse effects from the leachate discharge.

## 8.5 Downgradient of the Inalco Area

The area downgradient of the Inalco area comprises a flat densely vegetated area between the smelter boundary and the foreshore area. The CMA area downgradient of the Inalco area is a moderate to steeply sloping coastal beach. The initial CSM (**Section 3**) for the Inalco area is considered within the CSM for the greater smelter domain. Within the smelter domain, the GHD DSI indicated that there are multiple contamination sources within the Site that are leaching to groundwater, with the nature and distribution of contamination reflecting the nature of the manufacturing activities that are known to occur. Large plumes of fluoride and aluminium groundwater contamination lie below the main manufacturing complex, with contaminant concentrations declining as the contamination plume migrates towards Foveaux Strait (**Figures 8** and **9**, attached). Potential pathways associated with the Inalco area include leaching of soil contamination to groundwater, migration of contaminated soils or dusts via storm water to the south drain and aeolian transport of dust and particulates.

Tiwai Point was surveyed to determine areas of ecological significance as part of the NZAS closure assessment (GHD, 2021d). The results of the ecological survey indicated that parts of the Inalco area within the smelter domain are considered as seasonally very high value areas. Therefore, the revised CSM will need to consider these areas within the smelter domain to be ecologically valuable and should be compared to the ecological screening values. This refined context is critical to the assessment of smelter domain area specifically the Inalco area in the context of current exposure routes and possible post-closure plans for the Site.

The CMA assessment work recorded contamination associated primarily within the foreshore soils. There were no exceedances of the ESV in the Inalco area sediment, pore water, or surface water. Ecological risk is primarily associated with from soil to terrestrial and avian ecological receptors. This requires further assessment to establish potential risks and whether mitigation is needed.

## 8.6 SCL Pad Area

The initial CSM for the SCL pad identified historical and ongoing discharge of groundwater from the SCL pad to the downgradient areas of Foveaux Strait beach. This discharge is being managed by a natural attenuation approach agreed upon by ES historically (NZAS, 2020). The NZAS monitoring data indicates that while contaminant concentrations in the groundwater plume discharging from the SCL pad have reduced significantly over the years, there is still an ongoing discharge into the Foveaux Strait beach area.

The Foveaux Strait beach area downgradient of the SCL pad comprises an exposed steep high energy environment (with a large tidal range), with the beach being formed from pea gravel and containing minimal TOC (less than 0.1%). Findings from the CMA assessment indicated that ecological risk downgradient of the SCL pad is primarily associated with foreshore soil and potentially groundwater. Groundwater collected from the SCL pad at monitoring well 4-5 was the only instance where each phase of cyanide (total cyanide, free cyanide, and WAD cyanide) was detected during the CMA assessment.

The scope of the CMA assessment was not able to conclusively assess the nature and extent of potential environmental effects within the receiving environments down gradient of the SCL Pad. It is clear from the work undertaken that concentrations in various media exceed ESVs which triggers the need for further assessment.

The elevation at which groundwater/leachate contamination is discharging into the Foveaux Strait beach is unknown because relative groundwater elevation data for the NZAS wells located along the line of dunes behind the beach has not been sourced. Groundwater monitoring of selected NZAS wells located immediately downgradient of the SCL pad indicates that groundwater along the dune area lies approximately 3-4 m bgl. Data gaps included the following (but not limited to):

- It is anticipated that complex geochemical processes will be occurring at the interface of the groundwater/leachate discharge and the receiving marine environment. It was beyond the scope of the CMA assessment to fully characterise these processes, however understanding these processes will be critical in further assessing potential adverse effects from the leachate discharge.

Anecdotal evidence (namely discussions with NZAS and GHD during initial site inspections) suggests that erosion of the beach area adjacent to SCL pad is occurring at a higher rate than other areas of the smelter. The impact of the coastal erosion and sea level change on the SCL pad area would appear to be an area of concern.

# 9 Smelter Management Issues

Based on the EHS Support review of the various NZAS documents pertaining to the wider smelter complex, Site inspections undertaken in 2021, and the results from the CMA assessment the following issues (from an independent perspective) have been noted in relation to ES's on-going regulatory management of the wider smelter area. The management issues are presented as opportunities for improved environmental outcomes and potentially dovetail with certified environmental management systems that are used by NZAS.

The management issues are presented as issues that are deemed to apply the wider facility rather than specific spatial areas (Facility Wide) and then issues that are more particular to specific spatial areas/activities.

### *Facility Wide*

- Soil contamination above the terrestrial ESV was recorded within a majority of the CMA areas investigated (notably south and west drains, east landfill area, Inalco area, and SCL pad area). These impacts in peripheral areas are consistent with the sources and higher levels of impacts observed in interior portions of the operational facility (DSI). On the basis that the CMA soil sampling exercise was limited in scope, further assessment is needed to define the extent of this contamination and assess risk. In addition, some of the elevated contaminant concentrations recorded will be potentially contributing to groundwater contamination fluxing into the CMA. Based on the GHD work and works completed by EHS Support, identification and possible remediation of soils that may contribute to groundwater contamination may be needed. NZAS should undertake assessment work (if this has not been undertaken as part of recent assessment work) to establish the source(s) of the contamination (such as overland flow paths, dust/wind blow from the landfill, wharf conveyor etc.) and implement mitigation, as needed. It is likely that improved management practices/housekeeping and implementation of a Site wide environmental management plan (if one is not already in place) would assist in reducing future contamination of these areas.
- The various groundwater studies undertaken by NZAS and their retained environmental consultants (dating back to the 1990s) have identified extensive plumes of groundwater contamination originating from various activities and areas of the wider smelter complex. The source of some of this groundwater contamination is consented through the landfill and stormwater discharge consents, while other parts of the groundwater contamination plumes may not to be consented. Supplementary NZAS studies will assist in clarifying this situation.
- NZAS has an extensive network of groundwater monitoring wells that are routinely monitored to verify the nature and extent of groundwater contamination within the wider smelter complex and the concentration fluxing into the marine environment. Observations by EHS Support during the CMA investigation suggest that a number of these wells need upgrade and/or replacement to enable representative groundwater samples to be collected. EHS Support understands that NZAS has undertaken a programme of supplementary groundwater monitoring well installation work which will hopefully replace and/or upgrade existing wells and expand the groundwater monitoring well network. It is recommended that a consensus as to which groundwater monitoring wells are needed for long term monitoring purposes is agreed upon.
- The CMA groundwater monitoring (of select NZAS wells) yielded comparable results to the NZAS routine groundwater monitoring work and has provided independent verification of their work.
- Assessment of data collected as part of the CMA investigation has demonstrated that mass discharges of constituents above SV's are occurring to the receiving environment as surface water, sediment, and groundwater. This is particularly noted within the receiving environment of each of the three drains. Further management and monitoring needs to

consider the cumulative/total mass loading to the environment (especially Bluff Harbour) and set appropriate management limits to address concerns with bioaccumulation of constituents.

### Smelter Domain

- The CMA assessment work has verified that while discharge from the drains is a consented activity, there may be contaminants discharging through the three-smelter stormwater drains into the CMA (particularly the north and west drains).
- The contaminant concentrations in these discharges are elevated above environmental ESVs (including outside of the consented mixing zone) and suggest complete pathways exist that pose potential adverse environmental effects. The volume of the discharges was not quantified and the NZAS consent monitoring has no requirement to measure flow (this is a key data gap). The absence of flow data precludes assessment of mass flux and total maximum loads to the receiving environment and ideally improved monitoring would address this deficiency.
- First flush data for the north drain identified fluoride concentrations at much greater concentrations than non-discharging conditions, indicating a potential for acute toxicity that needs to be evaluated. Further assessment of acute toxicity and direct toxicity assessments of first flush discharges should be considered. In addition, a quantitative risk assessment should be completed on the sediment pore water to determine potential risks to benthic receptors.
- There appears to be daily/regular flow from the north and west drains (assumed to be process water) into the CMA which is also likely to be discharging to groundwater and fluxing into Bluff Harbour. In addition, episodic discharges occur during rainfall events, with particularly high contaminant concentrations discharging during first flush events which could pose acute ecological effects.
- The assessment data demonstrates significant transport of constituents into the receiving environment as solids/sediment. This reflects the nature of Site practices, the construction of the drains (especially the north drain) and the absence of retention and settling structures. Improved housekeeping practices and potential modifications to the stormwater system (including detention structures) should be considered to better contain solids/sediment to the Site.
- Based on the results from the CMA assessment, the current environmental monitoring programme (required by the current stormwater discharge consent [No. 203373]) appears not fit for purpose in terms of monitoring potential adverse effects. It is anticipated that a more thorough assessment of contaminant load discharging through storm events, coupled with an assessment of the contaminant load within the process water is needed.
- NZAS routinely excavate (and presumably re-distribute rather than remove) accumulated spoil from the mouth areas of the north and west drains. The soil/sediment removal is undertaken as a Permitted Activity through ES's rule 7.4.2.1 in their Regional Coastal Plan. A site visit conducted by Environment Southland staff (20 July 2023) found this work to be compliant with the permitted activity requirements.
- While it is unknown whether NZAS will secure a renewed electricity supply contract (and operate beyond 2024), regardless (and in the interests of continual improvement) NZAS should be encouraged to adopt improved operating practices, including (but not limited to):
  - Maintenance of the drains (particularly removal of sediment behind the weirs etc.) to reduce contaminant flux.
  - Implement better management processes for the discharge of stormwater prior to discharge.
  - Improvements to stormwater retention systems including the addition or modification of ponds and engineered wetlands.

  - Improvements to Site wide operational practices to reduce stormwater contact with contaminated materials.

### *NZAS Landfill*

- On the basis that the landfill is in process of being re-consented (with the current consent [No. 202196] expiring on 8 December 2023) then various landfill management initiatives and improvements will likely arise through this process.
- As a minimum, the following management issues should be considered on the basis that NZAS has terminated disposal activities within the landfill:
  - Capping to reduce leachate generation and flux.
  - Capping will also improve potential contaminant migration through dust blow, stormwater run-off etc.
  - Implement processes to ensure that any recycling/recovery of waste as part of possible landfill rehabilitation work needs to be well managed and monitored because of potential increased flux of contaminants into the CMA.
- The long-term integrity of the landfill area needs to be assessed in term of its resilience to the effects from climate change and coastal erosion.

### *Inalco Area*

- The CMA assessment work detected contamination downgradient of the Inalco area and current SCL storage warehouse (regardless of fact that a forested area separates the operational areas from the CMA assessment area). Given the magnitude of impacts observed in shallow soils within the Inalco area and off-site transport (including aeolian transport), improved operational practices are needed to reduce the impact downgradient and proximal to these operations.

### *SCL Pad Area*

- NZAS has a large volume of SCL encapsulated within the SCL Pad. If not already in place, NZAS should implement some form of management strategy/process to ensure the integrity of the capped waste is maintained, particularly if NZAS commences with removal and recycling activities. The routine groundwater monitoring NZAS undertakes within the SCL Pad area is one line of evidence that can be used to verify that the containment system has not been compromised.
- The management philosophy for the legacy groundwater contamination plume originating from the SCL Pad is based on monitored natural attenuation. While ES agreed to this management approach in principle (via their correspondence dated 14 February 2006), this correspondence pre-dates the introduction of the ES Proposed Southland Water and Land Plan Part A in 2018. Consequently, NZAS may need to apply for a consent to comply with the necessary rules.
- It is understood that NZAS is exploring options to remove and recycle the SCL waste stored on the SCL Pad. Given the nature of the waste this is a complex process but should be encouraged given the proximity of the SCL Pad to the CMA and the potential for the Pad to be affected climate change (sea level rise) and coastal erosion.

# 10 Summary and Conclusions

The key findings from the CMA assessment are listed below:

1. Sources of contamination exist within operational areas of smelter (as recorded in the NZAS/GHD detailed site investigation of the smelter site and landfill) that have generated wide-spread groundwater contamination that is discharging into the CMA.
2. The scale and nature of the contamination recorded in the CMA is less than expected given the age and extent of the NZAS operation(s). The potential for adverse environmental effects to arise from site-wide contaminant discharges exist within Bluff Harbour, while potential effects within Foveaux Strait are likely to be less. The nature of the Bluff Harbour and Foveaux Strait receiving environments are different, however they both attenuate contaminant discharges to varying degrees (through a mix of physical and chemical processes).
3. The lateral extent of the groundwater contamination plume discharging from the landfill to Foveaux Strait is extensive (approximately 1 km wide) with the effects from this discharge currently being assessed through the re-consenting of the NZAS landfill.
4. Discharges of contaminants are occurring via the consented stormwater drains (above ESV's) posing potential chronic and acute effects to ecological receptors. The CMA assessment has not quantified the mass of the contaminant discharge (with the sediment discharge being carried out into the wider Bluff Harbour), as this was beyond the work scope of the project.
5. Potential acute environmental effects occur during first flush stormwater events discharging from the north drain with fluoride contamination potentially impacting ecological receptors such as fish and benthic invertebrates and aluminium contaminations potentially impacting benthic invertebrates. Further work is warranted to identify if similar discharges exist at the west and south drains.
6. The CMA monitoring has shown there are first flush stormwater discharges from the north drain that extend beyond the mixing zone at concentrations greater than the ESV and consented limits. Sediment and pore water concentrations above ESVs extend beyond the mixing zones of the north drain and are not captured by the consent.
7. The results from the CMA assessment work suggest there are unlikely to be higher order or human health risks via contaminant bioaccumulation through the food chain. This determination requires further biological testing to provide a more affirmative conclusion.
8. Mass loadings and impacts to Bluff Harbour may have been exacerbated by drain sediment movement practices (currently undertaken as a Permitted Activity under rule 7.4.2.1 of ES's Regional Coastal Plan) where materials (including contaminated spoil) are spread above the low tide mark and may distribute sediment contamination further into the harbour than under normal depositional conditions. Further assessment work is required to assess this activity and the risks.
9. Groundwater discharges are occurring within the smelter domain and SCL pad areas that exceed the groundwater ESVs. Whether this non-consented groundwater contamination discharge is posing a risk to Bluff Harbour and Foveaux Strait requires further study and will, in part, depend on cumulative effects of groundwater and stormwater/process water contamination discharges.
10. The scope of the CMA assessment was not able to fully assess the likely nature and extent of potential environmental effects within the CMA receiving environments down gradient of the landfill, Inalco area, and SCL pad area within Foveaux Strait. It is anticipated that complex geochemical processes will be occurring at the interface of the groundwater/leachate discharges and the receiving marine environment(s) at a greater distance/depth into Foveaux Strait than was achieved by the CMA work. This requires further consideration/work to assess potential risk(s) and is in part being addressed by the NZAS landfill consent application.

11. It is clear from the work undertaken that concentrations in various media exceed ecological screening values within the CMA to the west of the landfill (in Bluff Harbour). These effects are being assessed by the NZAS landfill consent application.
12. Soil contamination along most foreshore areas investigated (i.e., DOC land butting against the smelter) recorded contaminant concentrations that could pose a potential terrestrial ecological risk (notably south and west drains, east landfill area, Inalco area, and SCL pad area). This contamination has arisen from internal smelter operations/practices. This soil contamination potentially poses effects to plants, soil invertebrates, and soil microbes and could result in growth, reproduction, soil process, and survival impacts (impacts vary based on contaminant).
13. The CMA assessment yielded similar contaminant concentrations to the routine groundwater monitoring work undertaken by NZAS (in selected wells) and has provided confidence in the integrity of this routine sampling work.
14. The CMA assessment of the stormwater discharge sampling suggests that the consent stormwater sampling is potentially under reporting contaminant concentrations beyond the mixing zone during certain flow conditions and does not address sediment or pore water contamination.
15. Given the ease of public access to Bluff Harbour and the discharge points for the stormwater drains measures should be implemented to warn the public of potential risk(s) associated with the discharge(s).
16. To improve the environmental performance of the smelter operations and reduce contaminant discharges, NZAS should focus on the issues listed below. While these improvements have not been discussed with NZAS, they may have been implemented or NZAS may intend to implement these (or similar) improvements. Plus, they are in-keeping with the certified environmental management systems that the smelter is believed to use.
    - Routine operation/housekeeping changes will yield improved stormwater quality and reduced groundwater contamination discharges.
    - Improvements to waste handling and storage within the smelter domain (such as refractory bricks stored on an unsealed area), and dust management will yield improved stormwater quality and reduced groundwater contamination discharges.
    - Landfill capping will reduce groundwater contamination discharges.
    - Improved maintenance of stormwater collection systems and focused/performance based environmental monitoring will yield improved stormwater quality. The drain mouth clearing process requires further assessment.

# 11 Limitations

The CMA assessment work has been undertaken in accordance with the Umbrella Contract between ES and EHS Support, dated 2 August 2021. The scope of work for the assessment was set out in EHS Support's email dated 15 November 2022.

EHS Support has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Environment Southland and only those third parties who have been authorised in writing by EHS Support to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 15 November 2022.

The methodology adopted and sources of information used by EHS Support are outlined in this report. EHS Support has made no independent verification of this information beyond the agreed scope of works and EHS Support assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to EHS Support was false.

This report was issued on 24 October 2023 and is based on the conditions encountered and information reviewed at the time of preparation. EHS Support disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. EHS Support's conclusions are based upon the analytical data presented in this report and our experience. Future advances regarding the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact our conclusions and recommendations regarding their potential presence on this Site.

Where conditions encountered at the Site are subsequently found to differ significantly from those anticipated in this report, EHS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels, can change in a limited time; therefore, this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.

# 12 EHS Support

The CMA investigation work performed by EHS Support was undertaken by a mix of New Zealand based experienced practitioners and specialist technical staff based in the United States. The work has also benefitted from support provided by Kennedy Environmental Ltd.

The technical work associated with assessing the environmental data and report preparation was undertaken by various staff in New Zealand and the United States. During the course of the preparation of the report it was subject to a variety of QA/QC checks and reviews that are used by consultants performing work on complex projects.

The key staff involved in the project are listed below and were responsible for the technical review of elements of the project/report relevant to their areas of technical expertise.

Simon Hunt acted as Project Director and was the key interface between ES and EHS Support. Simon has over 35 years of international environmental and contaminated land management experience. He holds a BSc Hons majoring in geology, a MSc and DIC in environmental technology, is a Chartered Geologist, and a Certified Environmental Practitioner-Site Contamination Specialist. Simon has a vast amount of experience assessing and remediating highly complex industrial sites that has been gained in Europe, Australasia, and Asia (both as a consultant and in industry).

Warren Sharp acted as the EHS Support Project Manager and oversaw the bulk of the field programme. Warren is a contaminated land specialist with over 25 years' experience in the investigation, risk assessment, remediation and consenting of contaminated sites. Warren has attained Certified Environmental Practitioner-Site Contaminated Specialist certification. Warren has worked on contaminated site projects locally and internationally in a variety of sectors including the assessment and remediation of sites associated with asbestos, petroleum hydrocarbons, timber treatment activities, chemical and pesticide disposal, landfills, and a wide variety of other industrial and commercial facilities.

Nigel Goulding has worked extensively over the last 28 years in both investigation and remediation of complex industrial sites, including aluminium smelters. These projects have included refineries and large petro-chemical impacted sites and aluminium refining and process facilities throughout the US, Asia Pacific, and Europe. Nigel started his career in New Zealand and has extended work assignments in Australia, USA, and Europe. Nigel has functioned as a technical director on numerous projects, working with peers and senior management within client organisations (as well as other consultant personnel) to develop investigation, assessment, and feasibility studies designed to define and manage environmental liabilities and potential financial expenditures.

Gary Long is an ecologist with over 20 years of experience working on ecological risk assessments in aquatic, terrestrial, and wetland environments. His work focuses primarily on ecological risk assessment, risk-based remedial decision making, and natural resource damage assessment (NRDA) for contaminated sites regulated in the U.S. under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and state voluntary programs. Gary also has done extensive work throughout Australia under the National Environment Protection Measures (NEPM) framework and in New Zealand under MfE guidance and Australian and New Zealand Guidelines (ANZG). He has developed site-specific risk assessment strategies for these sites involving the design and implementation of sediment/pore water quality, surface water quality, ecotoxicological, tissue residue, and biological community studies. In his role as technical leader on these projects, Gary has successfully participated in negotiations with state and federal regulators to develop risk assessment strategies, support the selection of risk-based remedial alternatives, and design long-term monitoring programs.

Dana McCue is an environmental professional with over 30 years of experience in human health risk assessment (HHRA), site investigation, remediation, and environmental chemistry. She received a Bachelor of Science in Biochemistry from Florida State University and a Master of Public Health, with an emphasis in Environmental and Occupational Health, from Emory University. As a Senior Risk Assessor at EHS Support, Dana has provided assistance to clients on HHRA and exposure assessment issues for sites located throughout the United States, Canada, Mexico, South America, Europe, Asia, Australia, and New Zealand. Responsibilities include investigation and remedial design support; preparation of baseline and site-specific risk assessments; development of conceptual site models; risk-based prioritization; vapor intrusion evaluations (including modelling); emerging contaminant evaluations (e.g., PFAS); preparation or review of toxicologic profiles; and development of site-specific screening levels for chemicals of concern.

Maxwell Landsman-Gerjoi is a US based ecologist with experience assessing ecological risk at aluminium smelters. Max provided on the ground support to the field work programme and back-office support managing the chemical testing database. He is an experienced in soil, sediment, water, and gas sampling for a broad range of compounds and related statistical analyses. Maxwell has experience in designing and implementing field programs on various scales within the United States and New Zealand. Maxwell’s specific areas of expertise include data collection, analysis, and interpretation for metals, volatile organic compounds (VOCs), PCBs, PAHs, and PFAS.

Paul Kennedy, from Kennedy Environmental Ltd, is an environmental consultant with over 40 years of experience working within New Zealand on coastal ecology and contaminants in those environments. He has provided technical and review support through the project as required. His experience includes evaluation of water quality, soils, estuarine and coastal sediments in natural environments and within ports, urban areas, and contaminated environments. His contaminant experience has included most trace elements especially those that bioaccumulate and a wide range of persistent organic compounds. He has a BSc (Hons) in ecology from Victoria University and has worked predominantly as a consultant in New Zealand and international consultancies.

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# Tables

# Figures

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# Table 1
## Summary of Analytical Results by Area and Matrix
## Tiwai Point, New Zealand
## Environment Southland

| | Soil | | | Groundwater | | | Sediment | | | Pore Water | | | Surface Water | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples |
| **Background Awarua Bay** | | | | | | | | | | | | | | | |
| Arsenic | -- | -- | 3 | --[a] | --[a] | --[a] | -- | -- | 9 | 1.9 | 1 | 3 | -- | -- | 6 |
| Boron | 3.5 | 2 | 3 | --[a] | --[a] | --[a] | -- | -- | 9 | -- | -- | 3 | -- | -- | 6 |
| Copper | -- | -- | 3 | --[a] | --[a] | --[a] | -- | -- | 9 | 4.6 | 1 | 3 | 3.1 | 1 | 6 |
| **Background Foveaux Strait** | | | | | | | | | | | | | | | |
| Aluminum | -- | -- | 3 | --[a] | --[a] | --[a] | -- | -- | 3 | 18 | 3 | 3 | 20 | 3 | 3 |
| Boron | -- | -- | 3 | --[a] | --[a] | --[a] | -- | -- | 3 | 1.5 | 1 | 3 | 1.6 | 1 | 3 |
| Cobalt | -- | -- | 3 | --[a] | --[a] | --[a] | -- | -- | 3 | 2 | 1 | 3 | -- | -- | 3 |
| Copper | -- | -- | 3 | --[a] | --[a] | --[a] | -- | -- | 3 | 1.5 | 1 | 3 | -- | -- | 3 |
| Cyanide (Free) | -- | -- | 3 | --[a] | --[a] | --[a] | -- | -- | 3 | 1.2 | 1 | 3 | -- | -- | 3 |
| Fluoride | 1.6 | 1 | 3 | --[a] | --[a] | --[a] | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 |
| Iron | -- | -- | 3 | --[a] | --[a] | --[a] | -- | -- | 3 | 6.3 | 3 | 3 | 9.3 | 3 | 3 |
| Zinc | -- | -- | 3 | --[a] | --[a] | --[a] | -- | -- | 3 | 1.2 | 1 | 3 | -- | -- | 3 |
| **East Landfill** | | | | | | | | | | | | | | | |
| Fluoride | 3.5 | 2 | 3 | 13 | 2 | 3 | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 |
| Aluminum | -- | -- | 3 | 13 | 2 | 3 | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 |
| Arsenic | 2.2 | 2 | 3 | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 |
| Iron | -- | -- | 3 | 26 | 2 | 3 | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 |
| Sum of Detected HMW PAHs | 20 | 3 | 3 | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 |
| Sum of Detected LMW PAHs | 3.4 | 3 | 3 | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 | -- | -- | 3 |
| **West Landfill** | | | | | | | | | | | | | | | |
| Boron | -- | -- | 3 | -- | -- | 1 | -- | -- | 9 | 1.4 | 1 | 3 | 1.5 | 2 | 6 |
| Fluoride | 1.3 | 1 | 3 | -- | -- | 1 | 1.1 | 1 | 9 | -- | -- | 3 | -- | -- | 6 |
| Iron | -- | -- | 3 | 13 | 1 | 1 | -- | -- | 9 | -- | -- | 3 | -- | -- | 6 |
| Mercury | -- | -- | 3 | -- | -- | 1 | 2.5 | 1 | 9 | -- | -- | 3 | -- | -- | 6 |
| Acenaphthene | -- | -- | 3 | -- | -- | 1 | 8.9 | 1 | 9 | -- | -- | 3 | -- | -- | 6 |
| Benzo[a]pyrene | -- | -- | 3 | -- | -- | 1 | 96 | 1 | 9 | -- | -- | 3 | -- | -- | 6 |
| Benzo[g,h,i]perylene | -- | -- | 3 | -- | -- | 1 | 3.1 | 3 | 9 | -- | -- | 3 | -- | -- | 6 |
| Dibenz(A,H)Anthracene | -- | -- | 3 | -- | -- | 1 | 105 | 3 | 9 | -- | -- | 3 | -- | -- | 6 |
| Indeno(1,2,3-C,D)Pyrene | -- | -- | 3 | -- | -- | 1 | 7.1 | 1 | 9 | -- | -- | 3 | -- | -- | 6 |
| **Inalco** | | | | | | | | | | | | | | | |
| Arsenic | 1.7 | 4 | 5 | -- | -- | 1 | -- | -- | 3 | -- | -- | 1 | -- | -- | 1 |
| Sum of Detected HMW PAHs | 8.2 | 5 | 5 | -- | -- | 1 | -- | -- | 3 | -- | -- | 1 | -- | -- | 1 |
| Sum of Detected LMW PAHs | 2.2 | 3 | 5 | -- | -- | 1 | -- | -- | 3 | -- | -- | 1 | -- | -- | 1 |

**Table 1**
**Summary of Analytical Results by Area and Matrix**
**Tiwai Point, New Zealand**
**Environment Southland**

| | Soil | | | Groundwater | | | Sediment | | | Pore Water | | | Surface Water | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Maximum HQ** | **Number of Exceedances** | **Number of Samples** | **Maximum HQ** | **Number of Exceedances** | **Number of Samples** | **Maximum HQ** | **Number of Exceedances** | **Number of Samples** | **Maximum HQ** | **Number of Exceedances** | **Number of Samples** | **Maximum HQ** | **Number of Exceedances** | **Number of Samples** |
| **SCL** | | | | | | | | | | | | | | | |
| Aluminum | -- | -- | 3 | 1.8 | 1 | 1 | -- | -- | 3 | -- | -- | 1 | 1.2 | 1 | 1 |
| Arsenic | 1.4 | 2 | 3 | -- | -- | 1 | -- | -- | 3 | -- | -- | 1 | -- | -- | 1 |
| Boron | -- | -- | 3 | -- | -- | 1 | -- | -- | 3 | 1.6 | 1 | 1 | 1.6 | 1 | 1 |
| Fluoride | 44 | 2 | 3 | -- | -- | 1 | -- | -- | 3 | -- | -- | 1 | -- | -- | 1 |
| Sum of Detected HMW PAHs | 4 | 2 | 3 | -- | -- | 1 | -- | -- | 3 | -- | -- | 1 | -- | -- | 1 |
| **North Drain** | | | | | | | | | | | | | | | |
| Aluminum | -- | -- | 3 | 7.9 | 1 | 1 | -- | -- | 15 | 3.2 | 4 | 5 | 4.6 | 6 | 10 |
| Arsenic | -- | -- | 3 | -- | -- | 1 | 1.5 | 1 | 15 | 1.4 | 1 | 5 | -- | -- | 10 |
| Boron | -- | -- | 3 | -- | -- | 1 | -- | -- | 15 | 1.6 | 2 | 5 | 1.8 | 8 | 10 |
| Cadmium | -- | -- | 3 | -- | -- | 1 | 1.1 | 1 | 15 | -- | -- | 5 | -- | -- | 10 |
| Cobalt | -- | -- | 3 | -- | -- | 1 | -- | -- | 15 | 2 | 1 | 5 | -- | -- | 10 |
| Copper | -- | -- | 3 | -- | -- | 1 | -- | -- | 15 | 4.6 | 3 | 5 | 6.2 | 8 | 10 |
| Fluoride | 1.3 | 1 | 3 | -- | -- | 1 | 1.7 | 3 | 15 | 9.9 | 5 | 5 | 1.4 | 2 | 10 |
| Iron | -- | -- | 3 | 223 | 1 | 1 | -- | -- | 15 | 14 | 2 | 5 | -- | -- | 10 |
| Lead | -- | -- | 3 | -- | -- | 1 | 1.2 | 1 | 15 | -- | -- | 5 | -- | -- | 10 |
| Nickel | -- | -- | 3 | -- | -- | 1 | 12 | 4 | 15 | -- | -- | 5 | -- | -- | 10 |
| Zinc | -- | -- | 3 | -- | -- | 1 | 2.6 | 1 | 15 | -- | -- | 5 | 2 | 2 | 10 |
| Anthracene | -- | -- | 3 | -- | -- | 1 | 2.1 | 1 | 15 | -- | -- | 5 | -- | -- | 10 |
| Benzo[a]pyrene | -- | -- | 3 | -- | -- | 1 | 4.5 | 4 | 15 | -- | -- | 5 | -- | -- | 10 |
| Benzo[g,h,i]perylene | -- | -- | 3 | -- | -- | 1 | 1.6 | 1 | 15 | -- | -- | 5 | -- | -- | 10 |
| Benzo[k]fluoranthene | -- | -- | 3 | -- | -- | 1 | 5 | 2 | 15 | -- | -- | 5 | -- | -- | 10 |
| Chrysene | -- | -- | 3 | -- | -- | 1 | 13 | 4 | 15 | -- | -- | 5 | -- | -- | 10 |
| Dibenz(A,H)Anthracene | -- | -- | 3 | -- | -- | 1 | 16 | 1 | 15 | -- | -- | 5 | -- | -- | 10 |
| Fluoranthene | -- | -- | 3 | -- | -- | 1 | 8.6 | 2 | 15 | -- | -- | 5 | -- | -- | 10 |
| Indeno(1,2,3-C,D)Pyrene | -- | -- | 3 | -- | -- | 1 | 22 | 2 | 15 | -- | -- | 5 | -- | -- | 10 |
| Phenanthrene | -- | -- | 3 | -- | -- | 1 | 1.2 | 1 | 15 | -- | -- | 5 | -- | -- | 10 |
| Pyrene | -- | -- | 3 | -- | -- | 1 | 3.1 | 1 | 15 | -- | -- | 5 | -- | -- | 10 |
| Sum of Detected PAHs | -- | -- | 3 | -- | -- | 1 | 1.1 | 1 | 15 | -- | -- | 5 | -- | -- | 10 |

# Table 1
## Summary of Analytical Results by Area and Matrix
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | Soil | | | Groundwater | | | Sediment | | | Pore Water | | | Surface Water | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples |
| **South Drain** | | | | | | | | | | | | | | | |
| Aluminum | -- | -- | 2 | --[a] | --[a] | --[a] | -- | -- | 11 | 3.8 | 2 | 4 | -- | -- | 7 |
| Boron | -- | -- | 2 | --[a] | --[a] | --[a] | -- | -- | 11 | 1.6 | 3 | 4 | 1.6 | 7 | 7 |
| Copper | -- | -- | 2 | --[a] | --[a] | --[a] | -- | -- | 11 | -- | -- | 4 | 12 | 1 | 7 |
| Fluoride | 1.1 | 1 | 2 | --[a] | --[a] | --[a] | 2 | 1 | 11 | -- | -- | 4 | -- | -- | 7 |
| Iron | -- | -- | 2 | --[a] | --[a] | --[a] | -- | -- | 11 | 1.2 | 1 | 4 | -- | -- | 7 |
| Zinc | 1.5 | 1 | 2 | --[a] | --[a] | --[a] | -- | -- | 11 | 14 | 2 | 4 | -- | -- | 7 |
| Benzo[a]pyrene | -- | -- | 2 | --[a] | --[a] | --[a] | 2.1 | 1 | 11 | -- | -- | 4 | -- | -- | 7 |
| Chrysene | -- | -- | 2 | --[a] | --[a] | --[a] | 1.5 | 1 | 11 | -- | -- | 4 | -- | -- | 7 |
| Fluoranthene | -- | -- | 2 | --[a] | --[a] | --[a] | 3.1 | 1 | 11 | -- | -- | 4 | -- | -- | 7 |
| Indeno(1,2,3-C,D)Pyrene | -- | -- | 2 | --[a] | --[a] | --[a] | 7.1 | 1 | 11 | -- | -- | 4 | -- | -- | 7 |
| Phenanthrene | -- | -- | 2 | --[a] | --[a] | --[a] | 1.8 | 1 | 11 | -- | -- | 4 | -- | -- | 7 |
| Pyrene | -- | -- | 2 | --[a] | --[a] | --[a] | 1.6 | 1 | 11 | -- | -- | 4 | -- | -- | 7 |
| Sum of Detected HMW PAHs | 85 | 2 | 2 | --[a] | --[a] | --[a] | -- | -- | 11 | -- | -- | 4 | -- | -- | 7 |
| Sum of Detected LMW PAHs | 19 | 2 | 2 | --[a] | --[a] | --[a] | -- | -- | 11 | -- | -- | 4 | -- | -- | 7 |

# Table 1
## Summary of Analytical Results by Area and Matrix
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | Soil | | | Groundwater | | | Sediment | | | Pore Water | | | Surface Water | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples | Maximum HQ | Number of Exceedances | Number of Samples |
| **West Drain** | | | | | | | | | | | | | | | |
| Aluminum | -- | -- | 2 | 3.1 | 1 | 1 | -- | -- | 13 | -- | -- | 4 | 14 | 8 | 8 |
| Boron | -- | -- | 2 | -- | -- | 1 | -- | -- | 13 | 5.4 | 3 | 4 | 1.4 | 4 | 8 |
| Copper | -- | -- | 2 | -- | -- | 1 | -- | -- | 13 | 1 | 1 | 4 | 7.7 | 6 | 8 |
| Fluoride | -- | -- | 2 | -- | -- | 1 | 1.6 | 2 | 13 | -- | -- | 4 | 1.9 | 5 | 8 |
| Iron | -- | -- | 2 | -- | -- | 1 | -- | -- | 13 | 3 | 4 | 4 | 4.7 | 3 | 8 |
| Zinc | -- | -- | 2 | -- | -- | 1 | -- | -- | 13 | 1.6 | 3 | 4 | 34 | 6 | 8 |
| Anthracene | -- | -- | 2 | -- | -- | 1 | 1.3 | 1 | 13 | -- | -- | 4 | -- | -- | 8 |
| Benzo[a]anthracene | -- | -- | 2 | -- | -- | 1 | -- | -- | 13 | -- | -- | 4 | 222 | 1 | 8 |
| Benzo[a]pyrene | -- | -- | 2 | -- | -- | 1 | 1.2 | 3 | 13 | -- | -- | 4 | -- | -- | 8 |
| Chrysene | -- | -- | 2 | -- | -- | 1 | 1.5 | 1 | 13 | -- | -- | 4 | -- | -- | 8 |
| Fluoranthene | -- | -- | 2 | -- | -- | 1 | 1.1 | 1 | 13 | -- | -- | 4 | -- | -- | 8 |
| Indeno(1,2,3-C,D)Pyrene | -- | -- | 2 | -- | -- | 1 | 4.7 | 2 | 13 | -- | -- | 4 | -- | -- | 8 |
| Sum of Detected HMW PAHs | 16 | 2 | 2 | -- | -- | 1 | -- | -- | 13 | -- | -- | 4 | -- | -- | 8 |
| Sum of Detected LMW PAHs | 2.5 | 1 | 2 | -- | -- | 1 | -- | -- | 13 | -- | -- | 4 | -- | -- | 8 |

**Notes**

Constituents are presented if there was at least one exceedance in soil, groundwater, sediment, pore water, or surface water.

HQs are calculated as the observed concentration of a constituent divded by the relevant benchmark. HQs are unitless.

Data are presented for samples collected within primary scope of work and summaries do not contain first flush or other additional samples.

-- = Data was collected for this constituent, however no exceedance was observed in this matrix.

--$^a$ = Samples were not collected for these areas due to inaccessibility. Background groundwater monitoring locations were beyond the scope of this investigation.

EF = Enrichment Factor

HQ = Hazard Quotient

HMW = High Molecular Weight

LMW = Low Molecular Weight

PAH = Polycyclic Aromatic Hydrocarbon

## Table 3
## Comparison of Sediment Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | Unit | Quantitation Limit | Screening Criteria | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| **Background Awarua Bay** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | µS/cm | -- | -- | 9 | 9 | 340 | 1577 | 3000 | 885 | -- | -- | -- |
| Cyanide | mg/kg | 5 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/kg | 5 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/kg | 100 | 290 | 9 | 1 | 160 | 160 | 160 | -- | 0 | < 1 | -- |
| Fluoride Soluble | mg/kg | 0.1 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Moisture Content (dried @ 103°C) | % | -- | -- | 9 | 9 | 16 | 19.9 | 29 | 4 | -- | -- | -- |
| pH | SU | -- | -- | 9 | 9 | 2.9 | 4.74 | 6.3 | 1.29 | -- | -- | -- |
| Total Organic Carbon | % | -- | -- | 9 | 8 | 0.1 | 0.2 | 0.3 | 0.05 | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/kg | 5 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/kg | 20 | -- | 9 | 9 | 3600 | 5767 | 9900 | 2289 | -- | -- | -- |
| Arsenic | mg/kg | 0.1 | 20 | 9 | 9 | 2 | 7.6 | 16 | 5 | 0 | < 1 | -- |
| Barium | mg/kg | 10 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/kg | 2 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/kg | 10 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/kg | 0.01 | 1.5 | 9 | 6 | 0.02 | 0.022 | 0.03 | 0.004 | 0 | < 1 | -- |
| Cation Exchange Capacity | meq/100g | -- | -- | 9 | 9 | 0.26 | 0.83 | 2.2 | 0.6 | -- | -- | -- |
| Chromium, total | mg/kg | 0.1 | 80 | 9 | 9 | 4.6 | 7.28 | 11 | 2.17 | 0 | < 1 | -- |
| Cobalt | mg/kg | 0.1 | 50 | 9 | 9 | 1.4 | 4.99 | 11 | 3.12 | 0 | < 1 | -- |
| Copper | mg/kg | 0.1 | 65 | 9 | 9 | 1.2 | 3.88 | 8.6 | 2.67 | 0 | < 1 | -- |
| Iron | mg/kg | 1 | -- | 9 | 9 | 4500 | 6944 | 9600 | 1707 | -- | -- | -- |
| Lead | mg/kg | 0.1 | 50 | 9 | 9 | 1.2 | 1.99 | 2.9 | 0.48 | 0 | < 1 | -- |
| Lithium | mg/kg | 5 | -- | 9 | 9 | 8.6 | 17.04 | 31 | 8.15 | -- | -- | -- |
| Manganese | mg/kg | 0.1 | -- | 9 | 9 | 54 | 91.1 | 120 | 26.5 | -- | -- | -- |
| Mercury | mg/kg | 0.01 | 0.15 | 9 | 6 | 0.02 | 0.033 | 0.05 | 0.012 | 0 | < 1 | -- |
| Nickel | mg/kg | 0.1 | 21 | 9 | 9 | 2.6 | 6.02 | 9.1 | 2.49 | 0 | < 1 | -- |
| Titanium | mg/kg | 10 | -- | 9 | 9 | 310 | 529 | 860 | 177 | -- | -- | -- |
| Vanadium | mg/kg | 0.1 | -- | 9 | 9 | 14 | 22.9 | 31 | 5.2 | -- | -- | -- |
| Zinc | mg/kg | 5 | 200 | 9 | 9 | 8.6 | 17.28 | 27 | 6.54 | 0 | < 1 | -- |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 0.03 | 0.00671 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/kg | 0.03 | 0.00587 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/kg | 0.03 | 0.0469 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/kg | 0.03 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/kg | 0.03 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/kg | 0.03 | 0.0888 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene TEQ (half LOR) | mg/kg | 0.03 | -- | 9 | 9 | 0.04 | 0.043 | 0.05 | 0.005 | -- | -- | -- |
| Benzo[a]pyrene TEQ (LOR) | mg/kg | 0.03 | -- | 9 | 9 | 0.08 | 0.09 | 0.11 | 0.01 | -- | -- | -- |
| Benzo[a]pyrene TEQ (zero) | mg/kg | 0.03 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/kg | 0.03 | 0.17 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/kg | 0.03 | 0.24 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/kg | 0.03 | 0.108 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/kg | 0.03 | 0.00622 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/kg | 0.03 | 0.113 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/kg | 0.03 | 0.0212 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/kg | 0.03 | 0.017 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/kg | 0.1 | 0.0346 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/kg | 0.03 | 0.0867 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/kg | 0.03 | 0.153 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/kg OC | 0.333 - 0.5 | 10 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **Background Foveaux Strait** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | µS/cm | -- | -- | 3 | 3 | 590 | 793 | 1000 | 205 | -- | -- | -- |
| Cyanide | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/kg | 100 | 290 | 3 | 1 | 120 | 120 | 120 | -- | 0 | < 1 | -- |
| Fluoride Soluble | mg/kg | 0.1 | -- | 3 | 1 | 2.2 | 2.2 | 2.2 | -- | -- | -- | -- |
| Moisture Content (dried @ 103°C) | % | -- | -- | 3 | 3 | 7.2 | 7.3 | 7.5 | 0.17 | -- | -- | -- |
| pH | SU | -- | -- | 3 | 3 | 7.3 | 8.07 | 8.8 | 0.75 | -- | -- | -- |
| Total Organic Carbon | % | -- | -- | 3 | 1 | 0.1 | 0.1 | 0.1 | -- | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/kg | 20 | -- | 3 | 3 | 1600 | 1967 | 2600 | 551 | -- | -- | -- |
| Arsenic | mg/kg | 0.1 | 20 | 3 | 3 | 3.1 | 3.47 | 4.2 | 0.64 | 0 | < 1 | -- |
| Barium | mg/kg | 10 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/kg | 2 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/kg | 10 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/kg | 0.01 | 1.5 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cation Exchange Capacity | meq/100g | -- | -- | 3 | 3 | 21 | 23 | 25 | 2 | -- | -- | -- |
| Chromium, total | mg/kg | 0.1 | 80 | 3 | 3 | 2.3 | 2.7 | 3.2 | 0.46 | 0 | < 1 | -- |
| Cobalt | mg/kg | 0.1 | 50 | 3 | 3 | 1 | 1.3 | 1.6 | 0.3 | 0 | < 1 | -- |

# Table 3
## Comparison of Sediment Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** | **Mean EF** |
| Copper | mg/kg | 0.1 | 65 | 3 | 3 | 1 | 1.4 | 1.9 | 0.5 | 0 | < 1 | -- |
| Iron | mg/kg | 1 | -- | 3 | 3 | 3500 | 4233 | 5200 | 874 | -- | -- | -- |
| Lead | mg/kg | 0.1 | 50 | 3 | 3 | 1.2 | 1.5 | 1.7 | 0.26 | 0 | < 1 | -- |
| Lithium | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/kg | 0.1 | -- | 3 | 3 | 54 | 63.3 | 72 | 9 | -- | -- | -- |
| Mercury | mg/kg | 0.01 | 0.15 | 3 | 1 | 0.01 | 0.01 | 0.01 | -- | 0 | < 1 | -- |
| Nickel | mg/kg | 0.1 | 21 | 3 | 3 | 1.6 | 1.87 | 2.4 | 0.46 | 0 | < 1 | -- |
| Titanium | mg/kg | 10 | -- | 3 | 3 | 110 | 147 | 200 | 47.3 | -- | -- | -- |
| Vanadium | mg/kg | 0.1 | -- | 3 | 3 | 6.8 | 7.87 | 10 | 1.85 | -- | -- | -- |
| Zinc | mg/kg | 5 | 200 | 3 | 3 | 5.2 | 6.77 | 8.3 | 1.55 | 0 | < 1 | -- |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 0.03 | 0.00671 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/kg | 0.03 | 0.00587 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/kg | 0.03 | 0.0469 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/kg | 0.03 | 0.0888 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene TEQ (half LOR) | mg/kg | 0.03 | -- | 3 | 3 | 0.04 | 0.04 | 0.04 | 0 | -- | -- | -- |
| Benzo[a]pyrene TEQ (LOR) | mg/kg | 0.03 | -- | 3 | 3 | 0.08 | 0.08 | 0.08 | 0 | -- | -- | -- |
| Benzo[a]pyrene TEQ (zero) | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/kg | 0.03 | 0.17 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/kg | 0.03 | 0.24 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/kg | 0.03 | 0.108 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/kg | 0.03 | 0.00622 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/kg | 0.03 | 0.113 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/kg | 0.03 | 0.0212 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/kg | 0.03 | 0.017 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/kg | 0.1 | 0.0346 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/kg | 0.03 | 0.0867 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/kg | 0.03 | 0.153 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/kg OC | 0.5 | 10 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **East Landfill** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | µS/cm | -- | -- | 3 | 3 | 63 | 644 | 1300 | 622 | -- | -- | < 1 |
| Cyanide | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/kg | 100 | 290 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride Soluble | mg/kg | 0.1 | -- | 3 | 3 | 1.9 | 5.73 | 13 | 6.3 | -- | -- | 2.6 |
| Moisture Content (dried @ 103°C) | % | -- | -- | 3 | 3 | 3.2 | 7.8 | 12 | 4.41 | -- | -- | 1.1 |
| pH | SU | -- | -- | 3 | 3 | 9 | 9.1 | 9.2 | 0.1 | -- | -- | 1.1 |
| Total Organic Carbon | % | -- | -- | 3 | 2 | 0.2 | 1.6 | 3 | 1.98 | -- | -- | 16 |
| Weak Acid Dissociable Cyanide | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/kg | 20 | -- | 3 | 3 | 1300 | 1667 | 2000 | 351 | -- | -- | < 1 |
| Arsenic | mg/kg | 0.1 | 20 | 3 | 3 | 8.4 | 9.73 | 12 | 1.97 | 0 | < 1 | 2.8 |
| Barium | mg/kg | 10 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/kg | 2 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/kg | 10 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/kg | 0.01 | 1.5 | 3 | 3 | 0.01 | 0.033 | 0.07 | 0.032 | 0 | < 1 | -- |
| Cation Exchange Capacity | meq/100g | -- | -- | 3 | 3 | 0.6 | 0.73 | 1 | 0.23 | -- | -- | < 1 |
| Chromium, total | mg/kg | 0.1 | 80 | 3 | 3 | 2.1 | 2.8 | 3.4 | 0.66 | 0 | < 1 | 1.0 |
| Cobalt | mg/kg | 0.1 | 50 | 3 | 3 | 1 | 1.2 | 1.5 | 0.3 | 0 | < 1 | < 1 |
| Copper | mg/kg | 0.1 | 65 | 3 | 3 | 1.2 | 1.37 | 1.6 | 0.21 | 0 | < 1 | < 1 |
| Iron | mg/kg | 1 | -- | 3 | 3 | 4400 | 5100 | 6100 | 889 | -- | -- | 1.2 |
| Lead | mg/kg | 0.1 | 50 | 3 | 3 | 0.9 | 0.97 | 1.1 | 0.12 | 0 | < 1 | < 1 |
| Lithium | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/kg | 0.1 | -- | 3 | 3 | 61 | 68 | 77 | 8.2 | -- | -- | 1.1 |
| Mercury | mg/kg | 0.01 | 0.15 | 3 | 1 | 0.01 | 0.01 | 0.01 | -- | 0 | < 1 | 1.0 |
| Nickel | mg/kg | 0.1 | 21 | 3 | 3 | 1.6 | 1.93 | 2.2 | 0.31 | 0 | < 1 | 1.0 |
| Titanium | mg/kg | 10 | -- | 3 | 3 | 100 | 160 | 200 | 52.9 | -- | -- | 1.1 |
| Vanadium | mg/kg | 0.1 | -- | 3 | 3 | 8.8 | 11.27 | 14 | 2.61 | -- | -- | 1.4 |
| Zinc | mg/kg | 5 | 200 | 3 | 3 | 5.2 | 6.37 | 8.1 | 1.53 | 0 | < 1 | < 1 |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 0.03 | 0.00671 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/kg | 0.03 | 0.00587 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/kg | 0.03 | 0.0469 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/kg | 0.03 | 0.0888 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene TEQ (half LOR) | mg/kg | 0.03 | -- | 3 | 3 | 0.04 | 0.04 | 0.04 | 0 | -- | -- | 1.0 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg | 0.03 | -- | 3 | 3 | 0.08 | 0.08 | 0.08 | 0 | -- | -- | 1.0 |
| Benzo[a]pyrene TEQ (zero) | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/kg | 0.03 | 0.17 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |

# Table 3
## Comparison of Sediment Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** | **Mean EF** |
| Benzo[k]fluoranthene | mg/kg | 0.03 | 0.24 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/kg | 0.03 | 0.108 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/kg | 0.03 | 0.00622 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/kg | 0.03 | 0.113 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/kg | 0.03 | 0.0212 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/kg | 0.03 | 0.017 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/kg | 0.1 | 0.0346 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/kg | 0.03 | 0.0867 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/kg | 0.03 | 0.153 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/kg OC | 0.033 - 0.5 | 10 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **West Landfill** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | µS/cm | -- | -- | 9 | 9 | 64 | 1436 | 4500 | 1306 | -- | -- | < 1 |
| Cyanide | mg/kg | 5 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/kg | 5 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/kg | 100 | 290 | 9 | 2 | 100 | 205 | 310 | 148 | 1 | 1.1 | 1.3 |
| Fluoride Soluble | mg/kg | 0.1 | -- | 9 | 6 | 1.1 | 3.52 | 11 | 3.74 | -- | -- | -- |
| Moisture Content (dried @ 103°C) | % | -- | -- | 9 | 9 | 15 | 28.9 | 83 | 21.3 | -- | -- | 1.5 |
| pH | SU | -- | -- | 9 | 9 | 7.1 | 7.57 | 8 | 0.3 | -- | -- | 1.6 |
| Total Organic Carbon | % | -- | -- | 9 | 9 | 0.1 | 7.4 | 46 | 15.24 | -- | -- | 37 |
| Weak Acid Dissociable Cyanide | mg/kg | 5 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/kg | 20 | -- | 9 | 9 | 1600 | 8022 | 19000 | 6189 | -- | -- | 1.4 |
| Arsenic | mg/kg | 0.1 | 20 | 9 | 9 | 0.9 | 2.44 | 4.2 | 1.27 | 0 | < 1 | < 1 |
| Barium | mg/kg | 10 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/kg | 2 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/kg | 10 | -- | 9 | 3 | 11 | 138 | 370 | 201 | -- | -- | -- |
| Cadmium | mg/kg | 0.01 | 1.5 | 9 | 9 | 0.02 | 0.042 | 0.12 | 0.03 | 0 | < 1 | 1.9 |
| Cation Exchange Capacity | meq/100g | -- | -- | 9 | 9 | 0.73 | 9.048 | 29 | 10.533 | -- | -- | 11 |
| Chromium, total | mg/kg | 0.1 | 80 | 9 | 9 | 2.3 | 11.49 | 24 | 7.61 | 0 | < 1 | 1.6 |
| Cobalt | mg/kg | 0.1 | 50 | 9 | 9 | 0.4 | 3.17 | 6.7 | 2.19 | 0 | < 1 | < 1 |
| Copper | mg/kg | 0.1 | 65 | 9 | 9 | 2.2 | 6.96 | 17 | 5.1 | 0 | < 1 | 1.8 |
| Iron | mg/kg | 1 | -- | 9 | 9 | 4400 | 9556 | 15000 | 4106 | -- | -- | 1.4 |
| Lead | mg/kg | 0.1 | 50 | 9 | 9 | 0.7 | 3.53 | 6.5 | 1.83 | 0 | < 1 | 1.8 |
| Lithium | mg/kg | 5 | -- | 9 | 7 | 5.7 | 13.21 | 25 | 7.96 | -- | -- | < 1 |
| Manganese | mg/kg | 0.1 | -- | 9 | 9 | 16 | 101 | 200 | 51.9 | -- | -- | 1.1 |
| Mercury | mg/kg | 0.01 | 0.15 | 9 | 4 | 0.01 | 0.125 | 0.38 | 0.172 | 1 | 2.5 | 3.8 |
| Nickel | mg/kg | 0.1 | 21 | 9 | 9 | 1.1 | 7.76 | 17 | 5.89 | 0 | < 1 | 1.3 |
| Titanium | mg/kg | 10 | -- | 9 | 9 | 140 | 651 | 1400 | 417 | -- | -- | 1.2 |
| Vanadium | mg/kg | 0.1 | -- | 9 | 9 | 12 | 37.8 | 80 | 23.4 | -- | -- | 1.7 |
| Zinc | mg/kg | 5 | 200 | 9 | 8 | 11 | 20.5 | 33 | 9.2 | 0 | < 1 | 1.2 |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 0.03 | 0.00671 | 9 | 1 | 0.06 | 0.06 | 0.06 | -- | 1 | 8.9 | -- |
| Acenaphthylene | mg/kg | 0.03 | 0.00587 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/kg | 0.03 | 0.0469 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/kg | 0.03 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/kg | 0.03 | -- | 9 | 4 | 0.07 | 0.108 | 0.15 | 0.035 | -- | -- | -- |
| Benzo[a]pyrene | mg/kg | 0.03 | 0.0888 | 9 | 3 | 0.04 | 2.867 | 8.5 | 4.879 | 1 | 96 | -- |
| Benzo[a]pyrene TEQ (half LOR) | mg/kg | 0.03 | -- | 9 | 9 | 0.04 | 1.082 | 9.2 | 3.044 | -- | -- | 25 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg | 0.03 | -- | 9 | 9 | 0.08 | 1.111 | 9.2 | 3.033 | -- | -- | 12 |
| Benzo[a]pyrene TEQ (zero) | mg/kg | 0.03 | -- | 9 | 5 | 0.04 | 1.9 | 9.2 | 4.081 | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/kg | 0.03 | 0.17 | 9 | 3 | 0.25 | 0.37 | 0.53 | 0.144 | 3 | 3.1 | -- |
| Benzo[k]fluoranthene | mg/kg | 0.03 | 0.24 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/kg | 0.03 | 0.108 | 9 | 2 | 0.03 | 0.035 | 0.04 | 0.007 | 0 | < 1 | -- |
| Dibenz(A,H)Anthracene | mg/kg | 0.03 | 0.00622 | 9 | 3 | 0.08 | 0.273 | 0.65 | 0.326 | 3 | 105 | -- |
| Fluoranthene | mg/kg | 0.03 | 0.113 | 9 | 3 | 0.03 | 0.06 | 0.09 | 0.03 | 0 | < 1 | -- |
| Fluorene | mg/kg | 0.03 | 0.0212 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/kg | 0.03 | 0.017 | 9 | 1 | 0.12 | 0.12 | 0.12 | -- | 1 | 7.1 | -- |
| Naphthalene | mg/kg | 0.1 | 0.0346 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/kg | 0.03 | 0.0867 | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/kg | 0.03 | 0.153 | 9 | 2 | 0.06 | 0.075 | 0.09 | 0.021 | 0 | < 1 | -- |
| Sum of Detected PAHs | mg/kg OC | 0.01 - 0.5 | 10 | 9 | 3 | 0.24 | 0.88 | 1.4 | 0.589 | 0 | < 1 | -- |
| **Inalco** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | µS/cm | -- | -- | 3 | 3 | 450 | 850 | 1100 | 350 | -- | -- | 1.1 |
| Cyanide | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/kg | 100 | 290 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride Soluble | mg/kg | 0.1 | -- | 3 | 2 | 0.4 | 1.2 | 2 | 1.13 | -- | -- | < 1 |
| Moisture Content (dried @ 103°C) | % | -- | -- | 3 | 3 | 4.6 | 8.17 | 11 | 3.26 | -- | -- | 1.1 |
| pH | SU | -- | -- | 3 | 3 | 9.2 | 9.27 | 9.3 | 0.06 | -- | -- | 1.1 |
| Total Organic Carbon | % | -- | -- | 3 | 3 | 1.8 | 2.37 | 3.3 | 0.81 | -- | -- | 24 |
| Weak Acid Dissociable Cyanide | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |

# Table 3
# Comparison of Sediment Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Unit | Quantitation Limit | Screening Criteria | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/kg | 20 | -- | 3 | 3 | 1200 | 1533 | 1800 | 306 | -- | -- | < 1 |
| Arsenic | mg/kg | 0.1 | 20 | 3 | 3 | 5.1 | 7.67 | 9.7 | 2.35 | 0 | < 1 | 2.2 |
| Barium | mg/kg | 10 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/kg | 2 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/kg | 10 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/kg | 0.01 | 1.5 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cation Exchange Capacity | meq/100g | -- | -- | 3 | 3 | 0.67 | 0.707 | 0.76 | 0.047 | -- | -- | < 1 |
| Chromium, total | mg/kg | 0.1 | 80 | 3 | 3 | 1.8 | 2.4 | 2.8 | 0.53 | 0 | < 1 | < 1 |
| Cobalt | mg/kg | 0.1 | 50 | 3 | 3 | 0.8 | 1.07 | 1.3 | 0.25 | 0 | < 1 | < 1 |
| Copper | mg/kg | 0.1 | 65 | 3 | 3 | 1.4 | 1.43 | 1.5 | 0.06 | 0 | < 1 | 1.0 |
| Iron | mg/kg | 1 | -- | 3 | 3 | 3400 | 4433 | 5300 | 961 | -- | -- | 1.0 |
| Lead | mg/kg | 0.1 | 50 | 3 | 3 | 0.8 | 0.83 | 0.9 | 0.06 | 0 | < 1 | < 1 |
| Lithium | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/kg | 0.1 | -- | 3 | 3 | 54 | 64.3 | 70 | 9 | -- | -- | 1.0 |
| Mercury | mg/kg | 0.01 | 0.15 | 3 | 1 | 0.01 | 0.01 | 0.01 | -- | 0 | < 1 | 1.0 |
| Nickel | mg/kg | 0.1 | 21 | 3 | 3 | 1.2 | 1.6 | 1.8 | 0.35 | 0 | < 1 | < 1 |
| Titanium | mg/kg | 10 | -- | 3 | 3 | 100 | 137 | 160 | 32.1 | -- | -- | < 1 |
| Vanadium | mg/kg | 0.1 | -- | 3 | 3 | 7 | 9.6 | 12 | 2.5 | -- | -- | 1.2 |
| Zinc | mg/kg | 5 | 200 | 3 | 2 | 6 | 6.2 | 6.3 | 0.2 | 0 | < 1 | < 1 |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 0.03 | 0.00671 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/kg | 0.03 | 0.00587 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/kg | 0.03 | 0.0469 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/kg | 0.03 | 0.0888 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene TEQ (half LOR) | mg/kg | 0.03 | -- | 3 | 3 | 0.04 | 0.04 | 0.04 | 0 | -- | -- | 1.0 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg | 0.03 | -- | 3 | 3 | 0.08 | 0.08 | 0.08 | 0 | -- | -- | 1.0 |
| Benzo[a]pyrene TEQ (zero) | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/kg | 0.03 | 0.17 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/kg | 0.03 | 0.24 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/kg | 0.03 | 0.108 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/kg | 0.03 | 0.00622 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/kg | 0.03 | 0.113 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/kg | 0.03 | 0.0212 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/kg | 0.03 | 0.017 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/kg | 0.1 | 0.0346 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/kg | 0.03 | 0.0867 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/kg | 0.03 | 0.153 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/kg OC | 0.03 - 0.056 | 10 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **SCL** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | µS/cm | -- | -- | 3 | 3 | 440 | 603 | 840 | 210 | -- | -- | < 1 |
| Cyanide | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/kg | 100 | 290 | 3 | 2 | 110 | 145 | 180 | 49.5 | 0 | < 1 | 1.2 |
| Fluoride Soluble | mg/kg | 0.1 | -- | 3 | 3 | 1.5 | 2.43 | 3.1 | 0.83 | -- | -- | 1.1 |
| Moisture Content (dried @ 103°C) | % | -- | -- | 3 | 3 | 2.6 | 3.63 | 5 | 1.23 | -- | -- | < 1 |
| pH | SU | -- | -- | 3 | 3 | 7.8 | 8 | 8.3 | 0.26 | -- | -- | < 1 |
| Total Organic Carbon | % | -- | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/kg | 20 | -- | 3 | 3 | 1400 | 1467 | 1500 | 57.7 | -- | -- | < 1 |
| Arsenic | mg/kg | 0.1 | 20 | 3 | 3 | 7.4 | 8.3 | 9 | 0.82 | 0 | < 1 | 2.4 |
| Barium | mg/kg | 10 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/kg | 2 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/kg | 10 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/kg | 0.01 | 1.5 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cation Exchange Capacity | meq/100g | -- | -- | 3 | 3 | 24 | 24.3 | 25 | 0.6 | -- | -- | 1.1 |
| Chromium, total | mg/kg | 0.1 | 80 | 3 | 3 | 1.9 | 2.07 | 2.3 | 0.21 | 0 | < 1 | < 1 |
| Cobalt | mg/kg | 0.1 | 50 | 3 | 3 | 1 | 1.1 | 1.2 | 0.1 | 0 | < 1 | < 1 |
| Copper | mg/kg | 0.1 | 65 | 3 | 3 | 1.1 | 1.2 | 1.3 | 0.1 | 0 | < 1 | < 1 |
| Iron | mg/kg | 1 | -- | 3 | 3 | 4300 | 4600 | 5000 | 361 | -- | -- | 1.1 |
| Lead | mg/kg | 0.1 | 50 | 3 | 3 | 0.7 | 0.7 | 0.7 | 0 | 0 | < 1 | < 1 |
| Lithium | mg/kg | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/kg | 0.1 | -- | 3 | 3 | 58 | 60.3 | 64 | 3.2 | -- | -- | < 1 |
| Mercury | mg/kg | 0.01 | 0.15 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/kg | 0.1 | 21 | 3 | 3 | 1.6 | 1.6 | 1.6 | 0 | 0 | < 1 | < 1 |
| Titanium | mg/kg | 10 | -- | 3 | 3 | 120 | 133 | 150 | 15.3 | -- | -- | < 1 |
| Vanadium | mg/kg | 0.1 | -- | 3 | 3 | 9.8 | 10.27 | 11 | 0.64 | -- | -- | 1.3 |
| Zinc | mg/kg | 5 | 200 | 3 | 1 | 5.7 | 5.7 | 5.7 | -- | 0 | < 1 | < 1 |
| ***SVOC*** | | | | | | | | | | | | |

### Table 3
### Comparison of Sediment Analytical Results to Ecological Screening Criteria
### Tiwai Point, New Zealand
### Environment Southland

| | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Unit | Quantitation Limit | Screening Criteria | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Acenaphthene | mg/kg | 0.03 | 0.00671 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/kg | 0.03 | 0.00587 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/kg | 0.03 | 0.0469 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/kg | 0.03 | 0.0888 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene TEQ (half LOR) | mg/kg | 0.03 | -- | 3 | 3 | 0.04 | 0.04 | 0.04 | 0 | -- | -- | 1.0 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg | 0.03 | -- | 3 | 3 | 0.08 | 0.08 | 0.08 | 0 | -- | -- | 1.0 |
| Benzo[a]pyrene TEQ (zero) | mg/kg | 0.03 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/kg | 0.03 | 0.17 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/kg | 0.03 | 0.24 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/kg | 0.03 | 0.108 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/kg | 0.03 | 0.00622 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/kg | 0.03 | 0.113 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/kg | 0.03 | 0.0212 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/kg | 0.03 | 0.017 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/kg | 0.1 | 0.0346 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/kg | 0.03 | 0.0867 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/kg | 0.03 | 0.153 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/kg OC | 0.5 | 10 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **North Drain** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/kg | 50 | -- | 15 | 7 | 53 | 94.4 | 150 | 37.3 | -- | -- | -- |
| Chloride (As Cl) | mg/kg | 5 | -- | 15 | 15 | 490 | 2141 | 9200 | 2063 | -- | -- | -- |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | µS/cm | -- | -- | 15 | 15 | 460 | 1166 | 3700 | 738 | -- | -- | < 1 |
| Cyanide | mg/kg | 5 | -- | 15 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/kg | 5 | -- | 15 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/kg | 100 | 290 | 15 | 11 | 110 | 230 | 480 | 113 | 3 | 1.7 | 1.4 |
| Fluoride Soluble | mg/kg | 0.1 | -- | 15 | 15 | 2.4 | 57.1 | 200 | 76.84 | -- | -- | -- |
| Moisture Content (dried @ 103°C) | % | -- | -- | 15 | 15 | 6 | 13.2 | 40 | 8.4 | -- | -- | < 1 |
| pH | SU | -- | -- | 15 | 15 | 7.4 | 7.86 | 9.2 | 0.44 | -- | -- | 1.7 |
| Total Organic Carbon | % | -- | -- | 15 | 11 | 0.1 | 3.32 | 27 | 8.06 | -- | -- | 17 |
| Weak Acid Dissociable Cyanide | mg/kg | 5 | -- | 15 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/kg | 20 | -- | 15 | 15 | 2400 | 8567 | 65000 | 15804 | -- | -- | 1.5 |
| Arsenic | mg/kg | 0.1 | 20 | 15 | 15 | 0.8 | 4.23 | 30 | 7.22 | 1 | 1.5 | < 1 |
| Barium | mg/kg | 10 | -- | 15 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/kg | 2 | -- | 15 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/kg | 10 | -- | 15 | 2 | 11 | 31.5 | 52 | 29 | -- | -- | -- |
| Cadmium | mg/kg | 0.01 | 1.5 | 15 | 13 | 0.02 | 0.187 | 1.6 | 0.427 | 1 | 1.1 | 8.6 |
| Calcium | mg/kg | 5 | -- | 15 | 15 | 1100 | 2447 | 5600 | 1321 | -- | -- | -- |
| Chromium, total | mg/kg | 0.1 | 80 | 15 | 15 | 3.3 | 6.03 | 22 | 4.54 | 0 | < 1 | < 1 |
| Cobalt | mg/kg | 0.1 | 50 | 15 | 15 | 1.2 | 1.83 | 4.1 | 0.7 | 0 | < 1 | < 1 |
| Copper | mg/kg | 0.1 | 65 | 15 | 15 | 1.6 | 7 | 58 | 14.27 | 0 | < 1 | 1.8 |
| Hardness (As CaCO3) | mg/kg | 5 | -- | 15 | 15 | 7000 | 15027 | 35000 | 8448 | -- | -- | -- |
| Iron | mg/kg | 1 | -- | 15 | 15 | 2800 | 4633 | 9400 | 1610 | -- | -- | < 1 |
| Lead | mg/kg | 0.1 | 50 | 15 | 15 | 1 | 6.4 | 58 | 14.4 | 1 | 1.2 | 3.2 |
| Lithium | mg/kg | 5 | -- | 15 | 11 | 6 | 8.9 | 24 | 5.2 | -- | -- | < 1 |
| Magnesium | mg/kg | 5 | -- | 15 | 15 | 660 | 1408 | 5900 | 1277 | -- | -- | -- |
| Manganese | mg/kg | 0.1 | -- | 15 | 15 | 45 | 64.7 | 94 | 14.7 | -- | -- | < 1 |
| Mercury | mg/kg | 0.01 | 0.15 | 15 | 3 | 0.01 | 0.02 | 0.03 | 0.01 | 0 | < 1 | < 1 |
| Nickel | mg/kg | 0.1 | 21 | 15 | 15 | 2.6 | 27.8 | 260 | 65.34 | 4 | 12 | 4.6 |
| Titanium | mg/kg | 10 | -- | 15 | 15 | 200 | 315 | 450 | 75.3 | -- | -- | < 1 |
| Vanadium | mg/kg | 0.1 | -- | 15 | 15 | 8.8 | 25.05 | 130 | 29.76 | -- | -- | 1.1 |
| Zinc | mg/kg | 5 | 200 | 15 | 15 | 7 | 65.7 | 530 | 131 | 1 | 2.6 | 3.8 |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 0.03 | 0.00671 | 15 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/kg | 0.03 | 0.00587 | 15 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/kg | 0.03 | 0.0469 | 15 | 2 | 0.03 | 0.065 | 0.1 | 0.049 | 1 | 2.1 | -- |
| Benzo(b+j)fluoranthene | mg/kg | 0.03 | -- | 15 | 8 | 0.03 | 0.22 | 0.63 | 0.191 | -- | -- | -- |
| Benzo[a]anthracene | mg/kg | 0.03 | -- | 15 | 6 | 0.03 | 0.182 | 0.37 | 0.136 | -- | -- | -- |
| Benzo[a]pyrene | mg/kg | 0.03 | 0.0888 | 15 | 6 | 0.04 | 0.16 | 0.4 | 0.127 | 4 | 4.5 | -- |
| Benzo[a]pyrene TEQ (half LOR) | mg/kg | 0.03 | -- | 15 | 15 | 0.04 | 0.138 | 0.78 | 0.193 | -- | -- | 3.2 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg | 0.03 | -- | 15 | 15 | 0.08 | 0.167 | 0.78 | 0.182 | -- | -- | 1.9 |
| Benzo[a]pyrene TEQ (zero) | mg/kg | 0.03 | -- | 15 | 6 | 0.08 | 0.27 | 0.78 | 0.255 | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/kg | 0.03 | 0.17 | 15 | 4 | 0.03 | 0.105 | 0.28 | 0.118 | 1 | 1.6 | -- |
| Benzo[k]fluoranthene | mg/kg | 0.03 | 0.24 | 15 | 7 | 0.04 | 0.313 | 1.2 | 0.398 | 2 | 5.0 | -- |
| Chrysene | mg/kg | 0.03 | 0.108 | 15 | 7 | 0.03 | 0.307 | 1.4 | 0.486 | 4 | 13 | -- |
| Dibenz(A,H)Anthracene | mg/kg | 0.03 | 0.00622 | 15 | 1 | 0.1 | 0.1 | 0.1 | -- | 1 | 16 | -- |
| Fluoranthene | mg/kg | 0.03 | 0.113 | 15 | 6 | 0.04 | 0.228 | 0.97 | 0.364 | 2 | 8.6 | -- |
| Fluorene | mg/kg | 0.03 | 0.0212 | 15 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/kg | 0.03 | 0.017 | 15 | 2 | 0.05 | 0.21 | 0.37 | 0.226 | 2 | 22 | -- |
| Naphthalene | mg/kg | 0.1 | 0.0346 | 15 | 0 | -- | -- | -- | -- | -- | -- | -- |

# Table 3
# Comparison of Sediment Analytical Results to Ecological Screening Criteria
# Tiwai Point, New Zealand
# Environment Southland

| | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** | **Mean EF** |
| Phenanthrene | mg/kg | 0.03 | 0.0867 | 15 | 1 | 0.1 | 0.1 | 0.1 | -- | 1 | 1.2 | -- |
| Pyrene | mg/kg | 0.03 | 0.153 | 15 | 6 | 0.03 | 0.128 | 0.47 | 0.17 | 1 | 3.1 | -- |
| Sum of Detected PAHs | mg/kg OC | 0.01 - 0.5 | 10 | 15 | 7 | 1 | 4.2 | 10.667 | 3.2 | 1 | 1.1 | -- |
| **South Drain** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | µS/cm | -- | -- | 11 | 11 | 500 | 1071 | 2400 | 537 | -- | -- | < 1 |
| Cyanide | mg/kg | 5 | -- | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/kg | 5 | -- | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/kg | 100 | 290 | 11 | 4 | 160 | 295 | 570 | 189 | 1 | 2.0 | 1.8 |
| Fluoride Soluble | mg/kg | 0.1 | -- | 11 | 3 | 2.1 | 3.47 | 5.4 | 1.72 | -- | -- | -- |
| Moisture Content (dried @ 103°C) | % | -- | -- | 11 | 11 | 7 | 10 | 16 | 3.1 | -- | -- | < 1 |
| pH | SU | -- | -- | 11 | 11 | 6.9 | 7.31 | 7.8 | 0.34 | -- | -- | 1.5 |
| Total Organic Carbon | % | -- | -- | 11 | 9 | 0.1 | 0.24 | 0.5 | 0.13 | -- | -- | 1.2 |
| Weak Acid Dissociable Cyanide | mg/kg | 5 | -- | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/kg | 20 | -- | 11 | 11 | 2300 | 3991 | 6600 | 1460 | -- | -- | < 1 |
| Arsenic | mg/kg | 0.1 | 20 | 11 | 11 | 1.5 | 3.61 | 6.4 | 1.59 | 0 | < 1 | < 1 |
| Barium | mg/kg | 10 | -- | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/kg | 2 | -- | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/kg | 10 | -- | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/kg | 0.01 | 1.5 | 11 | 11 | 0.01 | 0.035 | 0.08 | 0.023 | 0 | < 1 | 1.6 |
| Cation Exchange Capacity | meq/100g | -- | -- | 11 | 11 | 0.59 | 2.954 | 7.9 | 2.48 | -- | -- | 3.6 |
| Chromium, total | mg/kg | 0.1 | 80 | 11 | 11 | 4 | 6.4 | 11 | 2 | 0 | < 1 | < 1 |
| Cobalt | mg/kg | 0.1 | 50 | 11 | 11 | 1.4 | 2.25 | 3.5 | 0.65 | 0 | < 1 | < 1 |
| Copper | mg/kg | 0.1 | 65 | 11 | 11 | 1.7 | 6.23 | 41 | 11.55 | 0 | < 1 | 1.6 |
| Iron | mg/kg | 1 | -- | 11 | 11 | 4400 | 7236 | 15000 | 3117 | -- | -- | 1.0 |
| Lead | mg/kg | 0.1 | 50 | 11 | 11 | 1.3 | 2.01 | 2.8 | 0.59 | 0 | < 1 | 1.0 |
| Lithium | mg/kg | 5 | -- | 11 | 11 | 9 | 15.4 | 29 | 7 | -- | -- | < 1 |
| Manganese | mg/kg | 0.1 | -- | 11 | 11 | 66 | 84.5 | 120 | 18.2 | -- | -- | < 1 |
| Mercury | mg/kg | 0.01 | 0.15 | 11 | 4 | 0.01 | 0.038 | 0.06 | 0.021 | 0 | < 1 | 1.1 |
| Nickel | mg/kg | 0.1 | 21 | 11 | 11 | 3.1 | 4.8 | 6.9 | 1.27 | 0 | < 1 | < 1 |
| Titanium | mg/kg | 10 | -- | 11 | 11 | 210 | 338 | 570 | 98.4 | -- | -- | < 1 |
| Vanadium | mg/kg | 0.1 | -- | 11 | 11 | 14 | 24 | 45 | 9.9 | -- | -- | 1.0 |
| Zinc | mg/kg | 5 | 200 | 11 | 11 | 8.5 | 23.05 | 70 | 20.04 | 0 | < 1 | 1.3 |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 0.03 | 0.00671 | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/kg | 0.03 | 0.00587 | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/kg | 0.03 | 0.0469 | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/kg | 0.03 | -- | 11 | 1 | 0.22 | 0.22 | 0.22 | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/kg | 0.03 | -- | 11 | 2 | 0.03 | 0.06 | 0.09 | 0.042 | -- | -- | -- |
| Benzo[a]pyrene | mg/kg | 0.03 | 0.0888 | 11 | 1 | 0.19 | 0.19 | 0.19 | -- | 1 | 2.1 | -- |
| Benzo[a]pyrene TEQ (half LOR) | mg/kg | 0.03 | -- | 11 | 11 | 0.04 | 0.061 | 0.27 | 0.069 | -- | -- | 1.4 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg | 0.03 | -- | 11 | 11 | 0.08 | 0.098 | 0.28 | 0.06 | -- | -- | 1.1 |
| Benzo[a]pyrene TEQ (zero) | mg/kg | 0.03 | -- | 11 | 1 | 0.25 | 0.25 | 0.25 | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/kg | 0.03 | 0.17 | 11 | 1 | 0.08 | 0.08 | 0.08 | -- | 0 | < 1 | -- |
| Benzo[k]fluoranthene | mg/kg | 0.03 | 0.24 | 11 | 1 | 0.12 | 0.12 | 0.12 | -- | 0 | < 1 | -- |
| Chrysene | mg/kg | 0.03 | 0.108 | 11 | 1 | 0.16 | 0.16 | 0.16 | -- | 1 | 1.5 | -- |
| Dibenz(A,H)Anthracene | mg/kg | 0.03 | 0.00622 | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/kg | 0.03 | 0.113 | 11 | 1 | 0.35 | 0.35 | 0.35 | -- | 1 | 3.1 | -- |
| Fluorene | mg/kg | 0.03 | 0.0212 | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/kg | 0.03 | 0.017 | 11 | 1 | 0.12 | 0.12 | 0.12 | -- | 1 | 7.1 | -- |
| Naphthalene | mg/kg | 0.1 | 0.0346 | 11 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/kg | 0.03 | 0.0867 | 11 | 1 | 0.16 | 0.16 | 0.16 | -- | 1 | 1.8 | -- |
| Pyrene | mg/kg | 0.03 | 0.153 | 11 | 1 | 0.25 | 0.25 | 0.25 | -- | 1 | 1.6 | -- |
| Sum of Detected PAHs | mg/kg OC | 0.2 - 0.5 | 10 | 11 | 1 | 8.5 | 8.5 | 8.5 | -- | 0 | < 1 | -- |
| **West Drain** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/kg | 50 | -- | 4 | 4 | 56 | 92.2 | 140 | 36.6 | -- | -- | -- |
| Chloride (As Cl) | mg/kg | 5 | -- | 4 | 4 | 710 | 1202 | 1700 | 436 | -- | -- | -- |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | µS/cm | -- | -- | 14 | 14 | 86 | 890 | 3400 | 923 | -- | -- | < 1 |
| Cyanide | mg/kg | 5 | -- | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/kg | 5 | -- | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/kg | 100 | 290 | 13 | 3 | 120 | 313 | 460 | 175 | 2 | 1.6 | 2.0 |
| Fluoride Soluble | mg/kg | 0.1 | -- | 13 | 7 | 0.2 | 2.19 | 4 | 1.35 | -- | -- | -- |
| Moisture Content (dried @ 103°C) | % | -- | -- | 13 | 13 | 2.7 | 9.12 | 13 | 2.49 | -- | -- | < 1 |
| pH | SU | -- | -- | 13 | 13 | 6.2 | 7.22 | 8.2 | 0.75 | -- | -- | 1.5 |
| Total Organic Carbon | % | -- | -- | 13 | 8 | 0.1 | 0.26 | 0.5 | 0.15 | -- | -- | 1.3 |
| Weak Acid Dissociable Cyanide | mg/kg | 5 | -- | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/kg | 20 | -- | 13 | 13 | 2100 | 2554 | 3000 | 257 | -- | -- | < 1 |
| Arsenic | mg/kg | 0.1 | 20 | 13 | 13 | 0.7 | 1.77 | 3.3 | 0.81 | 0 | < 1 | < 1 |
| Barium | mg/kg | 10 | -- | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/kg | 2 | -- | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |

# Table 3
# Comparison of Sediment Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Unit | Quantitation Limit | Screening Criteria | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Boron | mg/kg | 10 | -- | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/kg | 0.01 | 1.5 | 13 | 11 | 0.02 | 0.034 | 0.05 | 0.01 | 0 | < 1 | 1.6 |
| Calcium | mg/kg | 5 | -- | 4 | 4 | 1900 | 15000 | 31000 | 14264 | -- | -- | -- |
| Cation Exchange Capacity | meq/100g | -- | -- | 9 | 9 | 0.08 | 2.468 | 8.7 | 3.037 | -- | -- | 3.0 |
| Chromium, total | mg/kg | 0.1 | 80 | 13 | 13 | 2.6 | 4.11 | 6.7 | 1.14 | 0 | < 1 | < 1 |
| Cobalt | mg/kg | 0.1 | 50 | 13 | 13 | 1.1 | 1.44 | 2.2 | 0.32 | 0 | < 1 | < 1 |
| Copper | mg/kg | 0.1 | 65 | 13 | 13 | 1.3 | 1.95 | 2.7 | 0.44 | 0 | < 1 | < 1 |
| Hardness (As CaCO3) | mg/kg | 5 | -- | 4 | 4 | 8800 | 91200 | 190000 | 87908 | -- | -- | -- |
| Iron | mg/kg | 1 | -- | 13 | 13 | 2900 | 4262 | 6000 | 928 | -- | -- | < 1 |
| Lead | mg/kg | 0.1 | 50 | 13 | 13 | 1.1 | 1.72 | 3.4 | 0.58 | 0 | < 1 | < 1 |
| Lithium | mg/kg | 5 | -- | 13 | 6 | 5.3 | 6.87 | 9.7 | 1.95 | -- | -- | < 1 |
| Magnesium | mg/kg | 5 | -- | 4 | 4 | 960 | 1158 | 1400 | 226 | -- | -- | -- |
| Manganese | mg/kg | 0.1 | -- | 13 | 13 | 39 | 63.8 | 87 | 13.9 | -- | -- | < 1 |
| Mercury | mg/kg | 0.01 | 0.15 | 13 | 1 | 0.01 | 0.01 | 0.01 | -- | 0 | < 1 | < 1 |
| Nickel | mg/kg | 0.1 | 21 | 13 | 13 | 2.6 | 3.42 | 5.9 | 1.05 | 0 | < 1 | < 1 |
| Titanium | mg/kg | 10 | -- | 13 | 13 | 180 | 282 | 430 | 75.4 | -- | -- | < 1 |
| Vanadium | mg/kg | 0.1 | -- | 13 | 13 | 8.7 | 14.75 | 22 | 3.89 | -- | -- | < 1 |
| Zinc | mg/kg | 5 | 200 | 13 | 13 | 8.5 | 18.93 | 35 | 8.87 | 0 | < 1 | 1.1 |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/kg | 0.03 | 0.00671 | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/kg | 0.03 | 0.00587 | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/kg | 0.03 | 0.0469 | 13 | 1 | 0.06 | 0.06 | 0.06 | -- | 1 | 1.3 | -- |
| Benzo(b+j)fluoranthene | mg/kg | 0.03 | -- | 13 | 7 | 0.03 | 0.129 | 0.21 | 0.064 | -- | -- | -- |
| Benzo[a]anthracene | mg/kg | 0.03 | -- | 13 | 7 | 0.04 | 0.153 | 0.28 | 0.106 | -- | -- | -- |
| Benzo[a]pyrene | mg/kg | 0.03 | 0.0888 | 13 | 6 | 0.03 | 0.073 | 0.11 | 0.035 | 3 | 1.2 | -- |
| Benzo[a]pyrene TEQ (half LOR) | mg/kg | 0.03 | -- | 13 | 13 | 0.04 | 0.084 | 0.2 | 0.06 | -- | -- | 1.9 |
| Benzo[a]pyrene TEQ (LOR) | mg/kg | 0.03 | -- | 13 | 13 | 0.08 | 0.115 | 0.22 | 0.052 | -- | -- | 1.3 |
| Benzo[a]pyrene TEQ (zero) | mg/kg | 0.03 | -- | 13 | 6 | 0.04 | 0.117 | 0.19 | 0.06 | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/kg | 0.03 | 0.17 | 13 | 3 | 0.03 | 0.047 | 0.06 | 0.015 | 0 | < 1 | -- |
| Benzo[k]fluoranthene | mg/kg | 0.03 | 0.24 | 13 | 7 | 0.03 | 0.103 | 0.24 | 0.069 | 0 | 1.0 | -- |
| Chrysene | mg/kg | 0.03 | 0.108 | 13 | 6 | 0.03 | 0.068 | 0.16 | 0.048 | 1 | 1.5 | -- |
| Dibenz(A,H)Anthracene | mg/kg | 0.03 | 0.00622 | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/kg | 0.03 | 0.113 | 13 | 4 | 0.05 | 0.08 | 0.12 | 0.036 | 1 | 1.1 | -- |
| Fluorene | mg/kg | 0.03 | 0.0212 | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/kg | 0.03 | 0.017 | 13 | 2 | 0.05 | 0.065 | 0.08 | 0.021 | 2 | 4.7 | -- |
| Naphthalene | mg/kg | 0.1 | 0.0346 | 13 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/kg | 0.03 | 0.0867 | 13 | 1 | 0.04 | 0.04 | 0.04 | -- | 0 | < 1 | -- |
| Pyrene | mg/kg | 0.03 | 0.153 | 13 | 4 | 0.03 | 0.065 | 0.11 | 0.041 | 0 | < 1 | -- |
| Sum of Detected PAHs | mg/kg OC | 0.2 - 0.5 | 10 | 13 | 7 | 1 | 2.6 | 7 | 2.3 | 0 | < 1 | -- |

**Notes**

HQs are calculated as the observed concentration of a constituent divded by the relevant benchmark. HQs are unitless.

EFs are calculated as the mean concentration of a constituent divded by the mean background concentration.

The North Drain, South Drain, West Drain, and West Landfill areas were compared to the Background Awarua Bay.

The SCL, Inalco, and East Landfill areas were compared to the Background Foveux Strait. EFs are unitless.

Data are presented for samples collected under baseline conditions and summaries do not contain first flush or other additional samples.

Statistical summaries consider detected results.

-- = Data is not available for this field.

EF = enrichment factor

HQ = hazard quotient

HMW = high molecular weight

LMW = low molecular weight

max = maximum value

µS/cm = microsiemens per centimeter

min = minimum value

meq/100g = milliequivalents per 100 grams of soil

mg/kg = milligrams per kilogram

PAH = polycyclic aromatic hydrocarbon

SD = standard deviation

SVOC = semi volatile organic compounds

## Table 4
## Comparison of Groundwater Analytical Results to Ecological Screening Critiera
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ |
| **East Landfill** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 3 | 3 | 270 | 517 | 740 | 236 | -- | -- |
| Chloride (As Cl) | mg/L | T | 1 | -- | 3 | 3 | 89 | 2500 | 7300 | 4157 | -- | -- |
| Conductivity | µS/cm | T | -- | -- | 3 | 3 | 640 | 4680 | 12000 | 6351 | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.014 | 3 | 1 | 0.05 | 0.05 | 0.05 | -- | 1 | 3.6 |
| Cyanide (Free) | mg/L | T | 0.005 | 0.014 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 3 | 3 | 0.09 | 11.897 | 19.2 | 10.32 | 2 | 13 |
| pH Value | SU | T | -- | -- | 3 | 3 | 7.9 | 8 | 8.1 | 0.1 | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 3 | 3 | 19 | 30 | 44 | 12.8 | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.202 | 3 | 3 | 0.08 | 1.627 | 2.7 | 1.373 | 2 | 13 |
| Aluminum | mg/L | T | 0.05 | -- | 3 | 3 | 0.23 | 1.877 | 2.7 | 1.426 | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.14 | 3 | 3 | 0.002 | 0.0063 | 0.013 | 0.0059 | 0 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 3 | 3 | 0.002 | 0.007 | 0.014 | 0.0062 | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 3 | 1 | 0.07 | 0.07 | 0.07 | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 3 | 1 | 0.08 | 0.08 | 0.08 | -- | 0 | < 1 |
| Beryllium | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 2.5 | 3 | 3 | 0.1 | 0.93 | 1.5 | 0.74 | 0 | < 1 |
| Boron | mg/L | T | 0.05 | -- | 3 | 3 | 0.12 | 1.173 | 1.8 | 0.918 | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.036 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 3 | 3 | 30 | 137 | 350 | 184 | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.091 | 3 | 2 | 0.004 | 0.0055 | 0.007 | 0.0021 | 0 | < 1 |
| Chromium, total | mg/L | T | 0.001 | -- | 3 | 3 | 0.001 | 0.0047 | 0.007 | 0.0032 | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.15 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.008 | 3 | 2 | 0.001 | 0.003 | 0.005 | 0.0028 | 0 | < 1 |
| Copper | mg/L | T | 0.001 | -- | 3 | 2 | 0.002 | 0.004 | 0.006 | 0.0028 | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 3 | 3 | 87 | 932 | 2600 | 1444 | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 3 | 2 | 0.83 | 4.215 | 7.6 | 4.787 | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 3 | 3 | 0.25 | 3.15 | 7.8 | 4.068 | 2 | 26 |
| Lead | mg/L | D | 0.001 | 0.012 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 3 | 1 | 0.031 | 0.031 | 0.031 | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 3 | 2 | 0.006 | 0.0205 | 0.035 | 0.0205 | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 3 | 3 | 2.8 | 147 | 430 | 245 | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 3 | 3 | 0.075 | 0.305 | 0.73 | 0.3685 | -- | -- |
| Manganese | mg/L | T | 0.005 | 3.6 | 3 | 3 | 0.073 | 0.3277 | 0.78 | 0.3928 | 0 | < 1 |
| Mercury | mg/L | D | 0.0001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0014 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.56 | 3 | 2 | 0.001 | 0.0015 | 0.002 | 0.0007 | 0 | < 1 |
| Nickel | mg/L | T | 0.001 | -- | 3 | 2 | 0.002 | 0.0025 | 0.003 | 0.0007 | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 3 | 2 | 0.014 | 0.025 | 0.036 | 0.0156 | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 3 | 3 | 0.019 | 0.0247 | 0.036 | 0.0098 | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 3 | 3 | 0.007 | 0.026 | 0.058 | 0.0279 | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.28 | 3 | 3 | 0.008 | 0.026 | 0.056 | 0.0262 | 0 | < 1 |
| Zinc | mg/L | D | 0.005 | 0.021 | 3 | 1 | 0.005 | 0.005 | 0.005 | -- | 0 | < 1 |
| Zinc | mg/L | T | 0.005 | -- | 3 | 2 | 0.006 | 0.0065 | 0.007 | 0.0007 | -- | -- |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.007 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.002 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.12 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.008 | 3 | 0 | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 3 | 0 | -- | -- | -- | -- | -- | -- |

## Table 4
## Comparison of Groundwater Analytical Results to Ecological Screening Critiera
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- |
| **West Landfill** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 1 | 1 | 190 | 190 | 190 | -- | -- | -- |
| Chloride (As Cl) | mg/L | T | 1 | -- | 1 | 1 | 90 | 90 | 90 | -- | -- | -- |
| Conductivity | µS/cm | T | -- | -- | 1 | 1 | 590 | 590 | 590 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 1 | 1 | 0.12 | 0.12 | 0.12 | -- | 0 | < 1 |
| pH Value | SU | T | -- | -- | 1 | 1 | 7.7 | 7.7 | 7.7 | -- | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 1 | 1 | 14 | 14 | 14 | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.202 | 1 | 1 | 0.12 | 0.12 | 0.12 | -- | 0 | < 1 |
| Aluminum | mg/L | T | 0.05 | -- | 1 | 1 | 0.24 | 0.24 | 0.24 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.14 | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | 0 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 1 | 1 | 0.03 | 0.03 | 0.03 | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 1 | 1 | 0.03 | 0.03 | 0.03 | -- | 0 | < 1 |
| Beryllium | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 2.5 | 1 | 1 | 0.06 | 0.06 | 0.06 | -- | 0 | < 1 |
| Boron | mg/L | T | 0.05 | -- | 1 | 1 | 0.08 | 0.08 | 0.08 | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.036 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 1 | 1 | 9.4 | 9.4 | 9.4 | -- | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.091 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 1 | 1 | 0.004 | 0.004 | 0.004 | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.15 | 1 | 1 | 0.004 | 0.004 | 0.004 | -- | 0 | < 1 |
| Copper | mg/L | D | 0.001 | 0.008 | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | 0 | < 1 |
| Copper | mg/L | T | 0.001 | -- | 1 | 1 | 0.004 | 0.004 | 0.004 | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 1 | 1 | 55 | 55 | 55 | -- | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 1 | 1 | 3.1 | 3.1 | 3.1 | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 1 | 1 | 4 | 4 | 4 | -- | 1 | 13 |
| Lead | mg/L | D | 0.001 | 0.012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 1 | 1 | 0.006 | 0.006 | 0.006 | -- | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 1 | 1 | 7.7 | 7.7 | 7.7 | -- | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 1 | 1 | 0.62 | 0.62 | 0.62 | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 3.6 | 1 | 1 | 0.73 | 0.73 | 0.73 | -- | 0 | < 1 |
| Mercury | mg/L | D | 0.0001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.56 | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | 0 | < 1 |
| Nickel | mg/L | T | 0.001 | -- | 1 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 1 | 1 | 0.005 | 0.005 | 0.005 | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.28 | 1 | 1 | 0.005 | 0.005 | 0.005 | -- | 0 | < 1 |
| Zinc | mg/L | D | 0.005 | 0.021 | 1 | 1 | 0.006 | 0.006 | 0.006 | -- | 0 | < 1 |
| Zinc | mg/L | T | 0.005 | -- | 1 | 1 | 0.01 | 0.01 | 0.01 | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.002 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.12 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.008 | 1 | 0 | -- | -- | -- | -- | -- | -- |

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# Comparison of Groundwater Analytical Results to Ecological Screening Critiera
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| **Inalco** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 1 | 1 | 210 | 210 | 210 | -- | -- | -- |
| Chloride (As Cl) | mg/L | T | 1 | -- | 1 | 1 | 96 | 96 | 96 | -- | -- | -- |
| Conductivity | µS/cm | T | -- | -- | 1 | 1 | 570 | 570 | 570 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 1 | 1 | 0.55 | 0.55 | 0.55 | -- | 0 | < 1 |
| pH Value | SU | T | -- | -- | 1 | 1 | 8.2 | 8.2 | 8.2 | -- | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 1 | 1 | 5.8 | 5.8 | 5.8 | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.202 | 1 | 1 | 0.1 | 0.1 | 0.1 | -- | 0 | < 1 |
| Aluminum | mg/L | T | 0.05 | -- | 1 | 1 | 0.15 | 0.15 | 0.15 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.14 | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | 0 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 2.5 | 1 | 1 | 0.05 | 0.05 | 0.05 | -- | 0 | < 1 |
| Boron | mg/L | T | 0.05 | -- | 1 | 1 | 0.07 | 0.07 | 0.07 | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.036 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 1 | 1 | 38 | 38 | 38 | -- | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.091 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.15 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.008 | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | 0 | < 1 |
| Copper | mg/L | T | 0.001 | -- | 1 | 1 | 0.004 | 0.004 | 0.004 | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 1 | 1 | 120 | 120 | 120 | -- | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 1 | 1 | 0.07 | 0.07 | 0.07 | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 1 | 1 | 0.16 | 0.16 | 0.16 | -- | 0 | < 1 |
| Lead | mg/L | D | 0.001 | 0.012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 1 | 1 | 5.5 | 5.5 | 5.5 | -- | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 3.6 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.56 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.28 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.021 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 1 | 1 | 0.007 | 0.007 | 0.007 | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.002 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.12 | 1 | 0 | -- | -- | -- | -- | -- | -- |

# Table 4
# Comparison of Groundwater Analytical Results to Ecological Screening Critiera
# Tiwai Point, New Zealand
# Environment Southland

| | | | | | Number of | | Detected Results | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** |
| Phenanthrene | mg/L | T | 0.001 | 0.008 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| **SCL** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 1 | 1 | 2100 | 2100 | 2100 | -- | -- | -- |
| Chloride (As Cl) | mg/L | T | 1 | -- | 1 | 1 | 150 | 150 | 150 | -- | -- | -- |
| Conductivity | µS/cm | T | -- | -- | 1 | 1 | 770 | 770 | 770 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.014 | 1 | 1 | 0.28 | 0.28 | 0.28 | -- | 1 | 20 |
| Cyanide (Free) | mg/L | T | 0.005 | 0.014 | 1 | 1 | 0.009 | 0.009 | 0.009 | -- | 0 | < 1 |
| pH Value | SU | T | -- | -- | 1 | 1 | 8.3 | 8.3 | 8.3 | -- | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 1 | 1 | 6.3 | 6.3 | 6.3 | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 1 | 1 | 0.015 | 0.015 | 0.015 | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.202 | 1 | 1 | 0.37 | 0.37 | 0.37 | -- | 1 | 1.8 |
| Aluminum | mg/L | T | 0.05 | -- | 1 | 1 | 0.42 | 0.42 | 0.42 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.14 | 1 | 1 | 0.021 | 0.021 | 0.021 | -- | 0 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 1 | 1 | 0.024 | 0.024 | 0.024 | -- | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 2.5 | 1 | 1 | 0.09 | 0.09 | 0.09 | -- | 0 | < 1 |
| Boron | mg/L | T | 0.05 | -- | 1 | 1 | 0.12 | 0.12 | 0.12 | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.036 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 1 | 1 | 6.5 | 6.5 | 6.5 | -- | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.091 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.15 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.008 | 1 | 1 | 0.002 | 0.002 | 0.002 | -- | 0 | < 1 |
| Copper | mg/L | T | 0.001 | -- | 1 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 1 | 1 | 34 | 34 | 34 | -- | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 1 | 1 | 0.1 | 0.1 | 0.1 | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 1 | 1 | 0.24 | 0.24 | 0.24 | -- | 0 | < 1 |
| Lead | mg/L | D | 0.001 | 0.012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 1 | 1 | 4.4 | 4.4 | 4.4 | -- | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 3.6 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.56 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 1 | 1 | 0.006 | 0.006 | 0.006 | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 1 | 1 | 0.036 | 0.036 | 0.036 | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.28 | 1 | 1 | 0.039 | 0.039 | 0.039 | -- | 0 | < 1 |
| Zinc | mg/L | D | 0.005 | 0.021 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.002 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.12 | 1 | 0 | -- | -- | -- | -- | -- | -- |

## Table 4
## Comparison of Groundwater Analytical Results to Ecological Screening Critiera
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** |
| Phenanthrene | mg/L | T | 0.001 | 0.008 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| **North Drain** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 1 | 1 | 100 | 100 | 100 | -- | -- | -- |
| Chloride (As Cl) | mg/L | T | 1 | -- | 1 | 1 | 52 | 52 | 52 | -- | -- | -- |
| Conductivity | µS/cm | T | -- | -- | 1 | 1 | 300 | 300 | 300 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 1 | 1 | 0.05 | 0.05 | 0.05 | -- | 0 | < 1 |
| pH Value | SU | T | -- | -- | 1 | 1 | 6.8 | 6.8 | 6.8 | -- | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 1 | 1 | 70 | 70 | 70 | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 1 | 1 | 81 | 81 | 81 | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.202 | 1 | 1 | 1.6 | 1.6 | 1.6 | -- | 1 | 7.9 |
| Aluminum | mg/L | T | 0.05 | -- | 1 | 1 | 1.7 | 1.7 | 1.7 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.14 | 1 | 1 | 0.011 | 0.011 | 0.011 | -- | 0 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 1 | 1 | 0.012 | 0.012 | 0.012 | -- | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 2.5 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | T | 0.05 | -- | 1 | 1 | 0.06 | 0.06 | 0.06 | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.036 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 1 | 1 | 12 | 12 | 12 | -- | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.091 | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | 0 | < 1 |
| Chromium, total | mg/L | T | 0.001 | -- | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.15 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.008 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 1 | 1 | 45 | 45 | 45 | -- | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 1 | 1 | 61 | 61 | 61 | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 1 | 1 | 67 | 67 | 67 | -- | 1 | 223 |
| Lead | mg/L | D | 0.001 | 0.012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 1 | 1 | 3.8 | 3.8 | 3.8 | -- | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 1 | 1 | 0.91 | 0.91 | 0.91 | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 3.6 | 1 | 1 | 1 | 1 | 1 | -- | 0 | < 1 |
| Mercury | mg/L | D | 0.0001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.56 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 1 | 1 | 0.017 | 0.017 | 0.017 | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 1 | 1 | 0.019 | 0.019 | 0.019 | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 1 | 1 | 0.011 | 0.011 | 0.011 | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.28 | 1 | 1 | 0.011 | 0.011 | 0.011 | -- | 0 | < 1 |
| Zinc | mg/L | D | 0.005 | 0.021 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.002 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |

## Table 4
## Comparison of Groundwater Analytical Results to Ecological Screening Critiera
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** |
| Naphthalene | mg/L | T | 0.001 | 0.12 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.008 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| **West Drain** | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chloride (As Cl) | mg/L | T | 1 | -- | 1 | 1 | 97 | 97 | 97 | -- | -- | -- |
| Conductivity | µS/cm | T | -- | -- | 1 | 1 | 410 | 410 | 410 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 1 | 1 | 0.33 | 0.33 | 0.33 | -- | 0 | < 1 |
| pH Value | SU | T | -- | -- | 1 | 1 | 8 | 8 | 8 | -- | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 1 | 1 | 11 | 11 | 11 | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.202 | 1 | 1 | 0.63 | 0.63 | 0.63 | -- | 1 | 3.1 |
| Aluminum | mg/L | T | 0.05 | -- | 1 | 1 | 0.71 | 0.71 | 0.71 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.14 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 2.5 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | T | 0.05 | -- | 1 | 1 | 0.05 | 0.05 | 0.05 | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.036 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 1 | 1 | 10 | 10 | 10 | -- | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.091 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.15 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.008 | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | 0 | < 1 |
| Copper | mg/L | T | 0.001 | -- | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 1 | 1 | 62 | 62 | 62 | -- | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 1 | 1 | 0.09 | 0.09 | 0.09 | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 1 | 1 | 0.16 | 0.16 | 0.16 | -- | 0 | < 1 |
| Lead | mg/L | D | 0.001 | 0.012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 1 | 1 | 8.9 | 8.9 | 8.9 | -- | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 3.6 | 1 | 1 | 0.006 | 0.006 | 0.006 | -- | 0 | < 1 |
| Mercury | mg/L | D | 0.0001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0014 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.56 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 1 | 1 | 0.005 | 0.005 | 0.005 | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.28 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.021 | 1 | 1 | 0.015 | 0.015 | 0.015 | -- | 0 | < 1 |
| Zinc | mg/L | T | 0.005 | -- | 1 | 1 | 0.02 | 0.02 | 0.02 | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.002 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 1 | 0 | -- | -- | -- | -- | -- | -- |

# Table 4
# Comparison of Groundwater Analytical Results to Ecological Screening Critiera
# Tiwai Point, New Zealand
# Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of Observations | Number of Detects | Detected Results Min | Detected Results Mean | Detected Results Max | Detected Results SD | Detected Results # Exceed | Detected Results Max HQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.12 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.008 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 1 | 0 | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- |

**Notes**

HQs are calculated as the observed concentration of a constituent divded by the relevant benchmark. HQs are unitless.

EFs are calculated as the mean concentration of a constituent divded by the mean background concentration.

The North Drain, South Drain, West Drain, and West Landfill areas were compared to the Background Awarua Bay.

The SCL, Inalco, and East Landfill areas were compared to the Background Foveux Strait. EFs are unitless.

Data are presented for samples collected under baseline conditions and summaries do not contain first flush or other additional samples.

Statistical summaries consider detected results.

-- = Data is not available for this field.
BWC = Bottom of water column
D = Dissolved
EF = enrichment factor
HQ = hazard quotient
HMW = high molecular weight
LMW = low molecular weight
max = maximum value
µS/cm = microsiemens per centimeter
min = minimum value
meq/100g = milliequivalents per 100 grams of soil
mg/L = milligrams per liter
PAH = polycyclic aromatic hydrocarbon
SD = standard deviation
SVOC = semi volatile organic compounds
T = Total
TWC = Top of water column

### Table 5
### Comparison of Pore Water Analytical Results to Ecological Screening Criteria
### Tiwai Point, New Zealand
### Environment Southland

| | | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| **Background Awarua Bay** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 3 | 3 | 71 | 85.7 | 93 | 12.7 | -- | -- | -- |
| Chloride (As Cl) | mg/L | T | 1 | -- | 3 | 3 | 11000 | 15667 | 19000 | 4163 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 3 | 3 | 31000 | 42667 | 50000 | 10214 | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 3 | 3 | 0.35 | 0.523 | 0.7 | 0.175 | 0 | < 1 | -- |
| pH Value | SU | T | -- | -- | 3 | 3 | 7.6 | 7.7 | 7.8 | 0.1 | -- | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 3 | 1 | 8.3 | 8.3 | 8.3 | -- | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 3 | 3 | 12 | 23.3 | 33 | 10.6 | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 3 | 2 | 0.002 | 0.0125 | 0.023 | 0.0148 | 1 | 1.9 | -- |
| Arsenic | mg/L | T | 0.001 | -- | 3 | 3 | 0.001 | 0.0097 | 0.024 | 0.0125 | -- | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 3 | 1 | 0.03 | 0.03 | 0.03 | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 3 | 1 | 0.03 | 0.03 | 0.03 | -- | 0 | < 1 | -- |
| Beryllium | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 3 | 3 | 240 | 350 | 430 | 98.5 | -- | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 3 | 1 | 0.006 | 0.006 | 0.006 | -- | 1 | 4.6 | -- |
| Copper | mg/L | T | 0.001 | -- | 3 | 1 | 0.006 | 0.006 | 0.006 | -- | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 3 | 3 | 3700 | 5567 | 6700 | 1629 | -- | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 3 | 1 | 0.07 | 0.07 | 0.07 | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 3 | 2 | 0.14 | 0.21 | 0.28 | 0.099 | 0 | < 1 | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 3 | 3 | 0.048 | 0.096 | 0.13 | 0.0428 | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 3 | 3 | 0.048 | 0.096 | 0.13 | 0.0428 | -- | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 3 | 3 | 760 | 1153 | 1400 | 344 | -- | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 3 | 3 | 0.013 | 0.019 | 0.031 | 0.0104 | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 3 | 3 | 0.013 | 0.021 | 0.035 | 0.0122 | 0 | < 1 | -- |
| Mercury | mg/L | D | 0.0001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 3 | 2 | 0.001 | 0.0015 | 0.002 | 0.0007 | 0 | < 1 | -- |
| Nickel | mg/L | T | 0.001 | -- | 3 | 2 | 0.002 | 0.002 | 0.002 | 0 | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 4 | 1 | 0.005 | 0.005 | 0.005 | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 3 | 1 | 0.005 | 0.005 | 0.005 | -- | 0 | < 1 | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |

# Table 5
## Comparison of Pore Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

|  |  |  |  |  | Number of |  | Detected Results |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **Background Foveaux Strait** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ***GENERAL CHEMISTRY*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 3 | 3 | 120 | 183 | 230 | 56.9 | -- | -- | -- |
| Chloride (As Cl) | mg/L | T | 1 | -- | 3 | 3 | 18000 | 18667 | 19000 | 577 | -- | -- | -- |
| Conductivity | µS/cm | T | -- | -- | 3 | 3 | 32000 | 33333 | 34000 | 1155 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 3 | 1 | 0.011 | 0.011 | 0.011 | -- | 1 | 2.8 | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 3 | 1 | 0.005 | 0.005 | 0.005 | -- | 1 | 1.2 | -- |
| Fluoride | mg/L | D | -- | 1.5 | 3 | 3 | 0.91 | 1.037 | 1.28 | 0.211 | 0 | < 1 | -- |
| pH Value | SU | T | -- | -- | 3 | 3 | 7.8 | 7.87 | 7.9 | 0.06 | -- | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 3 | 1 | 6.3 | 6.3 | 6.3 | -- | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 3 | 3 | 13 | 16.3 | 20 | 3.5 | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 3 | 1 | 0.006 | 0.006 | 0.006 | -- | -- | -- | -- |
| ***METALS*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Aluminum | mg/L | D | 0.05 | 0.056 | 3 | 3 | 0.16 | 0.443 | 0.99 | 0.474 | 3 | 18 | -- |
| Aluminum | mg/L | T | 0.05 | -- | 3 | 3 | 0.24 | 0.537 | 1.1 | 0.488 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 3 | 3 | 0.004 | 0.0047 | 0.006 | 0.0012 | 0 | < 1 | -- |
| Arsenic | mg/L | T | 0.001 | -- | 3 | 3 | 0.002 | 0.0053 | 0.007 | 0.0029 | -- | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 3 | 1 | 0.002 | 0.002 | 0.002 | -- | 0 | < 1 | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 3 | 3 | 2.7 | 2.77 | 2.8 | 0.06 | 0 | < 1 | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 3 | 3 | 3.1 | 4.77 | 7.9 | 2.72 | 1 | 1.5 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 3 | 3 | 410 | 413 | 420 | 5.8 | -- | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 3 | 2 | 0.001 | 0.0015 | 0.002 | 0.0007 | 0 | < 1 | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 3 | 3 | 0.001 | 0.0023 | 0.003 | 0.0012 | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 3 | 1 | 0.002 | 0.002 | 0.002 | -- | 1 | 2.0 | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 3 | 2 | 0.001 | 0.0015 | 0.002 | 0.0007 | 1 | 1.5 | -- |
| Copper | mg/L | T | 0.001 | -- | 3 | 3 | 0.001 | 0.0027 | 0.004 | 0.0015 | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 3 | 3 | 6100 | 6300 | 6400 | 173 | -- | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 3 | 3 | 0.21 | 0.74 | 1.7 | 0.833 | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 3 | 3 | 0.31 | 0.87 | 1.9 | 0.893 | 3 | 6.3 | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 3 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 3 | 3 | 0.3 | 0.3 | 0.31 | 0.01 | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 3 | 3 | 0.31 | 0.31 | 0.31 | 0 | -- | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 3 | 3 | 1200 | 1267 | 1300 | 57.7 | -- | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 3 | 3 | 0.009 | 0.019 | 0.035 | 0.014 | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 3 | 3 | 0.012 | 0.0213 | 0.036 | 0.0129 | 0 | < 1 | -- |
| Mercury | mg/L | D | 0.0001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 3 | 2 | 0.002 | 0.002 | 0.002 | 0 | 0 | < 1 | -- |
| Nickel | mg/L | T | 0.001 | -- | 3 | 3 | 0.003 | 0.003 | 0.003 | 0 | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 3 | 2 | 0.006 | 0.0235 | 0.041 | 0.0247 | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 3 | 3 | 0.009 | 0.0233 | 0.051 | 0.024 | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 3 | 1 | 0.006 | 0.006 | 0.006 | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 3 | 1 | 0.007 | 0.007 | 0.007 | -- | 0 | < 1 | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 3 | 2 | 0.006 | 0.008 | 0.01 | 0.0028 | 1 | 1.2 | -- |
| Zinc | mg/L | T | 0.005 | -- | 3 | 3 | 0.006 | 0.0067 | 0.008 | 0.0012 | -- | -- | -- |
| ***SVOC*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |

## Table 5
## Comparison of Pore Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of Observations | Number of Detects | Detected Results Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pyrene | mg/L | T | 0.001 | 0.000025 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **East Landfill** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 3 | 3 | 95 | 105 | 110 | 8.7 | -- | -- | < 1 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 3 | 3 | 20000 | 20000 | 20000 | 0 | -- | -- | 1.1 |
| Cyanide | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 3 | 3 | 56000 | 56667 | 57000 | 577 | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 3 | 3 | 0.88 | 0.89 | 0.9 | 0.01 | 0 | < 1 | < 1 |
| pH Value | SU | T | -- | -- | 3 | 3 | 8 | 8 | 8 | 0 | -- | -- | 1.0 |
| Total Organic Carbon | mg/L | T | 5 | -- | 3 | 2 | 5.7 | 6.05 | 6.4 | 0.49 | -- | -- | < 1 |
| Total Suspended Solids | mg/L | T | 5 | -- | 3 | 3 | 22 | 24.3 | 29 | 4 | -- | -- | 1.5 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 3 | 3 | 0.001 | 0.0013 | 0.002 | 0.0006 | 0 | < 1 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 3 | 3 | 0.001 | 0.0017 | 0.002 | 0.0006 | -- | -- | < 1 |
| Barium | mg/L | D | 0.02 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 3 | 3 | 430 | 463 | 490 | 30.6 | -- | -- | 1.1 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 3 | 1 | 0.001 | 0.001 | 0.001 | -- | 0 | < 1 | < 1 |
| Copper | mg/L | T | 0.001 | -- | 3 | 2 | 0.001 | 0.001 | 0.001 | 0 | -- | -- | < 1 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 3 | 3 | 6700 | 7100 | 7400 | 361 | -- | -- | 1.1 |
| Iron | mg/L | D | 0.05 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 3 | 3 | 0.14 | 0.15 | 0.16 | 0.01 | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 3 | 3 | 0.14 | 0.15 | 0.16 | 0.01 | -- | -- | < 1 |
| Magnesium | mg/L | T | 0.5 | -- | 3 | 3 | 1400 | 1467 | 1500 | 57.7 | -- | -- | 1.2 |
| Manganese | mg/L | D | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |

## Table 5
## Comparison of Pore Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** | **Mean EF** |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **West Landfill** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 3 | 3 | 130 | 287 | 560 | 238 | -- | -- | 3.3 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 3 | 3 | 18000 | 18667 | 20000 | 1155 | -- | -- | 1.2 |
| Conductivity | µS/cm | T | -- | -- | 1 | 1 | 59000 | 59000 | 59000 | -- | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 2 | 2 | 57000 | 58000 | 59000 | 1414 | -- | -- | 1.4 |
| Fluoride | mg/L | D | -- | 1.5 | 3 | 3 | 0.92 | 1.107 | 1.45 | 0.298 | 0 | < 1 | 2.1 |
| pH Value | SU | T | -- | -- | 3 | 3 | 7.5 | 7.7 | 7.9 | 0.2 | -- | -- | 1.0 |
| Total Organic Carbon | mg/L | T | 5 | -- | 3 | 2 | 8.1 | 8.75 | 9.4 | 0.92 | -- | -- | 1.1 |
| Total Suspended Solids | mg/L | T | 5 | -- | 3 | 3 | 13 | 16.3 | 19 | 3.1 | -- | -- | < 1 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 3 | 3 | 0.002 | 0.0047 | 0.007 | 0.0025 | 0 | < 1 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 3 | 3 | 0.002 | 0.0053 | 0.009 | 0.0035 | -- | -- | < 1 |
| Barium | mg/L | D | 0.02 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 3 | 1 | 5.9 | 5.9 | 5.9 | -- | 1 | 1.2 | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 3 | 1 | 7.3 | 7.3 | 7.3 | -- | 1 | 1.4 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 3 | 3 | 400 | 410 | 420 | 10 | -- | -- | 1.2 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 3 | 3 | 5900 | 6467 | 6900 | 513 | -- | -- | 1.2 |
| Iron | mg/L | D | 0.05 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 3 | 1 | 0.05 | 0.05 | 0.05 | -- | 0 | < 1 | < 1 |
| Lead | mg/L | D | 0.001 | 0.0044 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 3 | 3 | 0.14 | 0.16 | 0.18 | 0.02 | -- | -- | 1.7 |
| Lithium | mg/L | T | 0.005 | -- | 3 | 3 | 0.14 | 0.153 | 0.16 | 0.012 | -- | -- | 1.6 |
| Magnesium | mg/L | T | 0.5 | -- | 3 | 3 | 1200 | 1333 | 1400 | 115 | -- | -- | 1.2 |
| Manganese | mg/L | D | 0.005 | -- | 3 | 2 | 0.006 | 0.021 | 0.036 | 0.0212 | -- | -- | 1.1 |
| Manganese | mg/L | T | 0.005 | 1.9 | 3 | 2 | 0.007 | 0.0215 | 0.036 | 0.0205 | 0 | < 1 | 1.0 |
| Mercury | mg/L | D | 0.0001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 3 | 1 | 0.008 | 0.008 | 0.008 | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |

# Table 5
# Comparison of Pore Water Analytical Results to Ecological Screening Criteria
# Tiwai Point, New Zealand
# Environment Southland

| | | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** | **Mean EF** |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **Inalco** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 1 | 1 | 110 | 110 | 110 | -- | -- | -- | < 1 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 1 | 1 | 20000 | 20000 | 20000 | -- | -- | -- | 1.1 |
| Cyanide | mg/L | T | 0.005 | 0.004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 1 | 1 | 56000 | 56000 | 56000 | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 1 | 1 | 0.88 | 0.88 | 0.88 | -- | 0 | < 1 | < 1 |
| pH Value | SU | T | -- | -- | 1 | 1 | 8 | 8 | 8 | -- | -- | -- | 1.0 |
| Total Organic Carbon | mg/L | T | 5 | -- | 1 | 1 | 5.6 | 5.6 | 5.6 | -- | -- | -- | < 1 |
| Total Suspended Solids | mg/L | T | 5 | -- | 1 | 1 | 21 | 21 | 21 | -- | -- | -- | 1.3 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | 0 | < 1 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 1 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- | < 1 |
| Barium | mg/L | D | 0.02 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 1 | 1 | 490 | 490 | 490 | -- | -- | -- | 1.2 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | 0 | < 1 | < 1 |
| Copper | mg/L | T | 0.001 | -- | 1 | 1 | 0.003 | 0.003 | 0.003 | -- | -- | -- | 1.1 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 1 | 1 | 7600 | 7600 | 7600 | -- | -- | -- | 1.2 |
| Iron | mg/L | D | 0.05 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 1 | 1 | 0.15 | 0.15 | 0.15 | -- | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 1 | 1 | 0.15 | 0.15 | 0.15 | -- | -- | -- | < 1 |
| Magnesium | mg/L | T | 0.5 | -- | 1 | 1 | 1500 | 1500 | 1500 | -- | -- | -- | 1.2 |
| Manganese | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |

## Table 5
## Comparison of Pore Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of |  | Detected Results |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Fluorene | mg/L | T | 0.001 | 0.003 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **SCL** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ***GENERAL CHEMISTRY*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 1 | 1 | 110 | 110 | 110 | -- | -- | -- | < 1 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 1 | 1 | 19000 | 19000 | 19000 | -- | -- | -- | 1.0 |
| Conductivity | µS/cm | T | -- | -- | 1 | 1 | 32000 | 32000 | 32000 | -- | -- | -- | < 1 |
| Cyanide | mg/L | T | 0.005 | 0.004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 1 | 1 | 0.87 | 0.87 | 0.87 | -- | 0 | < 1 | < 1 |
| pH Value | SU | T | -- | -- | 1 | 1 | 8 | 8 | 8 | -- | -- | -- | 1.0 |
| Total Organic Carbon | mg/L | T | 5 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 1 | 1 | 68 | 68 | 68 | -- | -- | -- | 4.2 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Aluminum | mg/L | D | 0.05 | 0.056 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 1 | 1 | 0.06 | 0.06 | 0.06 | -- | -- | -- | < 1 |
| Arsenic | mg/L | D | 0.001 | 0.012 | 1 | 1 | 0.002 | 0.002 | 0.002 | -- | 0 | < 1 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 1 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- | < 1 |
| Barium | mg/L | D | 0.02 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 1 | 1 | 7.8 | 7.8 | 7.8 | -- | 1 | 1.5 | 2.8 |
| Boron | mg/L | T | 0.05 | 5.1 | 1 | 1 | 8.3 | 8.3 | 8.3 | -- | 1 | 1.6 | 1.7 |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 1 | 1 | 450 | 450 | 450 | -- | -- | -- | 1.1 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | -- | -- | < 1 |
| Cobalt | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 1 | 1 | 6500 | 6500 | 6500 | -- | -- | -- | 1.0 |
| Iron | mg/L | D | 0.05 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | -- | -- | < 1 |
| Lithium | mg/L | D | 0.005 | -- | 1 | 1 | 0.28 | 0.28 | 0.28 | -- | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 1 | 1 | 0.3 | 0.3 | 0.3 | -- | -- | -- | < 1 |
| Magnesium | mg/L | T | 0.5 | -- | 1 | 1 | 1300 | 1300 | 1300 | -- | -- | -- | 1.0 |
| Manganese | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | 0 | < 1 | < 1 |
| Nickel | mg/L | T | 0.001 | -- | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | -- | -- | < 1 |
| Titanium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 1 | 1 | 0.013 | 0.013 | 0.013 | -- | -- | -- | 1.9 |
| ***SVOC*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |

## Table 5
## Comparison of Pore Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **North Drain** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 5 | 5 | 130 | 230 | 320 | 77.8 | -- | -- | 2.7 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 5 | 5 | 15000 | 17600 | 21000 | 2191 | -- | -- | 1.1 |
| Conductivity | µS/cm | T | -- | -- | 4 | 4 | 40000 | 46250 | 53000 | 5377 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 1 | 1 | 64000 | 64000 | 64000 | -- | -- | -- | 1.5 |
| Fluoride | mg/L | D | -- | 1.5 | 5 | 5 | 4.22 | 8.256 | 14.8 | 4.14 | 5 | 9.9 | 16 |
| pH Value | SU | T | -- | -- | 5 | 5 | 7.4 | 7.56 | 7.7 | 0.11 | -- | -- | < 1 |
| Total Organic Carbon | mg/L | T | 5 | -- | 5 | 5 | 6.9 | 9.44 | 13 | 2.85 | -- | -- | 1.1 |
| Total Suspended Solids | mg/L | T | 5 | -- | 5 | 5 | 15 | 163 | 330 | 152 | -- | -- | 7.0 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 5 | 4 | 0.06 | 0.115 | 0.18 | 0.055 | 4 | 3.2 | -- |
| Aluminum | mg/L | T | 0.05 | -- | 5 | 4 | 0.09 | 4.47 | 9.1 | 5.062 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 5 | 5 | 0.002 | 0.0056 | 0.017 | 0.0064 | 1 | 1.4 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 5 | 5 | 0.003 | 0.0104 | 0.027 | 0.0109 | -- | -- | 1.1 |
| Barium | mg/L | D | 0.02 | -- | 5 | 2 | 0.02 | 0.02 | 0.02 | 0 | -- | -- | < 1 |
| Barium | mg/L | T | 0.02 | 1 | 5 | 3 | 0.02 | 0.037 | 0.05 | 0.015 | 0 | < 1 | 1.2 |
| Beryllium | mg/L | D | 0.001 | -- | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 5 | 4 | 5 | 5.7 | 7.8 | 1.4 | 1 | 1.5 | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 5 | 4 | 4.8 | 5.85 | 8.2 | 1.58 | 2 | 1.6 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 5 | 1 | 0.0002 | 0.0002 | 0.0002 | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 5 | 5 | 320 | 360 | 460 | 59.6 | -- | -- | 1.0 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 5 | 2 | 0.004 | 0.0045 | 0.005 | 0.0007 | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 5 | 1 | 0.002 | 0.002 | 0.002 | -- | 1 | 2.0 | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 5 | 3 | 0.003 | 0.0043 | 0.006 | 0.0015 | 3 | 4.6 | < 1 |
| Copper | mg/L | T | 0.001 | -- | 5 | 4 | 0.003 | 0.0095 | 0.016 | 0.0053 | -- | -- | 1.6 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 5 | 5 | 4400 | 5620 | 7400 | 1105 | -- | -- | 1.0 |
| Iron | mg/L | D | 0.05 | -- | 5 | 1 | 0.11 | 0.11 | 0.11 | -- | -- | -- | 1.6 |
| Iron | mg/L | T | 0.05 | 0.3 | 5 | 2 | 1.8 | 3.05 | 4.3 | 1.77 | 2 | 14 | 15 |
| Lead | mg/L | D | 0.001 | 0.0044 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 5 | 2 | 0.006 | 0.0065 | 0.007 | 0.0007 | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 5 | 5 | 0.1 | 0.13 | 0.18 | 0.03 | -- | -- | 1.3 |
| Lithium | mg/L | T | 0.005 | -- | 5 | 5 | 0.1 | 0.13 | 0.18 | 0.03 | -- | -- | 1.4 |
| Magnesium | mg/L | T | 0.5 | -- | 5 | 5 | 880 | 1136 | 1500 | 236 | -- | -- | < 1 |
| Manganese | mg/L | D | 0.005 | -- | 5 | 4 | 0.005 | 0.041 | 0.1 | 0.0437 | -- | -- | 2.2 |
| Manganese | mg/L | T | 0.005 | 1.9 | 5 | 4 | 0.011 | 0.0535 | 0.1 | 0.0455 | 0 | < 1 | 2.5 |
| Mercury | mg/L | D | 0.0001 | -- | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 5 | 3 | 0.003 | 0.005 | 0.007 | 0.002 | 0 | < 1 | 3.3 |
| Nickel | mg/L | T | 0.001 | -- | 5 | 5 | 0.002 | 0.0154 | 0.035 | 0.0174 | -- | -- | 7.7 |
| Titanium | mg/L | D | 0.005 | -- | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 5 | 2 | 0.057 | 0.0985 | 0.14 | 0.0587 | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 5 | 2 | 0.006 | 0.0125 | 0.019 | 0.0092 | 0 | < 1 | 2.5 |
| Zinc | mg/L | D | 0.005 | 0.008 | 5 | 2 | 0.005 | 0.006 | 0.007 | 0.0014 | 0 | < 1 | -- |
| Zinc | mg/L | T | 0.005 | -- | 5 | 4 | 0.009 | 0.054 | 0.1 | 0.0503 | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |

### Table 5
### Comparison of Pore Water Analytical Results to Ecological Screening Criteria
### Tiwai Point, New Zealand
### Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of |  | Detected Results |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 5 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **South Drain** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ***GENERAL CHEMISTRY*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 4 | 4 | 140 | 298 | 510 | 155 | -- | -- | 3.5 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 4 | 4 | 19000 | 19250 | 20000 | 500 | -- | -- | 1.2 |
| Conductivity | µS/cm | T | -- | -- | 4 | 4 | 62000 | 63500 | 66000 | 1732 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 3 | 3 | 0.89 | 1.077 | 1.42 | 0.298 | 0 | < 1 | 2.1 |
| pH Value | SU | T | -- | -- | 4 | 4 | 7.9 | 7.93 | 8 | 0.05 | -- | -- | 1.0 |
| Total Organic Carbon | mg/L | T | 5 | -- | 4 | 3 | 5.5 | 8.5 | 12 | 3.28 | -- | -- | 1.0 |
| Total Suspended Solids | mg/L | T | 5 | -- | 4 | 4 | 19 | 22.2 | 29 | 4.6 | -- | -- | < 1 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Aluminum | mg/L | D | 0.05 | 0.056 | 4 | 2 | 0.07 | 0.14 | 0.21 | 0.099 | 2 | 3.8 | -- |
| Aluminum | mg/L | T | 0.05 | -- | 4 | 2 | 0.07 | 0.13 | 0.19 | 0.085 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 4 | 4 | 0.001 | 0.003 | 0.004 | 0.0014 | 0 | < 1 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 4 | 4 | 0.002 | 0.0035 | 0.005 | 0.0013 | -- | -- | < 1 |
| Barium | mg/L | D | 0.02 | -- | 4 | 1 | 0.02 | 0.02 | 0.02 | -- | -- | -- | < 1 |
| Barium | mg/L | T | 0.02 | 1 | 4 | 1 | 0.02 | 0.02 | 0.02 | -- | 0 | < 1 | < 1 |
| Beryllium | mg/L | D | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 4 | 4 | 4.9 | 6.28 | 7.8 | 1.35 | 3 | 1.5 | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 4 | 4 | 5 | 6.6 | 8.2 | 1.4 | 3 | 1.6 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 4 | 1 | 0.001 | 0.001 | 0.001 | -- | 0 | < 1 | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 4 | 1 | 0.0011 | 0.0011 | 0.0011 | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 4 | 4 | 410 | 450 | 480 | 31.6 | -- | -- | 1.3 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | T | 0.001 | -- | 4 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- | < 1 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 4 | 4 | 6200 | 6550 | 6900 | 289 | -- | -- | 1.2 |
| Iron | mg/L | D | 0.05 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 4 | 3 | 0.1 | 0.19 | 0.35 | 0.14 | 1 | 1.2 | < 1 |
| Lead | mg/L | D | 0.001 | 0.0044 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 4 | 4 | 0.1 | 0.13 | 0.15 | 0.02 | -- | -- | 1.4 |
| Lithium | mg/L | T | 0.005 | -- | 4 | 4 | 0.13 | 0.14 | 0.15 | 0.008 | -- | -- | 1.5 |
| Magnesium | mg/L | T | 0.5 | -- | 4 | 4 | 1300 | 1325 | 1400 | 50 | -- | -- | 1.1 |
| Manganese | mg/L | D | 0.005 | -- | 4 | 1 | 0.007 | 0.007 | 0.007 | -- | -- | -- | < 1 |
| Manganese | mg/L | T | 0.005 | 1.9 | 4 | 1 | 0.008 | 0.008 | 0.008 | -- | 0 | < 1 | < 1 |
| Mercury | mg/L | D | 0.0001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 4 | 2 | 0.002 | 0.0025 | 0.003 | 0.0007 | 0 | < 1 | 1.7 |
| Nickel | mg/L | T | 0.001 | -- | 4 | 2 | 0.002 | 0.003 | 0.004 | 0.0014 | -- | -- | 1.5 |
| Titanium | mg/L | D | 0.005 | -- | 4 | 1 | 0.006 | 0.006 | 0.006 | -- | -- | -- | 1.2 |
| Titanium | mg/L | T | 0.005 | -- | 4 | 1 | 0.006 | 0.006 | 0.006 | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 4 | 2 | 0.022 | 0.066 | 0.11 | 0.0622 | 2 | 14 | -- |
| Zinc | mg/L | T | 0.005 | -- | 4 | 4 | 0.006 | 0.0438 | 0.13 | 0.0584 | -- | -- | -- |
| ***SVOC*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |

# Table 5
## Comparison of Pore Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **West Drain** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 4 | 4 | 110 | 135 | 150 | 19.1 | -- | -- | 1.6 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 4 | 4 | 11000 | 15000 | 19000 | 4082 | -- | -- | < 1 |
| Conductivity | µS/cm | T | -- | -- | 4 | 4 | 31000 | 41000 | 49000 | 8485 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 4 | 1 | 0.005 | 0.005 | 0.005 | -- | 1 | 1.2 | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 4 | 4 | 0.7 | 0.94 | 1.37 | 0.3 | 0 | < 1 | 1.8 |
| pH Value | SU | T | -- | -- | 4 | 4 | 6.9 | 7.33 | 7.7 | 0.39 | -- | -- | < 1 |
| Total Organic Carbon | mg/L | T | 5 | -- | 4 | 2 | 7 | 9 | 11 | 2.8 | -- | -- | 1.1 |
| Total Suspended Solids | mg/L | T | 5 | -- | 4 | 4 | 33 | 153 | 240 | 92.6 | -- | -- | 6.6 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 4 | 4 | 0.15 | 0.295 | 0.51 | 0.158 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 4 | 4 | 0.002 | 0.0025 | 0.004 | 0.001 | 0 | < 1 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 4 | 4 | 0.003 | 0.0042 | 0.005 | 0.001 | -- | -- | < 1 |
| Barium | mg/L | D | 0.02 | -- | 4 | 2 | 0.02 | 0.025 | 0.03 | 0.007 | -- | -- | < 1 |
| Barium | mg/L | T | 0.02 | 1 | 4 | 2 | 0.02 | 0.025 | 0.03 | 0.007 | 0 | < 1 | < 1 |
| Beryllium | mg/L | D | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 4 | 3 | 2.4 | 3.37 | 5.1 | 1.5 | 0 | 1.0 | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 4 | 3 | 2.5 | 3.4 | 5.2 | 1.56 | 1 | 1.0 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 4 | 4 | 230 | 290 | 350 | 58.9 | -- | -- | < 1 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 4 | 1 | 0.001 | 0.001 | 0.001 | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 4 | 3 | 0.006 | 0.007 | 0.008 | 0.001 | 3 | 6.2 | 1.2 |
| Copper | mg/L | T | 0.001 | -- | 4 | 3 | 0.005 | 0.007 | 0.009 | 0.002 | -- | -- | 1.2 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 4 | 4 | 3700 | 4675 | 5700 | 1072 | -- | -- | < 1 |
| Iron | mg/L | D | 0.05 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 4 | 4 | 0.35 | 0.588 | 0.9 | 0.268 | 4 | 3.0 | 2.8 |
| Lead | mg/L | D | 0.001 | 0.0044 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 4 | 4 | 0.065 | 0.0958 | 0.13 | 0.034 | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 4 | 4 | 0.067 | 0.1042 | 0.14 | 0.0413 | -- | -- | 1.1 |
| Magnesium | mg/L | T | 0.5 | -- | 4 | 4 | 750 | 958 | 1200 | 226 | -- | -- | < 1 |
| Manganese | mg/L | D | 0.005 | -- | 4 | 3 | 0.006 | 0.138 | 0.38 | 0.2099 | -- | -- | 7.3 |
| Manganese | mg/L | T | 0.005 | 1.9 | 4 | 4 | 0.013 | 0.1148 | 0.39 | 0.1836 | 0 | < 1 | 5.5 |
| Mercury | mg/L | D | 0.0001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 4 | 1 | 0.002 | 0.002 | 0.002 | -- | 0 | < 1 | 1.3 |
| Nickel | mg/L | T | 0.001 | -- | 4 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- | 1.0 |
| Titanium | mg/L | D | 0.005 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 4 | 4 | 0.006 | 0.0173 | 0.03 | 0.0116 | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 4 | 3 | 0.011 | 0.012 | 0.013 | 0.001 | 3 | 1.6 | -- |
| Zinc | mg/L | T | 0.005 | -- | 4 | 3 | 0.014 | 0.0197 | 0.029 | 0.0081 | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |

# Table 5
## Comparison of Pore Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 4 | 0 | -- | -- | -- | -- | -- | -- | -- |

**Notes**

HQs are calculated as the observed concentration of a constituent divded by the relevant benchmark.  HQs are unitless.

EFs are calculated as the mean concentration of a constituent divded by the mean background concentration.

The North Drain, South Drain, West Drain, and West Landfill areas were compared to the Background Awarua Bay.

The SCL, Inalco, and East Landfill areas were compared to the Background Foveux Strait. EFs are unitless.

Data are presented for samples collected under baseline conditions and summaries do not contain first flush or other additional samples.

Statistical summaries consider detected results.

-- = Data is not available for this field.

BWC = Bottom of water column

D = Dissolved

EF = enrichment factor

HQ = hazard quotient

HMW = high molecular weight

LMW = low molecular weight

max = maximum value

µS/cm = microsiemens per centimeter

min = minimum value

meq/100g = milliequivalents per 100 grams of soil

mg/L = milligrams per liter

PAH = polycyclic aromatic hydrocarbon

SD = standard deviation

SVOC = semi volatile organic compounds

T = Total

TWC = Top of water column

# Table 6
# Comparison of Surface Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| **Background Awarua Bay** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 6 | 6 | 95 | 106 | 120 | 9.5 | -- | -- | -- |
| Chloride (As Cl) | mg/L | T | 1 | -- | 6 | 6 | 21000 | 21500 | 22000 | 548 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 6 | 6 | 60000 | 60500 | 61000 | 548 | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 6 | 6 | 0.95 | 0.953 | 0.96 | 0.005 | 0 | < 1 | -- |
| pH Value | SU | T | -- | -- | 6 | 6 | 1.4 | 6.88 | 8 | 2.69 | -- | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 6 | 6 | 6.1 | 9.37 | 12 | 1.9 | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 6 | 6 | 10 | 21.8 | 43 | 11.7 | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 6 | 6 | 0.002 | 0.002 | 0.002 | 0 | 0 | < 1 | -- |
| Arsenic | mg/L | T | 0.001 | -- | 6 | 6 | 0.002 | 0.0022 | 0.003 | 0.0004 | -- | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 6 | 6 | 500 | 535 | 570 | 24.3 | -- | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 6 | 2 | 0.001 | 0.0025 | 0.004 | 0.0021 | 1 | 3.1 | -- |
| Copper | mg/L | T | 0.001 | -- | 6 | 2 | 0.001 | 0.0035 | 0.006 | 0.0035 | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 6 | 6 | 7500 | 8067 | 8600 | 398 | -- | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 6 | 6 | 0.13 | 0.153 | 0.18 | 0.02 | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 6 | 6 | 0.13 | 0.153 | 0.18 | 0.02 | -- | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 6 | 6 | 1500 | 1617 | 1700 | 75.3 | -- | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **Background Foveaux Strait** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 3 | 3 | 120 | 130 | 140 | 10 | -- | -- | -- |

## Table 6
## Comparison of Surface Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** | **Mean EF** |
| Chloride (As Cl) | mg/L | T | 1 | -- | 3 | 3 | 18000 | 19000 | 20000 | 1000 | -- | -- | -- |
| Conductivity | µS/cm | T | -- | -- | 3 | 3 | 33000 | 36000 | 39000 | 3000 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 3 | 3 | 0.87 | 0.897 | 0.91 | 0.023 | 0 | < 1 | -- |
| pH Value | SU | T | -- | -- | 3 | 3 | 7.5 | 7.83 | 8.2 | 0.35 | -- | -- | -- |
| Total Organic Carbon | mg/L | T | 5 | -- | 3 | 1 | 6.9 | 6.9 | 6.9 | -- | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 3 | 3 | 16 | 18 | 21 | 2.6 | -- | -- | -- |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 3 | 3 | 0.21 | 0.563 | 1.1 | 0.472 | 3 | 20 | -- |
| Aluminum | mg/L | T | 0.05 | -- | 3 | 3 | 0.26 | 0.923 | 2 | 0.941 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 3 | 3 | 0.004 | 0.0043 | 0.005 | 0.0006 | 0 | < 1 | -- |
| Arsenic | mg/L | T | 0.001 | -- | 3 | 3 | 0.003 | 0.0043 | 0.005 | 0.0012 | -- | -- | -- |
| Barium | mg/L | D | 0.02 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 3 | 3 | 2.7 | 2.73 | 2.8 | 0.06 | 0 | < 1 | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 3 | 3 | 3.2 | 4.93 | 8.3 | 2.92 | 1 | 1.6 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 3 | 3 | 410 | 423 | 440 | 15.3 | -- | -- | -- |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 3 | 1 | 0.002 | 0.002 | 0.002 | -- | 0 | < 1 | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 3 | 2 | 0.001 | 0.002 | 0.003 | 0.0014 | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 3 | 1 | 0.001 | 0.001 | 0.001 | -- | 0 | 1.0 | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 3 | 3 | 0.001 | 0.001 | 0.001 | 0 | 0 | < 1 | -- |
| Copper | mg/L | T | 0.001 | -- | 3 | 3 | 0.003 | 0.003 | 0.003 | 0 | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 3 | 3 | 6400 | 6500 | 6700 | 173 | -- | -- | -- |
| Iron | mg/L | D | 0.05 | -- | 3 | 3 | 0.25 | 0.91 | 1.9 | 0.873 | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 3 | 3 | 0.42 | 1.353 | 2.8 | 1.27 | 3 | 9.3 | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 3 | 3 | 0.3 | 0.31 | 0.32 | 0.01 | -- | -- | -- |
| Lithium | mg/L | T | 0.005 | -- | 3 | 3 | 0.3 | 0.32 | 0.33 | 0.02 | -- | -- | -- |
| Magnesium | mg/L | T | 0.5 | -- | 3 | 3 | 1300 | 1333 | 1400 | 57.7 | -- | -- | -- |
| Manganese | mg/L | D | 0.005 | -- | 3 | 3 | 0.008 | 0.0167 | 0.031 | 0.0125 | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 3 | 3 | 0.009 | 0.021 | 0.041 | 0.0174 | 0 | < 1 | -- |
| Mercury | mg/L | D | 0.0001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 3 | 1 | 0.001 | 0.001 | 0.001 | -- | 0 | < 1 | -- |
| Nickel | mg/L | T | 0.001 | -- | 3 | 2 | 0.001 | 0.0015 | 0.002 | 0.0007 | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 3 | 3 | 0.006 | 0.0253 | 0.053 | 0.0246 | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 3 | 3 | 0.012 | 0.0393 | 0.081 | 0.0367 | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 3 | 1 | 0.006 | 0.006 | 0.006 | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 3 | 1 | 0.008 | 0.008 | 0.008 | -- | 0 | < 1 | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 3 | 1 | 0.005 | 0.005 | 0.005 | -- | 0 | < 1 | -- |
| Zinc | mg/L | T | 0.005 | -- | 3 | 1 | 0.011 | 0.011 | 0.011 | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **East Landfill** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 3 | 3 | 110 | 113 | 120 | 5.8 | -- | -- | < 1 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 3 | 3 | 20000 | 20000 | 20000 | 0 | -- | -- | 1.1 |
| Cyanide | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |

### Table 6
### Comparison of Surface Water Analytical Results to Ecological Screening Criteria
### Tiwai Point, New Zealand
### Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 3 | 3 | 57000 | 57000 | 57000 | 0 | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 3 | 3 | 0.87 | 0.88 | 0.89 | 0.01 | 0 | < 1 | < 1 |
| pH Value | SU | T | -- | -- | 3 | 3 | 7.9 | 8 | 8.1 | 0.1 | -- | -- | 1.0 |
| Total Organic Carbon | mg/L | T | 5 | -- | 3 | 1 | 9.7 | 9.7 | 9.7 | -- | -- | -- | 1.4 |
| Total Suspended Solids | mg/L | T | 5 | -- | 3 | 3 | 18 | 23.3 | 30 | 6.1 | -- | -- | 1.3 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 3 | 3 | 0.001 | 0.001 | 0.001 | 0 | 0 | < 1 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 3 | 3 | 0.002 | 0.002 | 0.002 | 0 | -- | -- | < 1 |
| Barium | mg/L | D | 0.02 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 3 | 3 | 460 | 467 | 480 | 11.5 | -- | -- | 1.1 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 3 | 3 | 7000 | 7133 | 7200 | 115 | -- | -- | 1.1 |
| Iron | mg/L | D | 0.05 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 3 | 3 | 0.14 | 0.147 | 0.15 | 0.006 | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 3 | 3 | 0.14 | 0.147 | 0.15 | 0.006 | -- | -- | < 1 |
| Magnesium | mg/L | T | 0.5 | -- | 3 | 3 | 1400 | 1467 | 1500 | 57.7 | -- | -- | 1.1 |
| Manganese | mg/L | D | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 3 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **West Landfill** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 6 | 6 | 110 | 333 | 1400 | 523 | -- | -- | 3.2 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 6 | 6 | 18000 | 19000 | 20000 | 632 | -- | -- | < 1 |
| Conductivity | µS/cm | T | -- | -- | 2 | 2 | 62000 | 62000 | 62000 | 0 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 4 | 4 | 58000 | 58500 | 59000 | 577 | -- | -- | < 1 |
| Fluoride | mg/L | D | -- | 1.5 | 5 | 5 | 0.88 | 0.888 | 0.9 | 0.008 | 0 | < 1 | < 1 |

### Table 6
### Comparison of Surface Water Analytical Results to Ecological Screening Criteria
### Tiwai Point, New Zealand
### Environment Southland

| | | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** | **Mean EF** |
| pH Value | SU | T | -- | -- | 5 | 5 | 8 | 8 | 8.1 | 0.1 | -- | -- | 1.2 |
| Total Organic Carbon | mg/L | T | 5 | -- | 6 | 3 | 5.3 | 5.43 | 5.7 | 0.23 | -- | -- | < 1 |
| Total Suspended Solids | mg/L | T | 5 | -- | 6 | 6 | 10 | 19.5 | 46 | 13.3 | -- | -- | < 1 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 6 | 6 | 0.002 | 0.002 | 0.002 | 0 | 0 | < 1 | 1.0 |
| Arsenic | mg/L | T | 0.001 | -- | 6 | 6 | 0.002 | 0.0022 | 0.003 | 0.0004 | -- | -- | 1.0 |
| Barium | mg/L | D | 0.02 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 6 | 2 | 5.6 | 6.35 | 7.1 | 1.06 | 2 | 1.4 | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 6 | 2 | 6.6 | 7.15 | 7.7 | 0.78 | 2 | 1.5 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 6 | 6 | 360 | 410 | 440 | 26.8 | -- | -- | < 1 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 6 | 1 | 0.001 | 0.001 | 0.001 | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 6 | 6 | 5800 | 6583 | 7000 | 492 | -- | -- | < 1 |
| Iron | mg/L | D | 0.05 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 6 | 6 | 0.12 | 0.15 | 0.16 | 0.017 | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 6 | 6 | 0.13 | 0.152 | 0.16 | 0.013 | -- | -- | < 1 |
| Magnesium | mg/L | T | 0.5 | -- | 6 | 6 | 1200 | 1317 | 1400 | 98.3 | -- | -- | < 1 |
| Manganese | mg/L | D | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 6 | 1 | 0.008 | 0.008 | 0.008 | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 6 | 1 | 0.008 | 0.008 | 0.008 | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 6 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **Inalco** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 1 | 1 | 130 | 130 | 130 | -- | -- | -- | 1.0 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 1 | 1 | 20000 | 20000 | 20000 | -- | -- | -- | 1.1 |
| Cyanide | mg/L | T | 0.005 | 0.004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 1 | 1 | 56000 | 56000 | 56000 | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 1 | 1 | 0.88 | 0.88 | 0.88 | -- | 0 | < 1 | < 1 |
| pH Value | SU | T | -- | -- | 1 | 1 | 8 | 8 | 8 | -- | -- | -- | 1.0 |
| Total Organic Carbon | mg/L | T | 5 | -- | 1 | 1 | 8.3 | 8.3 | 8.3 | -- | -- | -- | 1.2 |
| Total Suspended Solids | mg/L | T | 5 | -- | 1 | 1 | 19 | 19 | 19 | -- | -- | -- | 1.1 |

# Table 6
# Comparison of Surface Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** | **Mean EF** |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | 0 | < 1 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | -- | -- | < 1 |
| Barium | mg/L | D | 0.02 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 1 | 1 | 440 | 440 | 440 | -- | -- | -- | 1.0 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | T | 0.001 | -- | 1 | 1 | 0.001 | 0.001 | 0.001 | -- | -- | -- | < 1 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 1 | 1 | 6900 | 6900 | 6900 | -- | -- | -- | 1.1 |
| Iron | mg/L | D | 0.05 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 1 | 1 | 0.14 | 0.14 | 0.14 | -- | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 1 | 1 | 0.14 | 0.14 | 0.14 | -- | -- | -- | < 1 |
| Magnesium | mg/L | T | 0.5 | -- | 1 | 1 | 1400 | 1400 | 1400 | -- | -- | -- | 1.1 |
| Manganese | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **SCL** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 1 | 1 | 110 | 110 | 110 | -- | -- | -- | < 1 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 1 | 1 | 19000 | 19000 | 19000 | -- | -- | -- | 1.0 |
| Conductivity | µS/cm | T | -- | -- | 1 | 1 | 34000 | 34000 | 34000 | -- | -- | -- | < 1 |
| Cyanide | mg/L | T | 0.005 | 0.004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 1 | 1 | 0.87 | 0.87 | 0.87 | -- | 0 | < 1 | < 1 |
| pH Value | SU | T | -- | -- | 1 | 1 | 8 | 8 | 8 | -- | -- | -- | 1.0 |
| Total Organic Carbon | mg/L | T | 5 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 1 | 1 | 10 | 10 | 10 | -- | -- | -- | < 1 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 1 | 1 | 0.07 | 0.07 | 0.07 | -- | 1 | 1.2 | < 1 |

## Table 6
## Comparison of Surface Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of |  | Detected Results |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Aluminum | mg/L | T | 0.05 | -- | 1 | 1 | 0.1 | 0.1 | 0.1 | -- | -- | -- | < 1 |
| Arsenic | mg/L | D | 0.001 | 0.012 | 1 | 1 | 0.004 | 0.004 | 0.004 | -- | 0 | < 1 | < 1 |
| Arsenic | mg/L | T | 0.001 | -- | 1 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- | < 1 |
| Barium | mg/L | D | 0.02 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 1 | 1 | 2.7 | 2.7 | 2.7 | -- | 0 | < 1 | < 1 |
| Boron | mg/L | T | 0.05 | 5.1 | 1 | 1 | 8.2 | 8.2 | 8.2 | -- | 1 | 1.6 | 1.7 |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 1 | 1 | 430 | 430 | 430 | -- | -- | -- | 1.0 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | T | 0.001 | -- | 1 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- | < 1 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 1 | 1 | 6000 | 6000 | 6000 | -- | -- | -- | < 1 |
| Iron | mg/L | D | 0.05 | -- | 1 | 1 | 0.06 | 0.06 | 0.06 | -- | -- | -- | < 1 |
| Iron | mg/L | T | 0.05 | 0.3 | 1 | 1 | 0.13 | 0.13 | 0.13 | -- | 0 | < 1 | < 1 |
| Lead | mg/L | D | 0.001 | 0.0044 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 1 | 1 | 0.3 | 0.3 | 0.3 | -- | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 1 | 1 | 0.33 | 0.33 | 0.33 | -- | -- | -- | 1.0 |
| Magnesium | mg/L | T | 0.5 | -- | 1 | 1 | 1200 | 1200 | 1200 | -- | -- | -- | < 1 |
| Manganese | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 1 | 1 | 0.008 | 0.008 | 0.008 | -- | 0 | 1.0 | 1.6 |
| Zinc | mg/L | T | 0.005 | -- | 1 | 1 | 0.02 | 0.02 | 0.02 | -- | -- | -- | 1.8 |
| ***SVOC*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 1 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **North Drain** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ***GENERAL CHEMISTRY*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 10 | 10 | 69 | 141 | 240 | 52.1 | -- | -- | 1.3 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 10 | 10 | 19000 | 19200 | 20000 | 422 | -- | -- | < 1 |
| Conductivity | µS/cm | T | -- | -- | 8 | 8 | 49000 | 51250 | 55000 | 2121 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 10 | 1 | 0.012 | 0.012 | 0.012 | -- | 1 | 3.0 | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Electrical Conductivity @ 25°C | µS/cm | T | -- | -- | 2 | 2 | 58000 | 58500 | 59000 | 707 | -- | -- | < 1 |
| Fluoride | mg/L | D | -- | 1.5 | 10 | 10 | 0.33 | 1.07 | 2.04 | 0.492 | 2 | 1.4 | 1.1 |
| pH Value | SU | T | -- | -- | 10 | 10 | 7.5 | 7.85 | 8.5 | 0.3 | -- | -- | 1.1 |
| Total Organic Carbon | mg/L | T | 5 | -- | 10 | 5 | 5.9 | 7.84 | 11 | 2.2 | -- | -- | < 1 |
| Total Suspended Solids | mg/L | T | 5 | -- | 10 | 10 | 11 | 190 | 850 | 255 | -- | -- | 8.7 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Aluminum | mg/L | D | 0.05 | 0.056 | 10 | 6 | 0.08 | 0.173 | 0.26 | 0.072 | 6 | 4.6 | -- |
| Aluminum | mg/L | T | 0.05 | -- | 10 | 7 | 0.06 | 0.184 | 0.36 | 0.109 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 10 | 10 | 0.002 | 0.0028 | 0.003 | 0.0004 | 0 | < 1 | 1.4 |

# Table 6
# Comparison of Surface Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Observations | Detects | Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
| Arsenic | mg/L | T | 0.001 | -- | 10 | 10 | 0.002 | 0.0032 | 0.004 | 0.0008 | -- | -- | 1.5 |
| Barium | mg/L | D | 0.02 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 10 | 8 | 6.2 | 7.21 | 8.9 | 1.04 | 8 | 1.7 | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 10 | 8 | 6.8 | 7.86 | 9.2 | 0.98 | 8 | 1.8 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 10 | 10 | 330 | 384 | 420 | 32 | -- | -- | < 1 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 10 | 8 | 0.002 | 0.0054 | 0.008 | 0.0018 | 8 | 6.2 | 2.1 |
| Copper | mg/L | T | 0.001 | -- | 10 | 8 | 0.003 | 0.0064 | 0.008 | 0.0016 | -- | -- | 1.8 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 10 | 10 | 5300 | 5890 | 6700 | 381 | -- | -- | < 1 |
| Iron | mg/L | D | 0.05 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 10 | 1 | 0.06 | 0.06 | 0.06 | -- | 0 | < 1 | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 10 | 10 | 0.12 | 0.137 | 0.16 | 0.013 | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 10 | 10 | 0.14 | 0.145 | 0.16 | 0.007 | -- | -- | < 1 |
| Magnesium | mg/L | T | 0.5 | -- | 10 | 10 | 1100 | 1200 | 1400 | 94.3 | -- | -- | < 1 |
| Manganese | mg/L | D | 0.005 | -- | 10 | 4 | 0.006 | 0.007 | 0.009 | 0.0014 | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 10 | 4 | 0.006 | 0.0072 | 0.01 | 0.0019 | 0 | < 1 | -- |
| Mercury | mg/L | D | 0.0001 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 10 | 4 | 0.002 | 0.0025 | 0.003 | 0.0006 | 0 | < 1 | -- |
| Nickel | mg/L | T | 0.001 | -- | 10 | 4 | 0.002 | 0.003 | 0.004 | 0.0008 | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 10 | 4 | 0.006 | 0.0095 | 0.016 | 0.0045 | 2 | 2.0 | -- |
| Zinc | mg/L | T | 0.005 | -- | 10 | 5 | 0.005 | 0.0114 | 0.021 | 0.0063 | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 10 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **South Drain** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 7 | 7 | 98 | 167 | 330 | 76.2 | -- | -- | 1.6 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 7 | 7 | 18000 | 18714 | 19000 | 488 | -- | -- | < 1 |
| Conductivity | µS/cm | T | -- | -- | 7 | 7 | 61000 | 61286 | 62000 | 488 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 7 | 1 | 0.02 | 0.02 | 0.02 | -- | 1 | 5.0 | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 6 | 6 | 0.86 | 0.898 | 0.94 | 0.028 | 0 | < 1 | < 1 |
| pH Value | SU | T | -- | -- | 6 | 6 | 7.9 | 7.93 | 8 | 0.05 | -- | -- | 1.2 |
| Total Organic Carbon | mg/L | T | 5 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Total Suspended Solids | mg/L | T | 5 | -- | 7 | 7 | 13 | 32.6 | 96 | 29.5 | -- | -- | 1.5 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Aluminum | mg/L | T | 0.05 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 7 | 7 | 0.002 | 0.0026 | 0.004 | 0.0008 | 0 | < 1 | 1.3 |
| Arsenic | mg/L | T | 0.001 | -- | 7 | 7 | 0.002 | 0.0027 | 0.004 | 0.0008 | -- | -- | 1.3 |
| Barium | mg/L | D | 0.02 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |

# Table 6
## Comparison of Surface Water Analytical Results to Ecological Screening Criteria
## Tiwai Point, New Zealand
## Environment Southland

| | | | | | Number of | | Detected Results | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Unit** | **Fraction** | **Quantitation Limit** | **Screening Criteria** | **Observations** | **Detects** | **Min** | **Mean** | **Max** | **SD** | **# Exceed** | **Max HQ** | **Mean EF** |
| Beryllium | mg/L | D | 0.001 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 7 | 7 | 5.5 | 6.66 | 7.6 | 0.84 | 7 | 1.5 | -- |
| Boron | mg/L | T | 0.05 | 5.1 | 7 | 7 | 6 | 7 | 8 | 0.8 | 7 | 1.6 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 7 | 7 | 360 | 427 | 500 | 42.3 | -- | -- | < 1 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 7 | 1 | 0.001 | 0.001 | 0.001 | -- | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 7 | 1 | 0.016 | 0.016 | 0.016 | -- | 1 | 12 | 6.4 |
| Copper | mg/L | T | 0.001 | -- | 7 | 1 | 0.02 | 0.02 | 0.02 | -- | -- | -- | 5.7 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 7 | 7 | 5800 | 6257 | 7000 | 391 | -- | -- | < 1 |
| Iron | mg/L | D | 0.05 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 7 | 1 | 0.002 | 0.002 | 0.002 | -- | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 7 | 7 | 0.11 | 0.127 | 0.15 | 0.014 | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 7 | 7 | 0.12 | 0.131 | 0.14 | 0.007 | -- | -- | < 1 |
| Magnesium | mg/L | T | 0.5 | -- | 7 | 7 | 1200 | 1257 | 1300 | 53.5 | -- | -- | < 1 |
| Manganese | mg/L | D | 0.005 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | D | 0.0001 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | T | 0.001 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | T | 0.005 | -- | 7 | 1 | 0.006 | 0.006 | 0.006 | -- | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 7 | 0 | -- | -- | -- | -- | -- | -- | -- |
| **West Drain** | | | | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 8 | 8 | 80 | 113 | 140 | 26.7 | -- | -- | 1.1 |
| Chloride (As Cl) | mg/L | T | 1 | -- | 8 | 8 | 12000 | 16875 | 20000 | 2997 | -- | -- | < 1 |
| Conductivity | µS/cm | T | -- | -- | 8 | 8 | 36000 | 47625 | 55000 | 7539 | -- | -- | -- |
| Cyanide | mg/L | T | 0.005 | 0.004 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cyanide (Free) | mg/L | T | 0.005 | 0.004 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoride | mg/L | D | -- | 1.5 | 8 | 8 | 1.4 | 1.91 | 2.87 | 0.59 | 5 | 1.9 | 2.0 |
| pH Value | SU | T | -- | -- | 8 | 8 | 7.4 | 7.83 | 8.2 | 0.27 | -- | -- | 1.1 |
| Total Organic Carbon | mg/L | T | 5 | -- | 8 | 1 | 5.7 | 5.7 | 5.7 | -- | -- | -- | < 1 |
| Total Suspended Solids | mg/L | T | 5 | -- | 8 | 8 | 14 | 106 | 240 | 96.6 | -- | -- | 4.8 |
| Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | | | | |
| Aluminum | mg/L | D | 0.05 | 0.056 | 8 | 8 | 0.07 | 0.272 | 0.76 | 0.206 | 8 | 14 | -- |
| Aluminum | mg/L | T | 0.05 | -- | 8 | 8 | 0.11 | 0.715 | 2 | 0.713 | -- | -- | -- |
| Arsenic | mg/L | D | 0.001 | 0.012 | 8 | 8 | 0.002 | 0.0026 | 0.003 | 0.0005 | 0 | < 1 | 1.3 |
| Arsenic | mg/L | T | 0.001 | -- | 8 | 8 | 0.003 | 0.0032 | 0.004 | 0.0005 | -- | -- | 1.5 |
| Barium | mg/L | D | 0.02 | -- | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Barium | mg/L | T | 0.02 | 1 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | D | 0.001 | -- | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Beryllium | mg/L | T | 0.001 | 0.1 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Boron | mg/L | D | 0.05 | 5.1 | 8 | 8 | 3.7 | 4.79 | 6 | 0.82 | 3 | 1.2 | -- |

# Table 6
# Comparison of Surface Water Analytical Results to Ecological Screening Criteria
# Tiwai Point, New Zealand
# Environment Southland

| Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Number of Observations | Detects | Detected Results Min | Mean | Max | SD | # Exceed | Max HQ | Mean EF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Boron | mg/L | T | 0.05 | 5.1 | 8 | 8 | 3.6 | 5.21 | 6.9 | 1.2 | 4 | 1.4 | -- |
| Cadmium | mg/L | D | 0.0002 | 0.0055 | 8 | 1 | 0.0002 | 0.0002 | 0.0002 | -- | 0 | < 1 | -- |
| Cadmium | mg/L | T | 0.0002 | -- | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Calcium | mg/L | T | 0.5 | -- | 8 | 8 | 240 | 310 | 370 | 51.8 | -- | -- | < 1 |
| Chromium, total | mg/L | D | 0.001 | 0.027 | 8 | 1 | 0.005 | 0.005 | 0.005 | -- | 0 | < 1 | -- |
| Chromium, total | mg/L | T | 0.001 | -- | 8 | 3 | 0.001 | 0.0013 | 0.002 | 0.0006 | -- | -- | -- |
| Cobalt | mg/L | D | 0.001 | -- | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Cobalt | mg/L | T | 0.001 | 0.001 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Copper | mg/L | D | 0.001 | 0.0013 | 8 | 6 | 0.002 | 0.0075 | 0.01 | 0.0029 | 6 | 7.7 | 3.0 |
| Copper | mg/L | T | 0.001 | -- | 8 | 6 | 0.003 | 0.0092 | 0.013 | 0.0034 | -- | -- | 2.6 |
| Hardness (As CaCO3) | mg/L | T | 5 | -- | 8 | 8 | 4000 | 5200 | 6100 | 910 | -- | -- | < 1 |
| Iron | mg/L | D | 0.05 | -- | 8 | 1 | 0.42 | 0.42 | 0.42 | -- | -- | -- | -- |
| Iron | mg/L | T | 0.05 | 0.3 | 8 | 5 | 0.07 | 0.714 | 1.4 | 0.605 | 3 | 4.7 | -- |
| Lead | mg/L | D | 0.001 | 0.0044 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Lead | mg/L | T | 0.001 | -- | 8 | 2 | 0.002 | 0.002 | 0.002 | 0 | -- | -- | -- |
| Lithium | mg/L | D | 0.005 | -- | 8 | 8 | 0.086 | 0.1154 | 0.14 | 0.0197 | -- | -- | < 1 |
| Lithium | mg/L | T | 0.005 | -- | 8 | 8 | 0.09 | 0.126 | 0.15 | 0.022 | -- | -- | < 1 |
| Magnesium | mg/L | T | 0.5 | -- | 8 | 8 | 820 | 1060 | 1300 | 187 | -- | -- | < 1 |
| Manganese | mg/L | D | 0.005 | -- | 8 | 4 | 0.005 | 0.0145 | 0.028 | 0.0097 | -- | -- | -- |
| Manganese | mg/L | T | 0.005 | 1.9 | 8 | 4 | 0.006 | 0.0215 | 0.029 | 0.0107 | 0 | < 1 | -- |
| Mercury | mg/L | D | 0.0001 | -- | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Mercury | mg/L | T | 0.0001 | 0.0001 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Nickel | mg/L | D | 0.001 | 0.07 | 8 | 6 | 0.001 | 0.002 | 0.004 | 0.0013 | 0 | < 1 | -- |
| Nickel | mg/L | T | 0.001 | -- | 8 | 7 | 0.001 | 0.0033 | 0.01 | 0.0037 | -- | -- | -- |
| Titanium | mg/L | D | 0.005 | -- | 9 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Titanium | mg/L | T | 0.005 | -- | 8 | 2 | 0.014 | 0.0155 | 0.017 | 0.0021 | -- | -- | -- |
| Vanadium | mg/L | D | 0.005 | -- | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Vanadium | mg/L | T | 0.005 | 0.1 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Zinc | mg/L | D | 0.005 | 0.008 | 8 | 8 | 0.005 | 0.0958 | 0.27 | 0.1084 | 6 | 34 | -- |
| Zinc | mg/L | T | 0.005 | -- | 8 | 8 | 0.006 | 0.1314 | 0.43 | 0.1673 | -- | -- | -- |
| ***SVOC*** | | | | | | | | | | | | | |
| Acenaphthene | mg/L | T | 0.001 | 0.0058 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | mg/L | T | 0.001 | 0.028 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | mg/L | T | 0.001 | 0.0004 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | 8 | 1 | 0.004 | 0.004 | 0.004 | -- | 1 | 222 | -- |
| Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | mg/L | T | 0.001 | 0.0001 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | mg/L | T | 0.001 | 0.0014 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | mg/L | T | 0.001 | 0.003 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | mg/L | T | 0.001 | 0.07 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | mg/L | T | 0.001 | 0.002 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | mg/L | T | 0.001 | 0.000025 | 8 | 0 | -- | -- | -- | -- | -- | -- | -- |
| Sum of Detected PAHs | mg/L | T | 0.001 | -- | 8 | 1 | 0.004 | 0.004 | 0.004 | -- | -- | -- | -- |

**Notes**

HQs are calculated as the observed concentration of a constituent divded by the relevant benchmark. HQs are unitless.

EFs are calculated as the mean concentration of a constituent divded by the mean background concentration.

The North Drain, South Drain, West Drain, and West Landfill areas were compared to the Background Awarua Bay.

The SCL, Inalco, and East Landfill areas were compared to the Background Foveux Strait. EFs are unitless.

Data are presented for samples collected under baseline conditions and summaries do not contain first flush or other additional samples.

Statistical summaries consider detected results.

-- = Data is not available for this field.

BWC = Bottom of water column

D = Dissolved

EF = enrichment factor

HQ = hazard quotient

HMW = high molecular weight

LMW = low molecular weight

max = maximum value

µS/cm = microsiemens per centimeter

min = minimum value

meq/100g = milliequivalents per 100 grams of soil

mg/L = milligrams per liter

PAH = polycyclic aromatic hydrocarbon

SD = standard deviation

SVOC = semi volatile organic compounds

T = Total

TWC = Top of water column

## Table 7
## First Flush Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Type | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ | EF |
|---|---|---|---|---|---|---|---|---|---|---|
| **North Drain** | | | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | | | |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 130 | -- | 1.2 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Chloride (As Cl) | mg/L | T | 1 | -- | 20000 | -- | < 1 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Conductivity | µS/cm | T | -- | -- | 6200 | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Cyanide | mg/L | T | 0.005 | 0.004 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Cyanide (Free) | mg/L | T | 0.005 | 0.004 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Dissolved Organic Carbon | mg/L | D | 5 | -- | 5.9 | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Fluoride | mg/L | D | -- | 1.5 | 4.21 | 2.8 | 4.4 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | pH Value | SU | T | -- | -- | 7 | -- | 1.0 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Total Organic Carbon | mg/L | T | 5 | -- | 7.8 | -- | < 1 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Total Suspended Solids | mg/L | T | 5 | -- | 17 | -- | < 1 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 74 | -- | < 1 |
| NOD-00 | North Drain SW | Outfall first flush | Chloride (As Cl) | mg/L | T | 1 | -- | 36 | -- | < 1 |
| NOD-00 | North Drain SW | Outfall first flush | Conductivity | µS/cm | T | -- | -- | 65 | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Cyanide | mg/L | T | 0.005 | 0.004 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Cyanide (Free) | mg/L | T | 0.005 | 0.004 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Dissolved Organic Carbon | mg/L | D | 5 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Fluoride | mg/L | D | -- | 1.5 | 66.3 | 44 | 70 |
| NOD-00 | North Drain SW | Outfall first flush | pH Value | SU | T | -- | -- | 6.4 | -- | < 1 |
| NOD-00 | North Drain SW | Outfall first flush | Total Organic Carbon | mg/L | T | 5 | -- | 5.1 | -- | < 1 |
| NOD-00 | North Drain SW | Outfall first flush | Total Suspended Solids | mg/L | T | 5 | -- | 15 | -- | < 1 |
| NOD-00 | North Drain SW | Outfall first flush | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Chloride (As Cl) | mg/L | T | 1 | -- | 3600 | -- | < 1 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Conductivity | µS/cm | T | -- | -- | 11000 | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Cyanide | mg/L | T | 0.005 | 0.004 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Cyanide (Free) | mg/L | T | 0.005 | 0.004 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Dissolved Organic Carbon | mg/L | D | 5 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Fluoride | mg/L | D | -- | 1.5 | 23.4 | 16 | 25 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | pH Value | SU | T | -- | -- | 6.1 | -- | < 1 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Total Organic Carbon | mg/L | T | 5 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Total Suspended Solids | mg/L | T | 5 | -- | 15 | -- | < 1 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- | -- |
| ***METALS*** | | | | | | | | | | |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Aluminum | mg/L | D | 0.05 | 0.056 | 0.27 | 4.8 | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Aluminum | mg/L | T | 0.05 | -- | 0.4 | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Arsenic | mg/L | D | 0.001 | 0.012 | 0.002 | < 1 | 1.0 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Arsenic | mg/L | T | 0.001 | -- | 0.002 | -- | < 1 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Barium | mg/L | D | 0.02 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Barium | mg/L | T | 0.02 | 1 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Beryllium | mg/L | D | 0.001 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Boron | mg/L | D | 0.05 | 5.1 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Boron | mg/L | T | 0.05 | 5.1 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Cadmium | mg/L | D | 0.0002 | 0.0055 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Cadmium | mg/L | T | 0.0002 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Calcium | mg/L | T | 0.5 | -- | 380 | -- | < 1 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Chromium, total | mg/L | D | 0.001 | 0.027 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Chromium, total | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Cobalt | mg/L | D | 0.001 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Cobalt | mg/L | T | 0.001 | 0.001 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Copper | mg/L | D | 0.001 | 0.0013 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Copper | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Hardness (As CaCO3) | mg/L | T | 5 | -- | 6300 | -- | < 1 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Iron | mg/L | D | 0.05 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Iron | mg/L | T | 0.05 | 0.3 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Lead | mg/L | D | 0.001 | 0.0044 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Lead | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Lithium | mg/L | D | 0.005 | -- | 0.13 | -- | < 1 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Lithium | mg/L | T | 0.005 | -- | 0.13 | -- | < 1 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Magnesium | mg/L | T | 0.5 | -- | 1300 | -- | < 1 |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Manganese | mg/L | D | 0.005 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Manganese | mg/L | T | 0.005 | 1.9 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Mercury | mg/L | D | 0.0001 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Mercury | mg/L | T | 0.0001 | 0.0001 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Nickel | mg/L | D | 0.001 | 0.07 | 0.016 | < 1 | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Nickel | mg/L | T | 0.001 | -- | 0.016 | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Titanium | mg/L | D | 0.005 | -- | -- | -- | -- |

# Table 7
# First Flush Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Type | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ | EF |
|---|---|---|---|---|---|---|---|---|---|---|
| NOD-04 | NOD SW 100m BWC | BWC First flush | Titanium | mg/L | T | 0.005 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Vanadium | mg/L | D | 0.005 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Vanadium | mg/L | T | 0.005 | 0.1 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Zinc | mg/L | D | 0.005 | 0.008 | 0.008 | 1.0 | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Zinc | mg/L | T | 0.005 | -- | 0.01 | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Aluminum | mg/L | D | 0.05 | 0.056 | 46 | 821 | -- |
| NOD-00 | North Drain SW | Outfall first flush | Aluminum | mg/L | T | 0.05 | -- | 46 | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Arsenic | mg/L | D | 0.001 | 0.012 | 0.007 | < 1 | 3.5 |
| NOD-00 | North Drain SW | Outfall first flush | Arsenic | mg/L | T | 0.001 | -- | 0.008 | -- | 3.7 |
| NOD-00 | North Drain SW | Outfall first flush | Barium | mg/L | D | 0.02 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Barium | mg/L | T | 0.02 | 1 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Beryllium | mg/L | D | 0.001 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Boron | mg/L | D | 0.05 | 5.1 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Boron | mg/L | T | 0.05 | 5.1 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Cadmium | mg/L | D | 0.0002 | 0.0055 | 0.0004 | < 1 | -- |
| NOD-00 | North Drain SW | Outfall first flush | Cadmium | mg/L | T | 0.0002 | -- | 0.0004 | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Calcium | mg/L | T | 0.5 | -- | 3.6 | -- | < 1 |
| NOD-00 | North Drain SW | Outfall first flush | Chromium, total | mg/L | D | 0.001 | 0.027 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Chromium, total | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Cobalt | mg/L | D | 0.001 | -- | 0.002 | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Cobalt | mg/L | T | 0.001 | 0.001 | 0.002 | 2.0 | -- |
| NOD-00 | North Drain SW | Outfall first flush | Copper | mg/L | D | 0.001 | 0.0013 | 0.005 | 3.8 | 2.0 |
| NOD-00 | North Drain SW | Outfall first flush | Copper | mg/L | T | 0.001 | -- | 0.006 | -- | 1.7 |
| NOD-00 | North Drain SW | Outfall first flush | Hardness (As CaCO3) | mg/L | T | 5 | -- | 28 | -- | < 1 |
| NOD-00 | North Drain SW | Outfall first flush | Iron | mg/L | D | 0.05 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Iron | mg/L | T | 0.05 | 0.3 | 0.09 | < 1 | -- |
| NOD-00 | North Drain SW | Outfall first flush | Lead | mg/L | D | 0.001 | 0.0044 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Lead | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Lithium | mg/L | D | 0.005 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Lithium | mg/L | T | 0.005 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Magnesium | mg/L | T | 0.5 | -- | 4.7 | -- | < 1 |
| NOD-00 | North Drain SW | Outfall first flush | Manganese | mg/L | D | 0.005 | -- | 0.063 | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Manganese | mg/L | T | 0.005 | 1.9 | 0.063 | < 1 | -- |
| NOD-00 | North Drain SW | Outfall first flush | Mercury | mg/L | D | 0.0001 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Mercury | mg/L | T | 0.0001 | 0.0001 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Nickel | mg/L | D | 0.001 | 0.07 | 0.37 | 5.3 | -- |
| NOD-00 | North Drain SW | Outfall first flush | Nickel | mg/L | T | 0.001 | -- | 0.37 | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Titanium | mg/L | D | 0.005 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Titanium | mg/L | T | 0.005 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Vanadium | mg/L | D | 0.005 | -- | 0.031 | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Vanadium | mg/L | T | 0.005 | 0.1 | 0.035 | < 1 | -- |
| NOD-00 | North Drain SW | Outfall first flush | Zinc | mg/L | D | 0.005 | 0.008 | 1 | 125 | -- |
| NOD-00 | North Drain SW | Outfall first flush | Zinc | mg/L | T | 0.005 | -- | 1 | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Aluminum | mg/L | D | 0.05 | 0.056 | 19 | 339 | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Aluminum | mg/L | T | 0.05 | -- | 19 | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Arsenic | mg/L | D | 0.001 | 0.012 | 0.002 | < 1 | 1.0 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Arsenic | mg/L | T | 0.001 | -- | 0.003 | -- | 1.4 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Barium | mg/L | D | 0.02 | -- | 0.03 | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Barium | mg/L | T | 0.02 | 1 | 0.03 | < 1 | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Beryllium | mg/L | D | 0.001 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Boron | mg/L | D | 0.05 | 5.1 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Boron | mg/L | T | 0.05 | 5.1 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Cadmium | mg/L | D | 0.0002 | 0.0055 | 0.0004 | < 1 | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Cadmium | mg/L | T | 0.0002 | -- | 0.0004 | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Calcium | mg/L | T | 0.5 | -- | 68 | -- | < 1 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Chromium, total | mg/L | D | 0.001 | 0.027 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Chromium, total | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Cobalt | mg/L | D | 0.001 | -- | 0.001 | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Cobalt | mg/L | T | 0.001 | 0.001 | 0.001 | 1.0 | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Copper | mg/L | D | 0.001 | 0.0013 | 0.006 | 4.6 | 2.4 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Copper | mg/L | T | 0.001 | -- | 0.006 | -- | 1.7 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Hardness (As CaCO3) | mg/L | T | 5 | -- | 1100 | -- | < 1 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Iron | mg/L | D | 0.05 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Iron | mg/L | T | 0.05 | 0.3 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Lead | mg/L | D | 0.001 | 0.0044 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Lead | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Lithium | mg/L | D | 0.005 | -- | 0.026 | -- | < 1 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Lithium | mg/L | T | 0.005 | -- | 0.026 | -- | < 1 |

# Table 7
## First Flush Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Type | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ | EF |
|---|---|---|---|---|---|---|---|---|---|---|
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Magnesium | mg/L | T | 0.5 | -- | 240 | -- | < 1 |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Manganese | mg/L | D | 0.005 | -- | 0.049 | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Manganese | mg/L | T | 0.005 | 1.9 | 0.049 | < 1 | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Mercury | mg/L | D | 0.0001 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Mercury | mg/L | T | 0.0001 | 0.0001 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Nickel | mg/L | D | 0.001 | 0.07 | 0.21 | 3.0 | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Nickel | mg/L | T | 0.001 | -- | 0.21 | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Titanium | mg/L | D | 0.005 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Titanium | mg/L | T | 0.005 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Vanadium | mg/L | D | 0.005 | -- | 0.01 | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Vanadium | mg/L | T | 0.005 | 0.1 | 0.013 | < 1 | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Zinc | mg/L | D | 0.005 | 0.008 | 1.2 | 150 | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Zinc | mg/L | T | 0.005 | -- | 1.2 | -- | -- |
| ***SVOC*** | | | | | | | | | | |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Anthracene | mg/L | T | 0.001 | 0.0004 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Fluoranthene | mg/L | T | 0.001 | 0.0014 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Naphthalene | mg/L | T | 0.001 | 0.07 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Phenanthrene | mg/L | T | 0.001 | 0.002 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- | -- |
| NOD-04 | NOD SW 100m BWC | BWC First flush | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Anthracene | mg/L | T | 0.001 | 0.0004 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Fluoranthene | mg/L | T | 0.001 | 0.0014 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Naphthalene | mg/L | T | 0.001 | 0.07 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Phenanthrene | mg/L | T | 0.001 | 0.002 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- | -- |
| NOD-00 | North Drain SW | Outfall first flush | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Anthracene | mg/L | T | 0.001 | 0.0004 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Fluoranthene | mg/L | T | 0.001 | 0.0014 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Naphthalene | mg/L | T | 0.001 | 0.07 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Phenanthrene | mg/L | T | 0.001 | 0.002 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- | -- |
| NOD-04 | North Drain SW 100m TWC | TWC first flush | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- | -- |

**Notes**

HQs are calculated as the observed concentration of a constituent divded by the relevant benchmark. HQs are unitless.

EFs are calculated as the mean concentration of a constituent divded by the mean background concentration.

The North Drain, South Drain, West Drain, and West Landfill areas were compared to the Background Awarua Bay.

The SCL, Inalco, and East Landfill areas were compared to the Background Foveux Strait. EFs are unitless.

| Location | Sample | Type | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ | EF |
|---|---|---|---|---|---|---|---|---|---|---|

Data are presented for samples collected under baseline conditions and summaries do not contain first flush or other additional samples.

Statistical summaries consider detected results.

-- = Data is not available for this field.
BWC = Bottom of water column
D = Dissolved
EF = enrichment factor
HQ = hazard quotient
HMW = high molecular weight
LMW = low molecular weight
max = maximum value
µS/cm = microsiemens per centimeter
min = minimum value
meq/100g = milliequivalents per 100 grams of soil
mg/L = milligrams per liter
PAH = polycyclic aromatic hydrocarbon
SD = standard deviation
SVOC = semi volatile organic compounds
T = Total
TWC = Top of water column

# Table 8
## Surface Water Supplemental Sampling
## Tiwai Point, New Zealand
## Environment Southland

| | | Location ID | NOD-01 | | WOD-01 | | WOD-01 | |
|---|---|---|---|---|---|---|---|---|
| | | Water Column Position | TWC | | TWC | | BWC | |
| | | Sample Date | | | | | | |
| Analyte | CAS-RN | Unit | 29-Jan-23 | 3-May-23 | 26-Jan-23 | 3-May-23 | 26-Jan-23 | 3-May-23 |
| **Trace Elements and Inorganics** | | | | | | | | |
| Aluminium (D) | 7429-90-5 | µg/L | 210 | 400 | 210 | < 100 | 240 | < 100 |
| Copper (D) | 7440-50-8 | µg/L | 7 | 11 | 10 | 0.3 | 8 | 0.64 |
| Fluoride | 16984-48-8 | µg/L | 1620 | 1160 | 2870 | 710 | 2770 | 750 |
| Total Cyanide | 57-12-5 | µg/L | 12 | < 5 | < 5 | < 5 | < 5 | < 5 |
| **Polycyclic Aromatic Hydrocarbons (PAHs)** | | | | | | | | |
| Acenaphthene | 83-32-9 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 |
| Acenaphthylene | 208-96-8 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 |
| Anthracene | 120-12-7 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 0.32 |
| Benzo(a)anthracene | 56-55-3 | µg/L | < 1 | < 0.1 | 4 | 0.13 | < 1 | < 2 |
| Benzo(a)pyrene | 50-32-8 | µg/L | < 1 | < 0.1 | < 1 | 0.67 | < 1 | 5.2 |
| Benzo(b)fluoranthene | edms_0016 | µg/L | < 1 | < 0.1 | < 1 | 0.42 | < 1 | 3.8 |
| Benzo(ghi)perylene | 191-24-2 | µg/L | < 1 | < 0.1 | < 1 | 0.22 | < 1 | < 2 |
| Benzo(k)fluoranthene | 207-08-9 | µg/L | < 1 | < 0.1 | < 1 | 0.36 | < 1 | < 2 |
| Chrysene | 218-01-9 | µg/L | < 1 | < 0.1 | < 1 | 0.17 | < 1 | < 2 |
| Dibenzo(ah)anthracene | 53-70-3 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 2 |
| Fluoranthene | 206-44-0 | µg/L | < 1 | < 0.1 | < 1 | 0.27 | < 1 | < 2 |
| Fluorene | 86-73-7 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 |
| Indeno(1,2,3,c,d)pyrene | 193-39-5 | µg/L | < 1 | < 0.1 | < 1 | 0.19 | < 1 | < 2 |
| Naphthalene | 91-20-3 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 |
| Phenanthrene | 85-01-8 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 0.73 |
| Pyrene | 129-00-0 | µg/L | < 1 | < 0.1 | < 1 | 0.43 | < 1 | 3.4 |

**Notes**

BWC = Bottom of Water Column
D = Dissolved
µg/L = Micrograms per liter
NOD = North Outfall Drain
PAH = Polycyclic Aromatic Hydrocarbon
SEP = Seep sample
SOD = South Outfall Drain
SVOC = Semi Volatile Organic Compounds
TWC = Top of Water Column
WOD = West Outfall Drain
< = indicates non-detect results presented at the detection limit

## Table 9
## Pore Water Supplemental Sampling
## Tiwai Point, New Zealand
## Environment Southland

| Analyte | CAS-RN | Location ID | NOD-01 | | NOD-03 | | NOD-04 | | SOD-01 | | SOD-03 | | WOD-01 | | WOD-02 | | WOD-04 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample Date | 29-Jan-23 | 3-May-23 | 31-Jan-23 | 4-May-23 | 29-Jan-23 | 3-May-23 | 26-Jan-23 | 3-May-23 | 25-Jan-23 | 3-May-23 | 26-Jan-23 | 2-May-23 | 27-Jan-23 | 3-May-23 | -- | 4-May-23 |
| | | Unit | | | | | | | | | | | | | | | | |
| **Trace Elements and Inorganics** | | | | | | | | | | | | | | | | | | |
| Aluminium (D) | 7429-90-5 | µg/L | 180 | 160 | 60 | < 100 | 80 | < 100 | 210 | < 100 | < 50 | < 100 | < 50 | < 100 | < 50 | < 100 | -- | < 100 |
| Copper (D) | 7440-50-8 | µg/L | 6 | 0.41 | < 1 | < 0.2 | 3 | < 0.2 | < 1 | 1.1 | < 1 | 0.34 | 7 | 0.31 | 6 | < 0.2 | -- | < 0.2 |
| Fluoride | 16984-48-8 | µg/L | 14800 | 8600 | 8120 | 9920 | 8890 | 4670 | -- | 3070 | 890 | 1450 | 700 | 4260 | 1370 | 760 | -- | 770 |
| Total Cyanide | 57-12-5 | µg/L | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | < 5 | -- | < 5 |
| **Polycyclic Aromatic Hydrocarbons (PAHs)** | | | | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 0.68 | < 1 | < 0.22 | -- | < 0.1 |
| Acenaphthylene | 208-96-8 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 0.61 | < 1 | < 0.22 | -- | < 0.1 |
| Anthracene | 120-12-7 | µg/L | < 1 | < 1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 2 | < 1 | < 0.22 | -- | < 0.1 |
| Benzo(a)anthracene | 56-55-3 | µg/L | < 1 | 5.2 | < 1 | < 1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 6.3 | < 1 | 1.4 | -- | 0.38 |
| Benzo(a)pyrene | 50-32-8 | µg/L | < 1 | 9.7 | < 1 | 1.1 | < 1 | 0.22 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 17 | < 1 | < 4.3 | -- | 0.84 |
| Benzo(b)fluoranthene | edms_0016 | µg/L | < 1 | 6.4 | < 1 | < 1 | < 1 | 0.16 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 13 | < 1 | < 4.3 | -- | 0.88 |
| Benzo(ghi)perylene | 191-24-2 | µg/L | < 1 | < 1 | < 1 | 0.56 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 4.7 | < 1 | 1.6 | -- | 0.42 |
| Benzo(k)fluoranthene | 207-08-9 | µg/L | < 1 | 5.5 | < 1 | < 1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 3.5 | < 1 | < 4.3 | -- | 0.32 |
| Chrysene | 218-01-9 | µg/L | < 1 | 7.8 | < 1 | < 1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 5.4 | < 1 | 1.7 | -- | 0.38 |
| Dibenzo(ah)anthracene | 53-70-3 | µg/L | < 1 | < 1 | < 1 | 0.25 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 1.5 | < 1 | 0.57 | -- | 0.13 |
| Fluoranthene | 206-44-0 | µg/L | < 1 | 5.3 | < 1 | < 1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 6.2 | < 1 | 1.6 | -- | 0.33 |
| Fluorene | 86-73-7 | µg/L | < 1 | 0.49 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 0.67 | < 1 | < 0.22 | -- | < 0.1 |
| Indeno(1,2,3,c,d)pyrene | 193-39-5 | µg/L | < 1 | 1.4 | < 1 | 0.75 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 4.8 | < 1 | < 4.3 | -- | 0.54 |
| Naphthalene | 91-20-3 | µg/L | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.22 | -- | < 0.1 |
| Phenanthrene | 85-01-8 | µg/L | < 1 | 1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 3.6 | < 1 | < 0.22 | -- | < 0.1 |
| Pyrene | 129-00-0 | µg/L | < 1 | 7.8 | < 1 | 0.79 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | < 0.1 | < 1 | 12 | < 1 | < 4.3 | -- | 0.5 |

**Notes**

-- = Data not available.
BWC = Bottom of Water Column
D = Dissolved
µg/L = Micrograms per liter
NOD = North Outfall Drain
PAH = Polycyclic Aromatic Hydrocarbon
SEP = Seep sample
SOD = South Outfall Drain
SVOC = Semi Volatile Organic Compounds
TWC = Top of Water Column
WOD = West Outfall Drain
< = indicates non-detect results presented at the detection limit

## Table 10
## Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| **North Drain** | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | |
| NOD-03 | NOD-WG-03 | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 96 | -- |
| NOD-04 | NOD-WG-04 | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 180 | -- |
| NOD-03 | NOD-WG-03 | Chloride (As Cl) | mg/L | T | 1 | -- | 20000 | -- |
| NOD-04 | NOD-WG-04 | Chloride (As Cl) | mg/L | T | 1 | -- | 21000 | -- |
| NOD-03 | NOD-WG-03 | Conductivity | µS/cm | T | -- | -- | 55000 | -- |
| NOD-04 | NOD-WG-04 | Conductivity | µS/cm | T | -- | -- | 6000 | -- |
| NOD-03 | NOD-WG-03 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| NOD-04 | NOD-WG-04 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| NOD-03 | NOD-WG-03 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| NOD-04 | NOD-WG-04 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| NOD-03 | NOD-WG-03 | Fluoride | mg/L | D | -- | 1.5 | 1.44 | < 1 |
| NOD-04 | NOD-WG-04 | Fluoride | mg/L | D | -- | 1.5 | 9.37 | 6.2 |
| NOD-03 | NOD-WG-03 | pH Value | SU | T | -- | -- | 7.7 | -- |
| NOD-04 | NOD-WG-04 | pH Value | SU | T | -- | -- | 7.1 | -- |
| NOD-03 | NOD-WG-03 | Total Organic Carbon | mg/L | T | 5 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Total Organic Carbon | mg/L | T | 5 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Total Suspended Solids | mg/L | T | 5 | -- | 18 | -- |
| NOD-04 | NOD-WG-04 | Total Suspended Solids | mg/L | T | 5 | -- | 23 | -- |
| NOD-03 | NOD-WG-03 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| ***METALS*** | | | | | | | | |
| NOD-03 | NOD-WG-03 | Aluminum | mg/L | D | 0.05 | 0.056 | 0.1 | 1.8 |
| NOD-03 | NOD-WG-03 | Aluminum | mg/L | T | 0.05 | -- | 0.09 | -- |
| NOD-04 | NOD-WG-04 | Aluminum | mg/L | D | 0.05 | 0.056 | -- | -- |
| NOD-04 | NOD-WG-04 | Aluminum | mg/L | T | 0.05 | -- | 0.17 | -- |
| NOD-03 | NOD-WG-03 | Arsenic | mg/L | D | 0.001 | 0.012 | 0.002 | < 1 |
| NOD-03 | NOD-WG-03 | Arsenic | mg/L | T | 0.001 | -- | 0.002 | -- |
| NOD-04 | NOD-WG-04 | Arsenic | mg/L | D | 0.001 | 0.012 | 0.001 | < 1 |
| NOD-04 | NOD-WG-04 | Arsenic | mg/L | T | 0.001 | -- | 0.002 | -- |
| NOD-03 | NOD-WG-03 | Barium | mg/L | D | 0.02 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Barium | mg/L | T | 0.02 | 1 | -- | -- |
| NOD-04 | NOD-WG-04 | Barium | mg/L | D | 0.02 | -- | 0.02 | -- |
| NOD-04 | NOD-WG-04 | Barium | mg/L | T | 0.02 | 1 | 0.03 | < 1 |
| NOD-03 | NOD-WG-03 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| NOD-04 | NOD-WG-04 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| NOD-03 | NOD-WG-03 | Boron | mg/L | D | 0.05 | 5.1 | -- | -- |
| NOD-03 | NOD-WG-03 | Boron | mg/L | T | 0.05 | 5.1 | -- | -- |
| NOD-04 | NOD-WG-04 | Boron | mg/L | D | 0.05 | 5.1 | -- | -- |
| NOD-04 | NOD-WG-04 | Boron | mg/L | T | 0.05 | 5.1 | -- | -- |
| NOD-03 | NOD-WG-03 | Cadmium | mg/L | D | 0.0002 | 0.0055 | -- | -- |
| NOD-03 | NOD-WG-03 | Cadmium | mg/L | T | 0.0002 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Cadmium | mg/L | D | 0.0002 | 0.0055 | 0.0003 | < 1 |
| NOD-04 | NOD-WG-04 | Cadmium | mg/L | T | 0.0002 | -- | 0.0003 | -- |
| NOD-03 | NOD-WG-03 | Calcium | mg/L | T | 0.5 | -- | 380 | -- |
| NOD-04 | NOD-WG-04 | Calcium | mg/L | T | 0.5 | -- | 490 | -- |
| NOD-03 | NOD-WG-03 | Chromium, total | mg/L | D | 0.001 | 0.027 | -- | -- |
| NOD-03 | NOD-WG-03 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Chromium, total | mg/L | D | 0.001 | 0.027 | -- | -- |
| NOD-04 | NOD-WG-04 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Cobalt | mg/L | T | 0.001 | 0.001 | -- | -- |
| NOD-04 | NOD-WG-04 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Cobalt | mg/L | T | 0.001 | 0.001 | -- | -- |
| NOD-03 | NOD-WG-03 | Copper | mg/L | D | 0.001 | 0.0013 | -- | -- |
| NOD-03 | NOD-WG-03 | Copper | mg/L | T | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Copper | mg/L | D | 0.001 | 0.0013 | -- | -- |
| NOD-04 | NOD-WG-04 | Copper | mg/L | T | 0.001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Hardness (As CaCO3) | mg/L | T | 5 | -- | 6100 | -- |
| NOD-04 | NOD-WG-04 | Hardness (As CaCO3) | mg/L | T | 5 | -- | 7000 | -- |
| NOD-03 | NOD-WG-03 | Iron | mg/L | D | 0.05 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Iron | mg/L | T | 0.05 | 0.3 | -- | -- |
| NOD-04 | NOD-WG-04 | Iron | mg/L | D | 0.05 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Iron | mg/L | T | 0.05 | 0.3 | 0.24 | < 1 |
| NOD-03 | NOD-WG-03 | Lead | mg/L | D | 0.001 | 0.0044 | -- | -- |
| NOD-03 | NOD-WG-03 | Lead | mg/L | T | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Lead | mg/L | D | 0.001 | 0.0044 | -- | -- |

## Table 10
## Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| NOD-04 | NOD-WG-04 | Lead | mg/L | T | 0.001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Lithium | mg/L | D | 0.005 | -- | 0.14 | -- |
| NOD-03 | NOD-WG-03 | Lithium | mg/L | T | 0.005 | -- | 0.14 | -- |
| NOD-04 | NOD-WG-04 | Lithium | mg/L | D | 0.005 | -- | 0.13 | -- |
| NOD-04 | NOD-WG-04 | Lithium | mg/L | T | 0.005 | -- | 0.13 | -- |
| NOD-03 | NOD-WG-03 | Magnesium | mg/L | T | 0.5 | -- | 1200 | -- |
| NOD-04 | NOD-WG-04 | Magnesium | mg/L | T | 0.5 | -- | 1400 | -- |
| NOD-03 | NOD-WG-03 | Manganese | mg/L | D | 0.005 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Manganese | mg/L | T | 0.005 | 1.9 | -- | -- |
| NOD-04 | NOD-WG-04 | Manganese | mg/L | D | 0.005 | -- | 0.2 | -- |
| NOD-04 | NOD-WG-04 | Manganese | mg/L | T | 0.005 | 1.9 | 0.2 | < 1 |
| NOD-03 | NOD-WG-03 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Mercury | mg/L | T | 0.0001 | 0.0001 | -- | -- |
| NOD-04 | NOD-WG-04 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Mercury | mg/L | T | 0.0001 | 0.0001 | -- | -- |
| NOD-03 | NOD-WG-03 | Nickel | mg/L | D | 0.001 | 0.07 | -- | -- |
| NOD-03 | NOD-WG-03 | Nickel | mg/L | T | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Nickel | mg/L | D | 0.001 | 0.07 | 0.012 | < 1 |
| NOD-04 | NOD-WG-04 | Nickel | mg/L | T | 0.001 | -- | 0.012 | -- |
| NOD-03 | NOD-WG-03 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Vanadium | mg/L | T | 0.005 | 0.1 | -- | -- |
| NOD-04 | NOD-WG-04 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Vanadium | mg/L | T | 0.005 | 0.1 | -- | -- |
| NOD-03 | NOD-WG-03 | Zinc | mg/L | D | 0.005 | 0.008 | -- | -- |
| NOD-03 | NOD-WG-03 | Zinc | mg/L | T | 0.005 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Zinc | mg/L | D | 0.005 | 0.008 | 0.038 | 4.8 |
| NOD-04 | NOD-WG-04 | Zinc | mg/L | T | 0.005 | -- | 0.039 | -- |
| ***SVOC*** | | | | | | | | |
| NOD-03 | NOD-WG-03 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| NOD-04 | NOD-WG-04 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| NOD-03 | NOD-WG-03 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| NOD-04 | NOD-WG-04 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| NOD-03 | NOD-WG-03 | Anthracene | mg/L | T | 0.001 | 0.0004 | -- | -- |
| NOD-04 | NOD-WG-04 | Anthracene | mg/L | T | 0.001 | 0.0004 | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| NOD-03 | NOD-WG-03 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| NOD-04 | NOD-WG-04 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| NOD-03 | NOD-WG-03 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| NOD-04 | NOD-WG-04 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| NOD-03 | NOD-WG-03 | Fluoranthene | mg/L | T | 0.001 | 0.0014 | -- | -- |
| NOD-04 | NOD-WG-04 | Fluoranthene | mg/L | T | 0.001 | 0.0014 | -- | -- |
| NOD-03 | NOD-WG-03 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| NOD-04 | NOD-WG-04 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| NOD-03 | NOD-WG-03 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| NOD-04 | NOD-WG-04 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| NOD-03 | NOD-WG-03 | Naphthalene | mg/L | T | 0.001 | 0.07 | -- | -- |
| NOD-04 | NOD-WG-04 | Naphthalene | mg/L | T | 0.001 | 0.07 | -- | -- |
| NOD-03 | NOD-WG-03 | Phenanthrene | mg/L | T | 0.001 | 0.002 | -- | -- |
| NOD-04 | NOD-WG-04 | Phenanthrene | mg/L | T | 0.001 | 0.002 | -- | -- |
| NOD-03 | NOD-WG-03 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| NOD-04 | NOD-WG-04 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| NOD-03 | NOD-WG-03 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| **South Drain** | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | |
| SEEP-01 | SOD-SEP-1 | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 86 | -- |
| SEEP-01 | SOD-SEP-1 | Chloride (As Cl) | mg/L | T | 1 | -- | 350 | -- |

# Table 10
## Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| SEEP-01 | SOD-SEP-1 | Conductivity | µS/cm | T | -- | -- | 2300 | -- |
| SEEP-01 | SOD-SEP-1 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Fluoride | mg/L | D | -- | 1.5 | 1.56 | 1.0 |
| SEEP-01 | SOD-SEP-1 | pH Value | SU | T | -- | -- | 8.1 | -- |
| SEEP-01 | SOD-SEP-1 | Total Organic Carbon | mg/L | T | 5 | -- | 9.8 | -- |
| SEEP-01 | SOD-SEP-1 | Total Suspended Solids | mg/L | T | 5 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| ***METALS*** | | | | | | | | |
| SEEP-01 | SOD-SEP-1 | Aluminum | mg/L | D | 0.05 | 0.202 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Aluminum | mg/L | T | 0.05 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Arsenic | mg/L | D | 0.001 | 0.14 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Arsenic | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Barium | mg/L | D | 0.02 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Barium | mg/L | T | 0.02 | 1 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Boron | mg/L | D | 0.05 | 2.5 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Boron | mg/L | T | 0.05 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cadmium | mg/L | D | 0.0002 | 0.036 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cadmium | mg/L | T | 0.0002 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Calcium | mg/L | T | 0.5 | -- | 27 | -- |
| SEEP-01 | SOD-SEP-1 | Chromium, total | mg/L | D | 0.001 | 0.091 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cobalt | mg/L | T | 0.001 | 0.15 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Copper | mg/L | D | 0.001 | 0.008 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Copper | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Hardness (As CaCO3) | mg/L | T | 5 | -- | 230 | -- |
| SEEP-01 | SOD-SEP-1 | Iron | mg/L | D | 0.05 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Iron | mg/L | T | 0.05 | 0.3 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Lead | mg/L | D | 0.001 | 0.012 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Lead | mg/L | T | 0.001 | -- | 0.007 | -- |
| SEEP-01 | SOD-SEP-1 | Lithium | mg/L | D | 0.005 | -- | 0.006 | -- |
| SEEP-01 | SOD-SEP-1 | Lithium | mg/L | T | 0.005 | -- | 0.007 | -- |
| SEEP-01 | SOD-SEP-1 | Magnesium | mg/L | T | 0.5 | -- | 39 | -- |
| SEEP-01 | SOD-SEP-1 | Manganese | mg/L | D | 0.005 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Manganese | mg/L | T | 0.005 | 3.6 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Mercury | mg/L | T | 0.0001 | 0.0014 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Nickel | mg/L | D | 0.001 | 0.56 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Nickel | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Vanadium | mg/L | T | 0.005 | 0.28 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Zinc | mg/L | D | 0.005 | 0.021 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Zinc | mg/L | T | 0.005 | -- | -- | -- |
| ***SVOC*** | | | | | | | | |
| SEEP-01 | SOD-SEP-1 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Anthracene | mg/L | T | 0.001 | 0.007 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Fluoranthene | mg/L | T | 0.001 | 0.002 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Naphthalene | mg/L | T | 0.001 | 0.12 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Phenanthrene | mg/L | T | 0.001 | 0.008 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| **West Drain** | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | |
| WOD-02 | WOD-WG-02 | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 91 | -- |
| WOD-03 | WOD-WG-03 | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 70 | -- |

# Table 10
## Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| WOD-02 | WOD-WG-02 | Chloride (As Cl) | mg/L | T | 1 | -- | 11000 | -- |
| WOD-03 | WOD-WG-03 | Chloride (As Cl) | mg/L | T | 1 | -- | 6900 | -- |
| WOD-02 | WOD-WG-02 | Conductivity | µS/cm | T | -- | -- | 33000 | -- |
| WOD-03 | WOD-WG-03 | Conductivity | µS/cm | T | -- | -- | 21000 | -- |
| WOD-01 | WOD-WG-01 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-02 | WOD-WG-02 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-03 | WOD-WG-03 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-01 | WOD-WG-01 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-02 | WOD-WG-02 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-03 | WOD-WG-03 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-01 | WOD-WG-01 | Fluoride | mg/L | D | -- | 1.5 | 0.87 | < 1 |
| WOD-02 | WOD-WG-02 | Fluoride | mg/L | D | -- | 1.5 | 1.72 | 1.1 |
| WOD-03 | WOD-WG-03 | Fluoride | mg/L | D | -- | 1.5 | 0.73 | < 1 |
| WOD-02 | WOD-WG-02 | pH Value | SU | T | -- | -- | 7.4 | -- |
| WOD-03 | WOD-WG-03 | pH Value | SU | T | -- | -- | 7 | -- |
| WOD-02 | WOD-WG-02 | Total Organic Carbon | mg/L | T | 5 | -- | 8.6 | -- |
| WOD-03 | WOD-WG-03 | Total Organic Carbon | mg/L | T | 5 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Total Suspended Solids | mg/L | T | 5 | -- | 15 | -- |
| WOD-03 | WOD-WG-03 | Total Suspended Solids | mg/L | T | 5 | -- | 12 | -- |
| WOD-01 | WOD-WG-01 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| ***METALS*** | | | | | | | | |
| WOD-01 | WOD-WG-01 | Aluminum | mg/L | D | 0.05 | 0.056 | -- | -- |
| WOD-01 | WOD-WG-01 | Aluminum | mg/L | T | 0.05 | -- | 0.05 | -- |
| WOD-02 | WOD-WG-02 | Aluminum | mg/L | D | 0.05 | 0.056 | -- | -- |
| WOD-02 | WOD-WG-02 | Aluminum | mg/L | T | 0.05 | -- | 0.05 | -- |
| WOD-03 | WOD-WG-03 | Aluminum | mg/L | D | 0.05 | 0.056 | -- | -- |
| WOD-03 | WOD-WG-03 | Aluminum | mg/L | T | 0.05 | -- | 0.06 | -- |
| WOD-01 | WOD-WG-01 | Arsenic | mg/L | D | 0.001 | 0.012 | 0.007 | < 1 |
| WOD-01 | WOD-WG-01 | Arsenic | mg/L | T | 0.001 | -- | 0.011 | -- |
| WOD-02 | WOD-WG-02 | Arsenic | mg/L | D | 0.001 | 0.012 | 0.002 | < 1 |
| WOD-02 | WOD-WG-02 | Arsenic | mg/L | T | 0.001 | -- | 0.003 | -- |
| WOD-03 | WOD-WG-03 | Arsenic | mg/L | D | 0.001 | 0.012 | 0.004 | < 1 |
| WOD-03 | WOD-WG-03 | Arsenic | mg/L | T | 0.001 | -- | 0.008 | -- |
| WOD-01 | WOD-WG-01 | Barium | mg/L | D | 0.02 | -- | 0.03 | -- |
| WOD-01 | WOD-WG-01 | Barium | mg/L | T | 0.02 | 1 | 0.03 | < 1 |
| WOD-02 | WOD-WG-02 | Barium | mg/L | D | 0.02 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Barium | mg/L | T | 0.02 | 1 | -- | -- |
| WOD-03 | WOD-WG-03 | Barium | mg/L | D | 0.02 | -- | 0.03 | -- |
| WOD-03 | WOD-WG-03 | Barium | mg/L | T | 0.02 | 1 | 0.03 | < 1 |
| WOD-01 | WOD-WG-01 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| WOD-02 | WOD-WG-02 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| WOD-03 | WOD-WG-03 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| WOD-01 | WOD-WG-01 | Boron | mg/L | D | 0.05 | 5.1 | -- | -- |
| WOD-01 | WOD-WG-01 | Boron | mg/L | T | 0.05 | 5.1 | -- | -- |
| WOD-02 | WOD-WG-02 | Boron | mg/L | D | 0.05 | 5.1 | -- | -- |
| WOD-02 | WOD-WG-02 | Boron | mg/L | T | 0.05 | 5.1 | -- | -- |
| WOD-03 | WOD-WG-03 | Boron | mg/L | D | 0.05 | 5.1 | -- | -- |
| WOD-03 | WOD-WG-03 | Boron | mg/L | T | 0.05 | 5.1 | -- | -- |
| WOD-01 | WOD-WG-01 | Cadmium | mg/L | D | 0.0002 | 0.0055 | -- | -- |
| WOD-01 | WOD-WG-01 | Cadmium | mg/L | T | 0.0002 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Cadmium | mg/L | D | 0.0002 | 0.0055 | -- | -- |
| WOD-02 | WOD-WG-02 | Cadmium | mg/L | T | 0.0002 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Cadmium | mg/L | D | 0.0002 | 0.0055 | -- | -- |
| WOD-03 | WOD-WG-03 | Cadmium | mg/L | T | 0.0002 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Calcium | mg/L | T | 0.5 | -- | 250 | -- |
| WOD-03 | WOD-WG-03 | Calcium | mg/L | T | 0.5 | -- | 130 | -- |
| WOD-01 | WOD-WG-01 | Chromium, total | mg/L | D | 0.001 | 0.027 | -- | -- |
| WOD-01 | WOD-WG-01 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Chromium, total | mg/L | D | 0.001 | 0.027 | -- | -- |
| WOD-02 | WOD-WG-02 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Chromium, total | mg/L | D | 0.001 | 0.027 | -- | -- |
| WOD-03 | WOD-WG-03 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Cobalt | mg/L | T | 0.001 | 0.001 | -- | -- |
| WOD-02 | WOD-WG-02 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |

# Table 10
# Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
# Tiwai Point, New Zealand
# Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| WOD-02 | WOD-WG-02 | Cobalt | mg/L | T | 0.001 | 0.001 | -- | -- |
| WOD-03 | WOD-WG-03 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Cobalt | mg/L | T | 0.001 | 0.001 | -- | -- |
| WOD-01 | WOD-WG-01 | Copper | mg/L | D | 0.001 | 0.0013 | -- | -- |
| WOD-01 | WOD-WG-01 | Copper | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Copper | mg/L | D | 0.001 | 0.0013 | 0.001 | < 1 |
| WOD-02 | WOD-WG-02 | Copper | mg/L | T | 0.001 | -- | 0.002 | -- |
| WOD-03 | WOD-WG-03 | Copper | mg/L | D | 0.001 | 0.0013 | -- | -- |
| WOD-03 | WOD-WG-03 | Copper | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Hardness (As CaCO3) | mg/L | T | 5 | -- | 3800 | -- |
| WOD-03 | WOD-WG-03 | Hardness (As CaCO3) | mg/L | T | 5 | -- | 1900 | -- |
| WOD-01 | WOD-WG-01 | Iron | mg/L | D | 0.05 | -- | 2.9 | -- |
| WOD-01 | WOD-WG-01 | Iron | mg/L | T | 0.05 | 0.3 | 3.3 | 11 |
| WOD-02 | WOD-WG-02 | Iron | mg/L | D | 0.05 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Iron | mg/L | T | 0.05 | 0.3 | 0.18 | < 1 |
| WOD-03 | WOD-WG-03 | Iron | mg/L | D | 0.05 | -- | 0.08 | -- |
| WOD-03 | WOD-WG-03 | Iron | mg/L | T | 0.05 | 0.3 | 0.4 | 1.3 |
| WOD-01 | WOD-WG-01 | Lead | mg/L | D | 0.001 | 0.0044 | -- | -- |
| WOD-01 | WOD-WG-01 | Lead | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Lead | mg/L | D | 0.001 | 0.0044 | -- | -- |
| WOD-02 | WOD-WG-02 | Lead | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Lead | mg/L | D | 0.001 | 0.0044 | -- | -- |
| WOD-03 | WOD-WG-03 | Lead | mg/L | T | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Lithium | mg/L | D | 0.005 | -- | 0.17 | -- |
| WOD-01 | WOD-WG-01 | Lithium | mg/L | T | 0.005 | -- | 0.17 | -- |
| WOD-02 | WOD-WG-02 | Lithium | mg/L | D | 0.005 | -- | 0.086 | -- |
| WOD-02 | WOD-WG-02 | Lithium | mg/L | T | 0.005 | -- | 0.086 | -- |
| WOD-03 | WOD-WG-03 | Lithium | mg/L | D | 0.005 | -- | 0.037 | -- |
| WOD-03 | WOD-WG-03 | Lithium | mg/L | T | 0.005 | -- | 0.037 | -- |
| WOD-02 | WOD-WG-02 | Magnesium | mg/L | T | 0.5 | -- | 760 | -- |
| WOD-03 | WOD-WG-03 | Magnesium | mg/L | T | 0.5 | -- | 390 | -- |
| WOD-01 | WOD-WG-01 | Manganese | mg/L | D | 0.005 | -- | 1 | -- |
| WOD-01 | WOD-WG-01 | Manganese | mg/L | T | 0.005 | 1.9 | 1.1 | < 1 |
| WOD-02 | WOD-WG-02 | Manganese | mg/L | D | 0.005 | -- | 0.044 | -- |
| WOD-02 | WOD-WG-02 | Manganese | mg/L | T | 0.005 | 1.9 | 0.044 | < 1 |
| WOD-03 | WOD-WG-03 | Manganese | mg/L | D | 0.005 | -- | 0.03 | -- |
| WOD-03 | WOD-WG-03 | Manganese | mg/L | T | 0.005 | 1.9 | 0.03 | < 1 |
| WOD-01 | WOD-WG-01 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Mercury | mg/L | T | 0.0001 | 0.0001 | -- | -- |
| WOD-02 | WOD-WG-02 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Mercury | mg/L | T | 0.0001 | 0.0001 | -- | -- |
| WOD-03 | WOD-WG-03 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Mercury | mg/L | T | 0.0001 | 0.0001 | -- | -- |
| WOD-01 | WOD-WG-01 | Nickel | mg/L | D | 0.001 | 0.07 | 0.001 | < 1 |
| WOD-01 | WOD-WG-01 | Nickel | mg/L | T | 0.001 | -- | 0.001 | -- |
| WOD-02 | WOD-WG-02 | Nickel | mg/L | D | 0.001 | 0.07 | -- | -- |
| WOD-02 | WOD-WG-02 | Nickel | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Nickel | mg/L | D | 0.001 | 0.07 | -- | -- |
| WOD-03 | WOD-WG-03 | Nickel | mg/L | T | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Vanadium | mg/L | T | 0.005 | 0.1 | -- | -- |
| WOD-02 | WOD-WG-02 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Vanadium | mg/L | T | 0.005 | 0.1 | -- | -- |
| WOD-03 | WOD-WG-03 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Vanadium | mg/L | T | 0.005 | 0.1 | -- | -- |
| WOD-01 | WOD-WG-01 | Zinc | mg/L | D | 0.005 | 0.008 | -- | -- |
| WOD-01 | WOD-WG-01 | Zinc | mg/L | T | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Zinc | mg/L | D | 0.005 | 0.008 | 0.008 | 1.0 |
| WOD-02 | WOD-WG-02 | Zinc | mg/L | T | 0.005 | -- | 0.01 | -- |
| WOD-03 | WOD-WG-03 | Zinc | mg/L | D | 0.005 | 0.008 | -- | -- |
| WOD-03 | WOD-WG-03 | Zinc | mg/L | T | 0.005 | -- | 0.006 | -- |
| ***SVOC*** | | | | | | | | |
| WOD-01 | WOD-WG-01 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| WOD-02 | WOD-WG-02 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |

## Table 10
## Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| WOD-03 | WOD-WG-03 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| WOD-01 | WOD-WG-01 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| WOD-02 | WOD-WG-02 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| WOD-03 | WOD-WG-03 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| WOD-01 | WOD-WG-01 | Anthracene | mg/L | T | 0.001 | 0.0004 | -- | -- |
| WOD-02 | WOD-WG-02 | Anthracene | mg/L | T | 0.001 | 0.0004 | -- | -- |
| WOD-03 | WOD-WG-03 | Anthracene | mg/L | T | 0.001 | 0.0004 | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0002 | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| WOD-01 | WOD-WG-01 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| WOD-02 | WOD-WG-02 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| WOD-03 | WOD-WG-03 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| WOD-01 | WOD-WG-01 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| WOD-02 | WOD-WG-02 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| WOD-03 | WOD-WG-03 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| WOD-01 | WOD-WG-01 | Fluoranthene | mg/L | T | 0.001 | 0.0014 | -- | -- |
| WOD-02 | WOD-WG-02 | Fluoranthene | mg/L | T | 0.001 | 0.0014 | -- | -- |
| WOD-03 | WOD-WG-03 | Fluoranthene | mg/L | T | 0.001 | 0.0014 | -- | -- |
| WOD-01 | WOD-WG-01 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| WOD-02 | WOD-WG-02 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| WOD-03 | WOD-WG-03 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| WOD-01 | WOD-WG-01 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-02 | WOD-WG-02 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-03 | WOD-WG-03 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-01 | WOD-WG-01 | Naphthalene | mg/L | T | 0.001 | 0.07 | -- | -- |
| WOD-02 | WOD-WG-02 | Naphthalene | mg/L | T | 0.001 | 0.07 | -- | -- |
| WOD-03 | WOD-WG-03 | Naphthalene | mg/L | T | 0.001 | 0.07 | -- | -- |
| WOD-01 | WOD-WG-01 | Phenanthrene | mg/L | T | 0.001 | 0.002 | -- | -- |
| WOD-02 | WOD-WG-02 | Phenanthrene | mg/L | T | 0.001 | 0.002 | -- | -- |
| WOD-03 | WOD-WG-03 | Phenanthrene | mg/L | T | 0.001 | 0.002 | -- | -- |
| WOD-01 | WOD-WG-01 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| WOD-02 | WOD-WG-02 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| WOD-03 | WOD-WG-03 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| WOD-01 | WOD-WG-01 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |

**Notes**

HQs are calculated as the observed concentration of a constituent divded by the relevant benchmark. HQs are unitless.

EFs are calculated as the mean concentration of a constituent divded by the mean background concentration.

North Drain and West Drain samples were screened against 95% level of protection ESVs. Seep samples were secreened against 80% level of protection ESVs.

Data are presented for samples collected under baseline conditions and summaries do not contain first flush or other additional samples.

Statistical summaries consider detected results.

-- = Data is not available for this field.

BWC = Bottom of water column
D = Dissolved
EF = enrichment factor
HQ = hazard quotient
HMW = high molecular weight
LMW = low molecular weight
max = maximum value
µS/cm = microsiemens per centimeter
min = minimum value
meq/100g = milliequivalents per 100 grams of soil
mg/L = milligrams per liter
PAH = polycyclic aromatic hydrocarbon
SD = standard deviation
SVOC = semi volatile organic compounds
T = Total
TWC = Top of water column

# Table 10
## Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| NOD-04 | NOD-WG-04 | Lead | mg/L | T | 0.001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Lithium | mg/L | D | 0.005 | -- | 0.14 | -- |
| NOD-03 | NOD-WG-03 | Lithium | mg/L | T | 0.005 | -- | 0.14 | -- |
| NOD-04 | NOD-WG-04 | Lithium | mg/L | D | 0.005 | -- | 0.13 | -- |
| NOD-04 | NOD-WG-04 | Lithium | mg/L | T | 0.005 | -- | 0.13 | -- |
| NOD-03 | NOD-WG-03 | Magnesium | mg/L | T | 0.5 | -- | 1200 | -- |
| NOD-04 | NOD-WG-04 | Magnesium | mg/L | T | 0.5 | -- | 1400 | -- |
| NOD-03 | NOD-WG-03 | Manganese | mg/L | D | 0.005 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Manganese | mg/L | T | 0.005 | 3.6 | -- | -- |
| NOD-04 | NOD-WG-04 | Manganese | mg/L | D | 0.005 | -- | 0.2 | -- |
| NOD-04 | NOD-WG-04 | Manganese | mg/L | T | 0.005 | 3.6 | 0.2 | < 1 |
| NOD-03 | NOD-WG-03 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Mercury | mg/L | T | 0.0001 | 0.0014 | -- | -- |
| NOD-04 | NOD-WG-04 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Mercury | mg/L | T | 0.0001 | 0.0014 | -- | -- |
| NOD-03 | NOD-WG-03 | Nickel | mg/L | D | 0.001 | 0.56 | -- | -- |
| NOD-03 | NOD-WG-03 | Nickel | mg/L | T | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Nickel | mg/L | D | 0.001 | 0.56 | 0.012 | < 1 |
| NOD-04 | NOD-WG-04 | Nickel | mg/L | T | 0.001 | -- | 0.012 | -- |
| NOD-03 | NOD-WG-03 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Vanadium | mg/L | T | 0.005 | 0.28 | -- | -- |
| NOD-04 | NOD-WG-04 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Vanadium | mg/L | T | 0.005 | 0.28 | -- | -- |
| NOD-03 | NOD-WG-03 | Zinc | mg/L | D | 0.005 | 0.021 | -- | -- |
| NOD-03 | NOD-WG-03 | Zinc | mg/L | T | 0.005 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Zinc | mg/L | D | 0.005 | 0.021 | 0.038 | 1.8 |
| NOD-04 | NOD-WG-04 | Zinc | mg/L | T | 0.005 | -- | 0.039 | -- |
| ***SVOC*** | | | | | | | | |
| NOD-03 | NOD-WG-03 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| NOD-04 | NOD-WG-04 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| NOD-03 | NOD-WG-03 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| NOD-04 | NOD-WG-04 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| NOD-03 | NOD-WG-03 | Anthracene | mg/L | T | 0.001 | 0.007 | -- | -- |
| NOD-04 | NOD-WG-04 | Anthracene | mg/L | T | 0.001 | 0.007 | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| NOD-03 | NOD-WG-03 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| NOD-04 | NOD-WG-04 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| NOD-03 | NOD-WG-03 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| NOD-04 | NOD-WG-04 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| NOD-03 | NOD-WG-03 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| NOD-04 | NOD-WG-04 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| NOD-03 | NOD-WG-03 | Fluoranthene | mg/L | T | 0.001 | 0.002 | -- | -- |
| NOD-04 | NOD-WG-04 | Fluoranthene | mg/L | T | 0.001 | 0.002 | -- | -- |
| NOD-03 | NOD-WG-03 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| NOD-04 | NOD-WG-04 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| NOD-03 | NOD-WG-03 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| NOD-04 | NOD-WG-04 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| NOD-03 | NOD-WG-03 | Naphthalene | mg/L | T | 0.001 | 0.12 | -- | -- |
| NOD-04 | NOD-WG-04 | Naphthalene | mg/L | T | 0.001 | 0.12 | -- | -- |
| NOD-03 | NOD-WG-03 | Phenanthrene | mg/L | T | 0.001 | 0.008 | -- | -- |
| NOD-04 | NOD-WG-04 | Phenanthrene | mg/L | T | 0.001 | 0.008 | -- | -- |
| NOD-03 | NOD-WG-03 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| NOD-04 | NOD-WG-04 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| NOD-03 | NOD-WG-03 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| NOD-04 | NOD-WG-04 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| **South Drain** | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | |
| SEEP-01 | SOD-SEP-1 | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 86 | -- |
| SEEP-01 | SOD-SEP-1 | Chloride (As Cl) | mg/L | T | 1 | -- | 350 | -- |

## Table 10
## Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| SEEP-01 | SOD-SEP-1 | Conductivity | µS/cm | T | -- | -- | 2300 | -- |
| SEEP-01 | SOD-SEP-1 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Fluoride | mg/L | D | -- | 1.5 | 1.56 | 1.0 |
| SEEP-01 | SOD-SEP-1 | pH Value | SU | T | -- | -- | 8.1 | -- |
| SEEP-01 | SOD-SEP-1 | Total Organic Carbon | mg/L | T | 5 | -- | 9.8 | -- |
| SEEP-01 | SOD-SEP-1 | Total Suspended Solids | mg/L | T | 5 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| ***METALS*** | | | | | | | | |
| SEEP-01 | SOD-SEP-1 | Aluminum | mg/L | D | 0.05 | 0.202 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Aluminum | mg/L | T | 0.05 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Arsenic | mg/L | D | 0.001 | 0.14 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Arsenic | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Barium | mg/L | D | 0.02 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Barium | mg/L | T | 0.02 | 1 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Boron | mg/L | D | 0.05 | 2.5 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Boron | mg/L | T | 0.05 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cadmium | mg/L | D | 0.0002 | 0.036 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cadmium | mg/L | T | 0.0002 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Calcium | mg/L | T | 0.5 | -- | 27 | -- |
| SEEP-01 | SOD-SEP-1 | Chromium, total | mg/L | D | 0.001 | 0.091 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Cobalt | mg/L | T | 0.001 | 0.15 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Copper | mg/L | D | 0.001 | 0.008 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Copper | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Hardness (As CaCO3) | mg/L | T | 5 | -- | 230 | -- |
| SEEP-01 | SOD-SEP-1 | Iron | mg/L | D | 0.05 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Iron | mg/L | T | 0.05 | 0.3 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Lead | mg/L | D | 0.001 | 0.012 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Lead | mg/L | T | 0.001 | -- | 0.007 | -- |
| SEEP-01 | SOD-SEP-1 | Lithium | mg/L | D | 0.005 | -- | 0.006 | -- |
| SEEP-01 | SOD-SEP-1 | Lithium | mg/L | T | 0.005 | -- | 0.007 | -- |
| SEEP-01 | SOD-SEP-1 | Magnesium | mg/L | T | 0.5 | -- | 39 | -- |
| SEEP-01 | SOD-SEP-1 | Manganese | mg/L | D | 0.005 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Manganese | mg/L | T | 0.005 | 3.6 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Mercury | mg/L | T | 0.0001 | 0.0014 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Nickel | mg/L | D | 0.001 | 0.56 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Nickel | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Vanadium | mg/L | T | 0.005 | 0.28 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Zinc | mg/L | D | 0.005 | 0.021 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Zinc | mg/L | T | 0.005 | -- | -- | -- |
| ***SVOC*** | | | | | | | | |
| SEEP-01 | SOD-SEP-1 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Anthracene | mg/L | T | 0.001 | 0.007 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Fluoranthene | mg/L | T | 0.001 | 0.002 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Naphthalene | mg/L | T | 0.001 | 0.12 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Phenanthrene | mg/L | T | 0.001 | 0.008 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| SEEP-01 | SOD-SEP-1 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| **West Drain** | | | | | | | | |
| ***GENERAL CHEMISTRY*** | | | | | | | | |
| WOD-02 | WOD-WG-02 | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 91 | -- |
| WOD-03 | WOD-WG-03 | Alkalinity, Total (As CaCO3) | mg/L | T | 20 | -- | 70 | -- |

## Table 10
## Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| WOD-02 | WOD-WG-02 | Chloride (As Cl) | mg/L | T | 1 | -- | 11000 | -- |
| WOD-03 | WOD-WG-03 | Chloride (As Cl) | mg/L | T | 1 | -- | 6900 | -- |
| WOD-02 | WOD-WG-02 | Conductivity | µS/cm | T | -- | -- | 33000 | -- |
| WOD-03 | WOD-WG-03 | Conductivity | µS/cm | T | -- | -- | 21000 | -- |
| WOD-01 | WOD-WG-01 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-02 | WOD-WG-02 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-03 | WOD-WG-03 | Cyanide | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-01 | WOD-WG-01 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-02 | WOD-WG-02 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-03 | WOD-WG-03 | Cyanide (Free) | mg/L | T | 0.005 | 0.014 | -- | -- |
| WOD-01 | WOD-WG-01 | Fluoride | mg/L | D | -- | 1.5 | 0.87 | < 1 |
| WOD-02 | WOD-WG-02 | Fluoride | mg/L | D | -- | 1.5 | 1.72 | 1.1 |
| WOD-03 | WOD-WG-03 | Fluoride | mg/L | D | -- | 1.5 | 0.73 | < 1 |
| WOD-02 | WOD-WG-02 | pH Value | SU | T | -- | -- | 7.4 | -- |
| WOD-03 | WOD-WG-03 | pH Value | SU | T | -- | -- | 7 | -- |
| WOD-02 | WOD-WG-02 | Total Organic Carbon | mg/L | T | 5 | -- | 8.6 | -- |
| WOD-03 | WOD-WG-03 | Total Organic Carbon | mg/L | T | 5 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Total Suspended Solids | mg/L | T | 5 | -- | 15 | -- |
| WOD-03 | WOD-WG-03 | Total Suspended Solids | mg/L | T | 5 | -- | 12 | -- |
| WOD-01 | WOD-WG-01 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Weak Acid Dissociable Cyanide | mg/L | T | 0.005 | -- | -- | -- |
| ***METALS*** | | | | | | | | |
| WOD-01 | WOD-WG-01 | Aluminum | mg/L | D | 0.05 | 0.202 | -- | -- |
| WOD-01 | WOD-WG-01 | Aluminum | mg/L | T | 0.05 | -- | 0.05 | -- |
| WOD-02 | WOD-WG-02 | Aluminum | mg/L | D | 0.05 | 0.202 | -- | -- |
| WOD-02 | WOD-WG-02 | Aluminum | mg/L | T | 0.05 | -- | 0.05 | -- |
| WOD-03 | WOD-WG-03 | Aluminum | mg/L | D | 0.05 | 0.202 | -- | -- |
| WOD-03 | WOD-WG-03 | Aluminum | mg/L | T | 0.05 | -- | 0.06 | -- |
| WOD-01 | WOD-WG-01 | Arsenic | mg/L | D | 0.001 | 0.14 | 0.007 | < 1 |
| WOD-01 | WOD-WG-01 | Arsenic | mg/L | T | 0.001 | -- | 0.011 | -- |
| WOD-02 | WOD-WG-02 | Arsenic | mg/L | D | 0.001 | 0.14 | 0.002 | < 1 |
| WOD-02 | WOD-WG-02 | Arsenic | mg/L | T | 0.001 | -- | 0.003 | -- |
| WOD-03 | WOD-WG-03 | Arsenic | mg/L | D | 0.001 | 0.14 | 0.004 | < 1 |
| WOD-03 | WOD-WG-03 | Arsenic | mg/L | T | 0.001 | -- | 0.008 | -- |
| WOD-01 | WOD-WG-01 | Barium | mg/L | D | 0.02 | -- | 0.03 | -- |
| WOD-01 | WOD-WG-01 | Barium | mg/L | T | 0.02 | 1 | 0.03 | < 1 |
| WOD-02 | WOD-WG-02 | Barium | mg/L | D | 0.02 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Barium | mg/L | T | 0.02 | 1 | -- | -- |
| WOD-03 | WOD-WG-03 | Barium | mg/L | D | 0.02 | -- | 0.03 | -- |
| WOD-03 | WOD-WG-03 | Barium | mg/L | T | 0.02 | 1 | 0.03 | < 1 |
| WOD-01 | WOD-WG-01 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| WOD-02 | WOD-WG-02 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| WOD-03 | WOD-WG-03 | Beryllium | mg/L | D | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Beryllium | mg/L | T | 0.001 | 0.1 | -- | -- |
| WOD-01 | WOD-WG-01 | Boron | mg/L | D | 0.05 | 2.5 | -- | -- |
| WOD-01 | WOD-WG-01 | Boron | mg/L | T | 0.05 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Boron | mg/L | D | 0.05 | 2.5 | -- | -- |
| WOD-02 | WOD-WG-02 | Boron | mg/L | T | 0.05 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Boron | mg/L | D | 0.05 | 2.5 | -- | -- |
| WOD-03 | WOD-WG-03 | Boron | mg/L | T | 0.05 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Cadmium | mg/L | D | 0.0002 | 0.036 | -- | -- |
| WOD-01 | WOD-WG-01 | Cadmium | mg/L | T | 0.0002 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Cadmium | mg/L | D | 0.0002 | 0.036 | -- | -- |
| WOD-02 | WOD-WG-02 | Cadmium | mg/L | T | 0.0002 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Cadmium | mg/L | D | 0.0002 | 0.036 | -- | -- |
| WOD-03 | WOD-WG-03 | Cadmium | mg/L | T | 0.0002 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Calcium | mg/L | T | 0.5 | -- | 250 | -- |
| WOD-03 | WOD-WG-03 | Calcium | mg/L | T | 0.5 | -- | 130 | -- |
| WOD-01 | WOD-WG-01 | Chromium, total | mg/L | D | 0.001 | 0.091 | -- | -- |
| WOD-01 | WOD-WG-01 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Chromium, total | mg/L | D | 0.001 | 0.091 | -- | -- |
| WOD-02 | WOD-WG-02 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Chromium, total | mg/L | D | 0.001 | 0.091 | -- | -- |
| WOD-03 | WOD-WG-03 | Chromium, total | mg/L | T | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Cobalt | mg/L | T | 0.001 | 0.15 | -- | -- |
| WOD-02 | WOD-WG-02 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |

## Table 10
## Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
## Tiwai Point, New Zealand
## Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| WOD-02 | WOD-WG-02 | Cobalt | mg/L | T | 0.001 | 0.15 | -- | -- |
| WOD-03 | WOD-WG-03 | Cobalt | mg/L | D | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Cobalt | mg/L | T | 0.001 | 0.15 | -- | -- |
| WOD-01 | WOD-WG-01 | Copper | mg/L | D | 0.001 | 0.008 | -- | -- |
| WOD-01 | WOD-WG-01 | Copper | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Copper | mg/L | D | 0.001 | 0.008 | 0.001 | < 1 |
| WOD-02 | WOD-WG-02 | Copper | mg/L | T | 0.001 | -- | 0.002 | -- |
| WOD-03 | WOD-WG-03 | Copper | mg/L | D | 0.001 | 0.008 | -- | -- |
| WOD-03 | WOD-WG-03 | Copper | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Hardness (As CaCO3) | mg/L | T | 5 | -- | 3800 | -- |
| WOD-03 | WOD-WG-03 | Hardness (As CaCO3) | mg/L | T | 5 | -- | 1900 | -- |
| WOD-01 | WOD-WG-01 | Iron | mg/L | D | 0.05 | -- | 2.9 | -- |
| WOD-01 | WOD-WG-01 | Iron | mg/L | T | 0.05 | 0.3 | 3.3 | 11 |
| WOD-02 | WOD-WG-02 | Iron | mg/L | D | 0.05 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Iron | mg/L | T | 0.05 | 0.3 | 0.18 | < 1 |
| WOD-03 | WOD-WG-03 | Iron | mg/L | D | 0.05 | -- | 0.08 | -- |
| WOD-03 | WOD-WG-03 | Iron | mg/L | T | 0.05 | 0.3 | 0.4 | 1.3 |
| WOD-01 | WOD-WG-01 | Lead | mg/L | D | 0.001 | 0.012 | -- | -- |
| WOD-01 | WOD-WG-01 | Lead | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Lead | mg/L | D | 0.001 | 0.012 | -- | -- |
| WOD-02 | WOD-WG-02 | Lead | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Lead | mg/L | D | 0.001 | 0.012 | -- | -- |
| WOD-03 | WOD-WG-03 | Lead | mg/L | T | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Lithium | mg/L | D | 0.005 | -- | 0.17 | -- |
| WOD-01 | WOD-WG-01 | Lithium | mg/L | T | 0.005 | -- | 0.17 | -- |
| WOD-02 | WOD-WG-02 | Lithium | mg/L | D | 0.005 | -- | 0.086 | -- |
| WOD-02 | WOD-WG-02 | Lithium | mg/L | T | 0.005 | -- | 0.086 | -- |
| WOD-03 | WOD-WG-03 | Lithium | mg/L | D | 0.005 | -- | 0.037 | -- |
| WOD-03 | WOD-WG-03 | Lithium | mg/L | T | 0.005 | -- | 0.037 | -- |
| WOD-02 | WOD-WG-02 | Magnesium | mg/L | T | 0.5 | -- | 760 | -- |
| WOD-03 | WOD-WG-03 | Magnesium | mg/L | T | 0.5 | -- | 390 | -- |
| WOD-01 | WOD-WG-01 | Manganese | mg/L | D | 0.005 | -- | 1 | -- |
| WOD-01 | WOD-WG-01 | Manganese | mg/L | T | 0.005 | 3.6 | 1.1 | < 1 |
| WOD-02 | WOD-WG-02 | Manganese | mg/L | D | 0.005 | -- | 0.044 | -- |
| WOD-02 | WOD-WG-02 | Manganese | mg/L | T | 0.005 | 3.6 | 0.044 | < 1 |
| WOD-03 | WOD-WG-03 | Manganese | mg/L | D | 0.005 | -- | 0.03 | -- |
| WOD-03 | WOD-WG-03 | Manganese | mg/L | T | 0.005 | 3.6 | 0.03 | < 1 |
| WOD-01 | WOD-WG-01 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Mercury | mg/L | T | 0.0001 | 0.0014 | -- | -- |
| WOD-02 | WOD-WG-02 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Mercury | mg/L | T | 0.0001 | 0.0014 | -- | -- |
| WOD-03 | WOD-WG-03 | Mercury | mg/L | D | 0.0001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Mercury | mg/L | T | 0.0001 | 0.0014 | -- | -- |
| WOD-01 | WOD-WG-01 | Nickel | mg/L | D | 0.001 | 0.56 | 0.001 | < 1 |
| WOD-01 | WOD-WG-01 | Nickel | mg/L | T | 0.001 | -- | 0.001 | -- |
| WOD-02 | WOD-WG-02 | Nickel | mg/L | D | 0.001 | 0.56 | -- | -- |
| WOD-02 | WOD-WG-02 | Nickel | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Nickel | mg/L | D | 0.001 | 0.56 | -- | -- |
| WOD-03 | WOD-WG-03 | Nickel | mg/L | T | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Titanium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Titanium | mg/L | T | 0.005 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Vanadium | mg/L | T | 0.005 | 0.28 | -- | -- |
| WOD-02 | WOD-WG-02 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Vanadium | mg/L | T | 0.005 | 0.28 | -- | -- |
| WOD-03 | WOD-WG-03 | Vanadium | mg/L | D | 0.005 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Vanadium | mg/L | T | 0.005 | 0.28 | -- | -- |
| WOD-01 | WOD-WG-01 | Zinc | mg/L | D | 0.005 | 0.021 | -- | -- |
| WOD-01 | WOD-WG-01 | Zinc | mg/L | T | 0.005 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Zinc | mg/L | D | 0.005 | 0.021 | 0.008 | < 1 |
| WOD-02 | WOD-WG-02 | Zinc | mg/L | T | 0.005 | -- | 0.01 | -- |
| WOD-03 | WOD-WG-03 | Zinc | mg/L | D | 0.005 | 0.021 | -- | -- |
| WOD-03 | WOD-WG-03 | Zinc | mg/L | T | 0.005 | -- | 0.006 | -- |
| ***SVOC*** | | | | | | | | |
| WOD-01 | WOD-WG-01 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| WOD-02 | WOD-WG-02 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |

# Table 10
# Sub-Surface Aqueous Samples Hazard Quotients and Enrichment Factors
# Tiwai Point, New Zealand
# Environment Southland

| Location | Sample | Analyte | Unit | Fraction | Quantitation Limit | Screening Criteria | Detected Concentration | HQ |
|---|---|---|---|---|---|---|---|---|
| WOD-03 | WOD-WG-03 | Acenaphthene | mg/L | T | 0.001 | 0.0058 | -- | -- |
| WOD-01 | WOD-WG-01 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| WOD-02 | WOD-WG-02 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| WOD-03 | WOD-WG-03 | Acenaphthylene | mg/L | T | 0.001 | 0.028 | -- | -- |
| WOD-01 | WOD-WG-01 | Anthracene | mg/L | T | 0.001 | 0.007 | -- | -- |
| WOD-02 | WOD-WG-02 | Anthracene | mg/L | T | 0.001 | 0.007 | -- | -- |
| WOD-03 | WOD-WG-03 | Anthracene | mg/L | T | 0.001 | 0.007 | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo(b+j)fluoranthene | mg/L | T | 0.001 | -- | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo[a]anthracene | mg/L | T | 0.001 | 0.000018 | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo[a]pyrene | mg/L | T | 0.001 | 0.0007 | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo[g,h,i]perylene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-01 | WOD-WG-01 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| WOD-02 | WOD-WG-02 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| WOD-03 | WOD-WG-03 | Benzo[k]fluoranthene | mg/L | T | 0.001 | 0.00006 | -- | -- |
| WOD-01 | WOD-WG-01 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| WOD-02 | WOD-WG-02 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| WOD-03 | WOD-WG-03 | Chrysene | mg/L | T | 0.001 | 0.0001 | -- | -- |
| WOD-01 | WOD-WG-01 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| WOD-02 | WOD-WG-02 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| WOD-03 | WOD-WG-03 | Dibenz(A,H)Anthracene | mg/L | T | 0.001 | 0.00001 | -- | -- |
| WOD-01 | WOD-WG-01 | Fluoranthene | mg/L | T | 0.001 | 0.002 | -- | -- |
| WOD-02 | WOD-WG-02 | Fluoranthene | mg/L | T | 0.001 | 0.002 | -- | -- |
| WOD-03 | WOD-WG-03 | Fluoranthene | mg/L | T | 0.001 | 0.002 | -- | -- |
| WOD-01 | WOD-WG-01 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| WOD-02 | WOD-WG-02 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| WOD-03 | WOD-WG-03 | Fluorene | mg/L | T | 0.001 | 0.003 | -- | -- |
| WOD-01 | WOD-WG-01 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-02 | WOD-WG-02 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-03 | WOD-WG-03 | Indeno(1,2,3-C,D)Pyrene | mg/L | T | 0.001 | 0.000012 | -- | -- |
| WOD-01 | WOD-WG-01 | Naphthalene | mg/L | T | 0.001 | 0.12 | -- | -- |
| WOD-02 | WOD-WG-02 | Naphthalene | mg/L | T | 0.001 | 0.12 | -- | -- |
| WOD-03 | WOD-WG-03 | Naphthalene | mg/L | T | 0.001 | 0.12 | -- | -- |
| WOD-01 | WOD-WG-01 | Phenanthrene | mg/L | T | 0.001 | 0.008 | -- | -- |
| WOD-02 | WOD-WG-02 | Phenanthrene | mg/L | T | 0.001 | 0.008 | -- | -- |
| WOD-03 | WOD-WG-03 | Phenanthrene | mg/L | T | 0.001 | 0.008 | -- | -- |
| WOD-01 | WOD-WG-01 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| WOD-02 | WOD-WG-02 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| WOD-03 | WOD-WG-03 | Pyrene | mg/L | T | 0.001 | 0.000025 | -- | -- |
| WOD-01 | WOD-WG-01 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| WOD-02 | WOD-WG-02 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |
| WOD-03 | WOD-WG-03 | Sum of Detected PAHs | mg/L | T | 0.001 | -- | -- | -- |

**Notes**

HQs are calculated as the observed concentration of a constituent divded by the relevant benchmark. HQs are unitless.

EFs are calculated as the mean concentration of a constituent divded by the mean background concentration.

North Drain and West Drain samples were screened against 95% level of protection ESVs. Seep samples were secreened against 80% level of protection ESVs.

Data are presented for samples collected under baseline conditions and summaries do not contain first flush or other additional samples.

Statistical summaries consider detected results.

-- = Data is not available for this field.

BWC = Bottom of water column
D = Dissolved
EF = enrichment factor
HQ = hazard quotient
HMW = high molecular weight
LMW = low molecular weight
max = maximum value
µS/cm = microsiemens per centimeter
min = minimum value
meq/100g = milliequivalents per 100 grams of soil
mg/L = milligrams per liter
PAH = polycyclic aromatic hydrocarbon
SD = standard deviation
SVOC = semi volatile organic compounds
T = Total
TWC = Top of water column

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# Site Overview Map

0 90 180 360 540 720 Meters
1 cm = 110 meters
[Page Size: A4]

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**ENVIRONMENT SOUTHLAND**

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## Figure 1

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | S. Hunt |
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| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:11,000 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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## Site Area Sampling Stations (January 17 - February 3, 2023)

0 90 180 360 540 720 Meters
1 cm = 110 meters [Page Size: A4]

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## FIGURE 2

| | |
|---|---|
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| APPROVED BY: | M. Gerjoi |
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| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:11,000 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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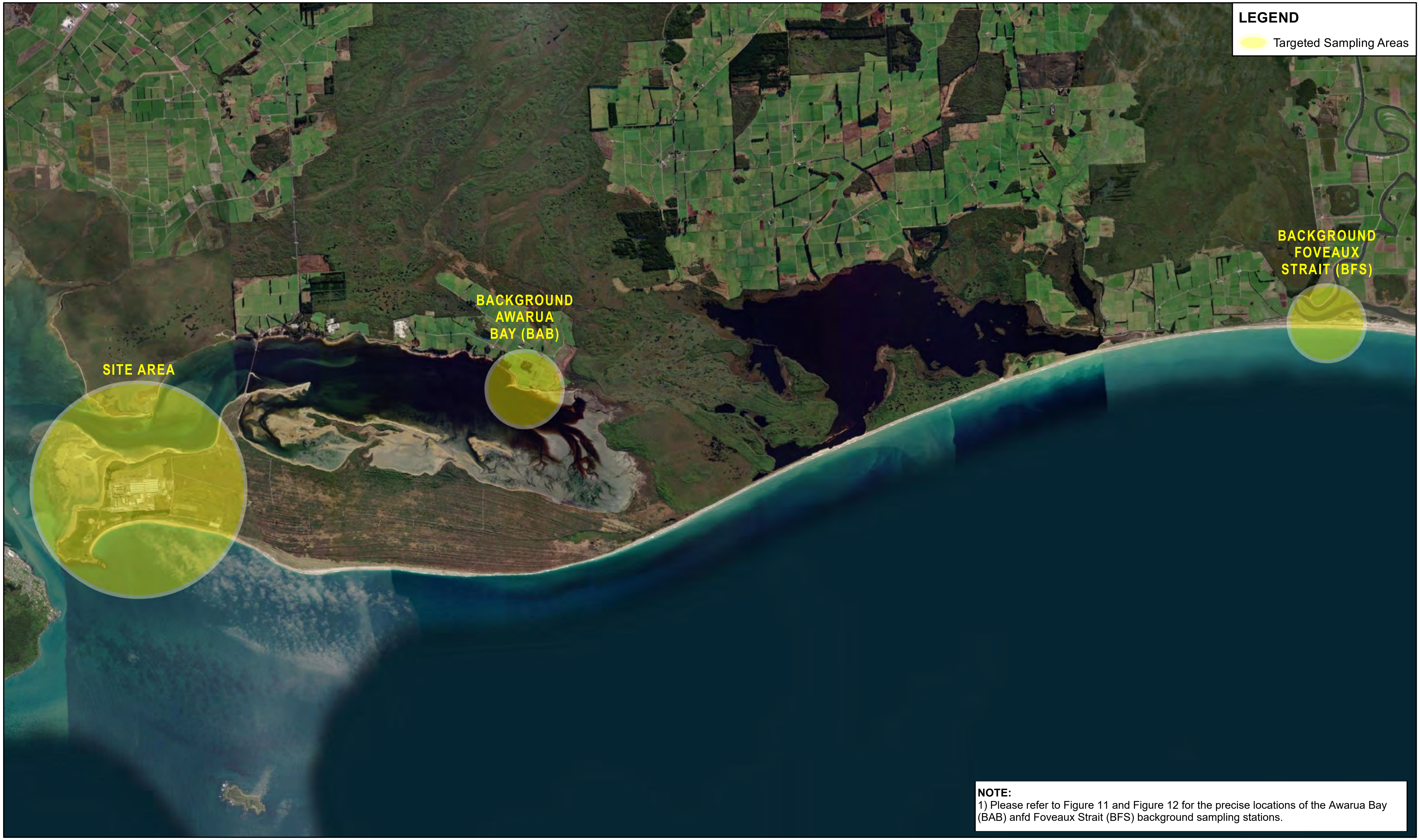

**NOTE:**
1) Please refer to Figure 11 and Figure 12 for the precise locations of the Awarua Bay (BAB) anfd Foveaux Strait (BFS) background sampling stations.

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# CMA Assessment and Background Sampling Areas (January 17 - February 3, 2023)

0 600 1,200 2,400 3,600 4,800 Meters
1 cm = 755 meters [Page Size: A4]

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**ENVIRONMENT SOUTHLAND**

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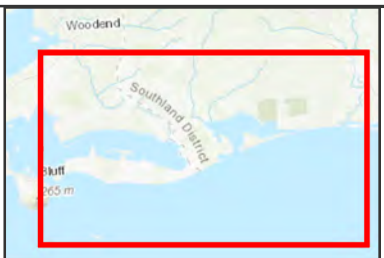
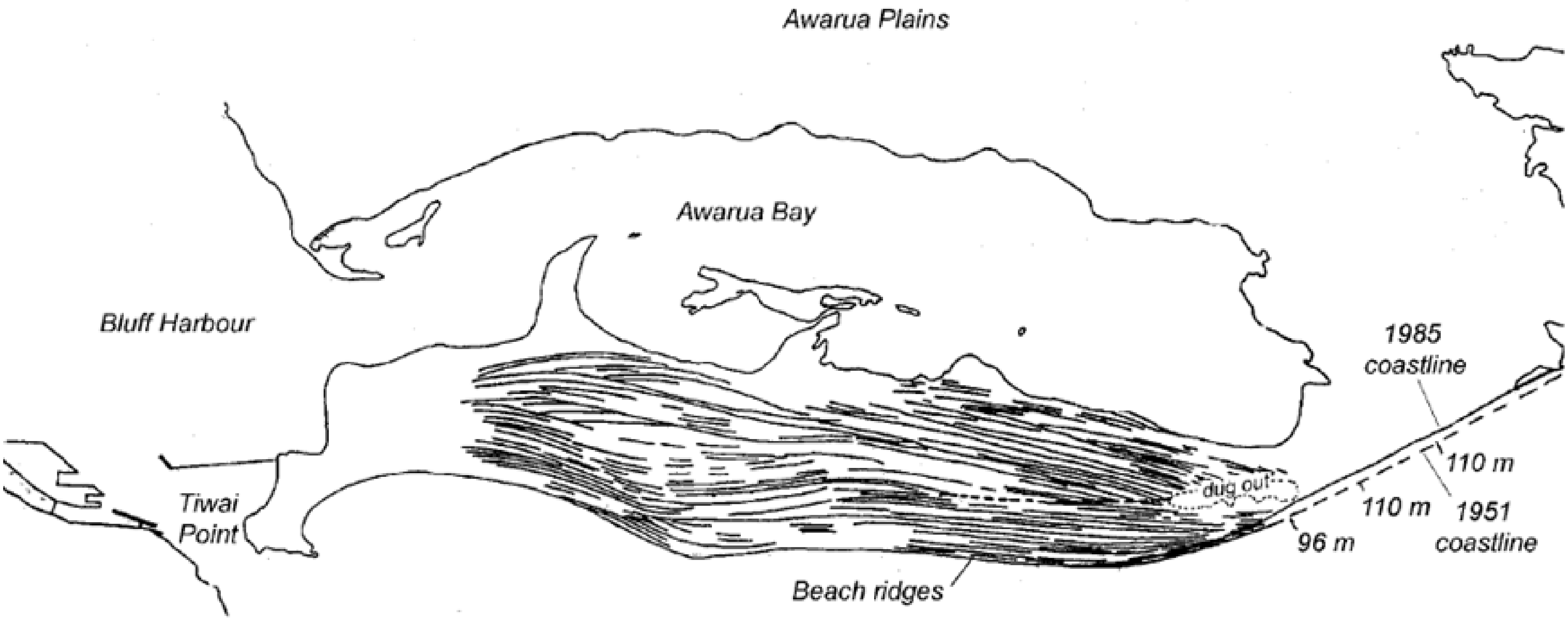


## FIGURE 3

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:75,500 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

N

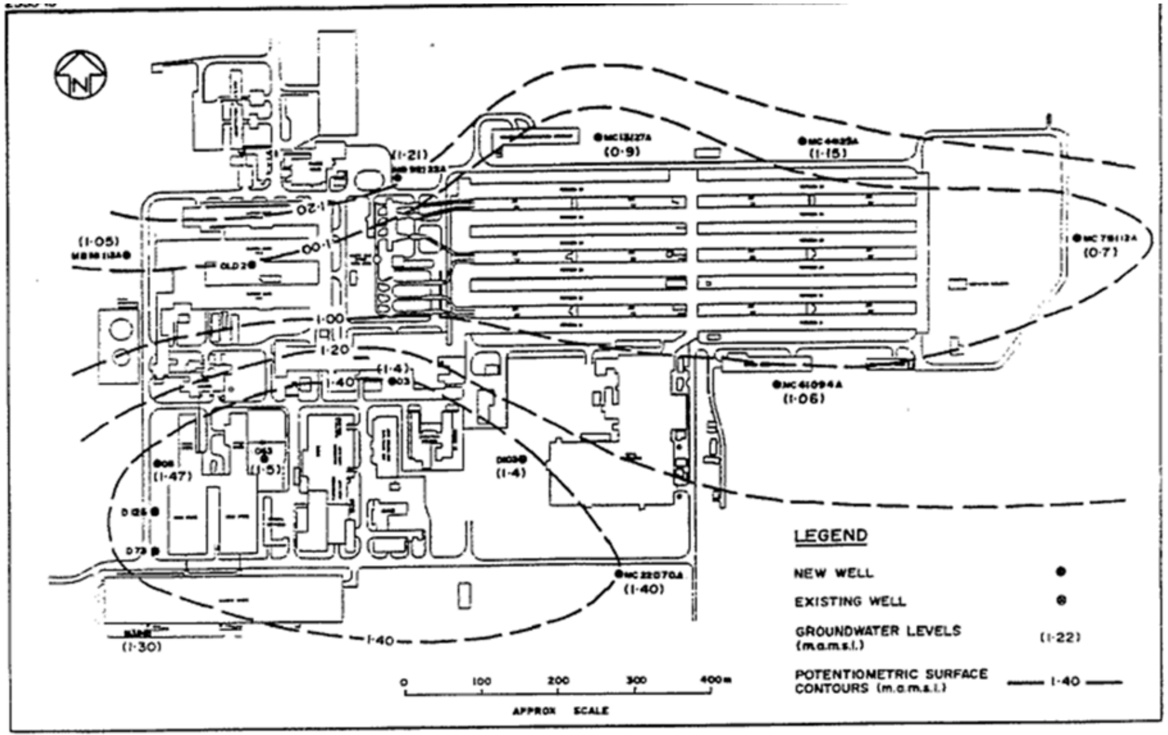


**Notes:**
Figure adapted from Kirk and Lauder (2000).

**Reference:**
Kirk, R.M.; Lauder, G.A. 2000: Significant coastal lagoon system in the South Island, New Zealand. Coastal processes and lagoon mouth closure. Science for Conservation 146.
Department of Conservation, Wellington, New Zealand. 47 p.

**Active Sand Dune and Back-Beach Ridge Fields (Kirk and Lauder, 2000)**

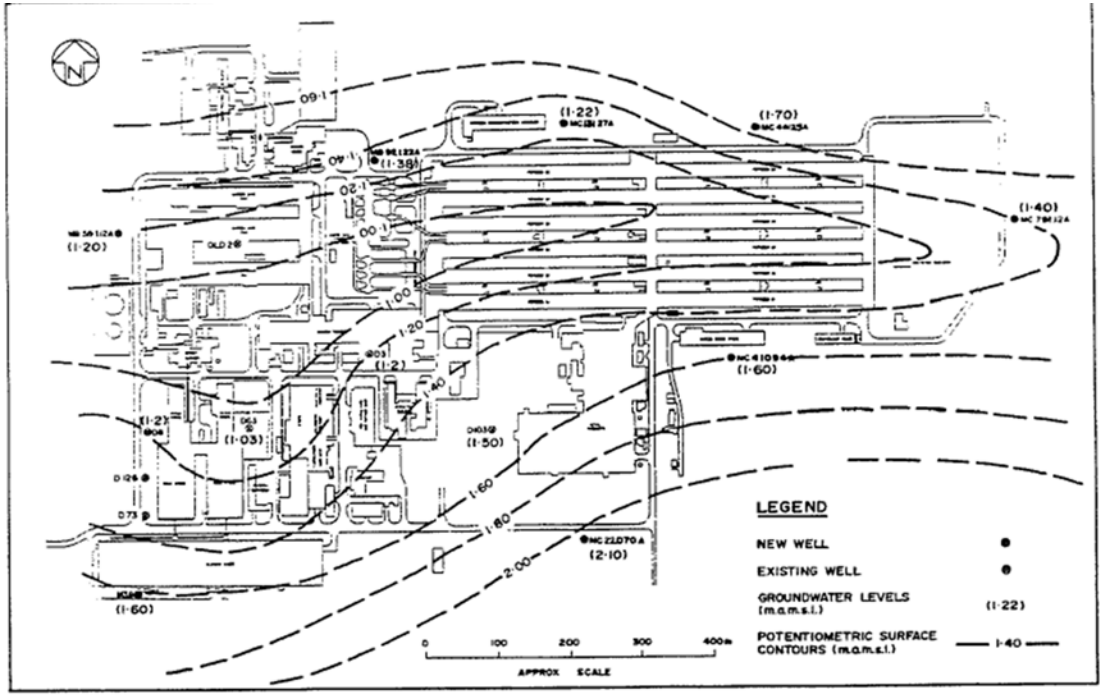
**FIGURE 4**



GROUNDWATER LEVELS & POTENTIOMETRIC SURFACE – APRIL 1992

**Notes:**
Figure adapted from Woodward Clyde (1994).

**Reference:**
Woodward Clyde New Zealand Ltd. 1994. Groundwaters of Tiwai Peninsula. Volume 1. Environmental Study. New Zealand Aluminium Smelters Ltd. 1994.



GROUNDWATER LEVELS & POTENTIOMETRIC SURFACE – AUGUST 1992

Figure 20

**Smelter Doman Groundwater Contours**
**(Woodward Clyde, 1994)**

**FIGURE 5**

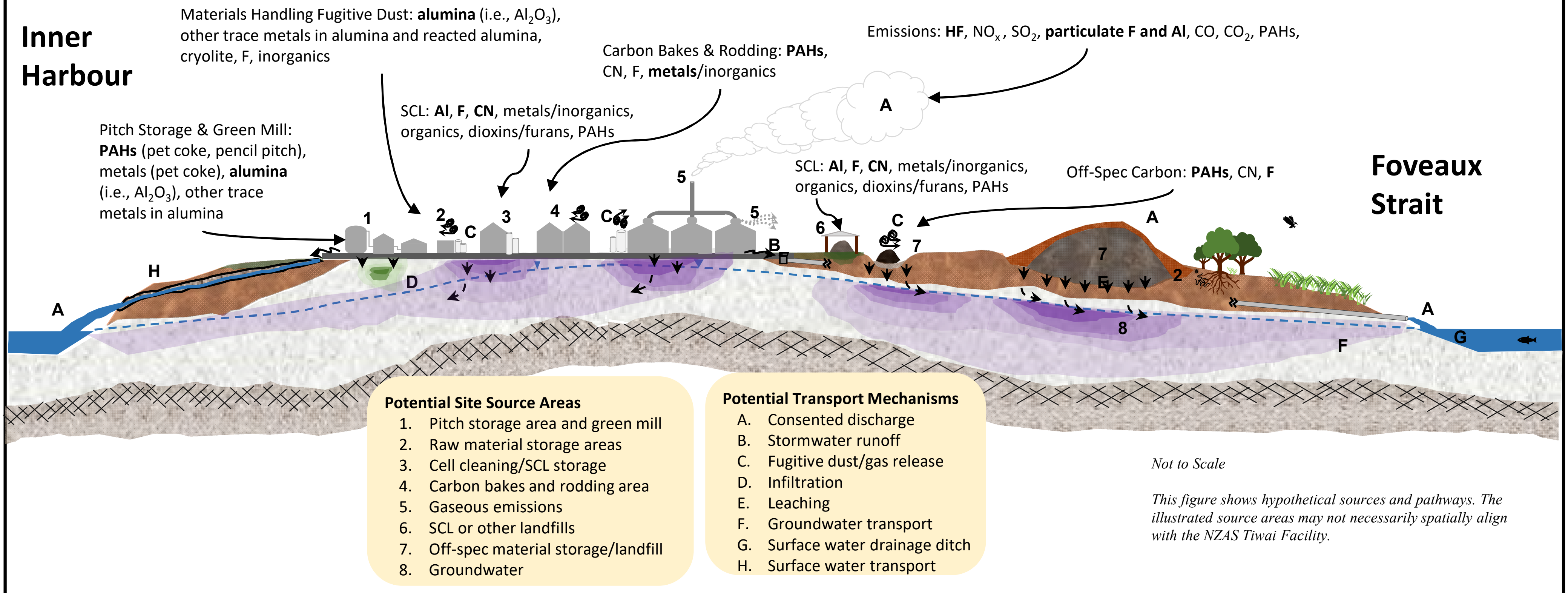
Figure 2-2 Piezometric Contour Map – October 2007 (Seasonal High)

Figure 2-3 Piezometric Contour Map – April 2008 (Seasonal Low)

**Notes:**
Figure adapted from URS (2009).

**Reference:**
URS New Zealand Ltd. 2009. Analysis of Landfill Groundwater Monitoring Data and Review of Modelling Assumptions. Final Report. May 2009.

**NZAS Landfill Groundwater Contours (URS, 2009)**



**Potential Site Source Areas**

1. Pitch storage area and green mill
2. Raw material storage areas
3. Cell cleaning/SCL storage
4. Carbon bakes and rodding area
5. Gaseous emissions
6. SCL or other landfills
7. Off-spec material storage/landfill
8. Groundwater

**Potential Transport Mechanisms**

A. Consented discharge
B. Stormwater runoff
C. Fugitive dust/gas release
D. Infiltration
E. Leaching
F. Groundwater transport
G. Surface water drainage ditch
H. Surface water transport

*Not to Scale*

*This figure shows hypothetical sources and pathways. The illustrated source areas may not necessarily spatially align with the NZAS Tiwai Facility.*

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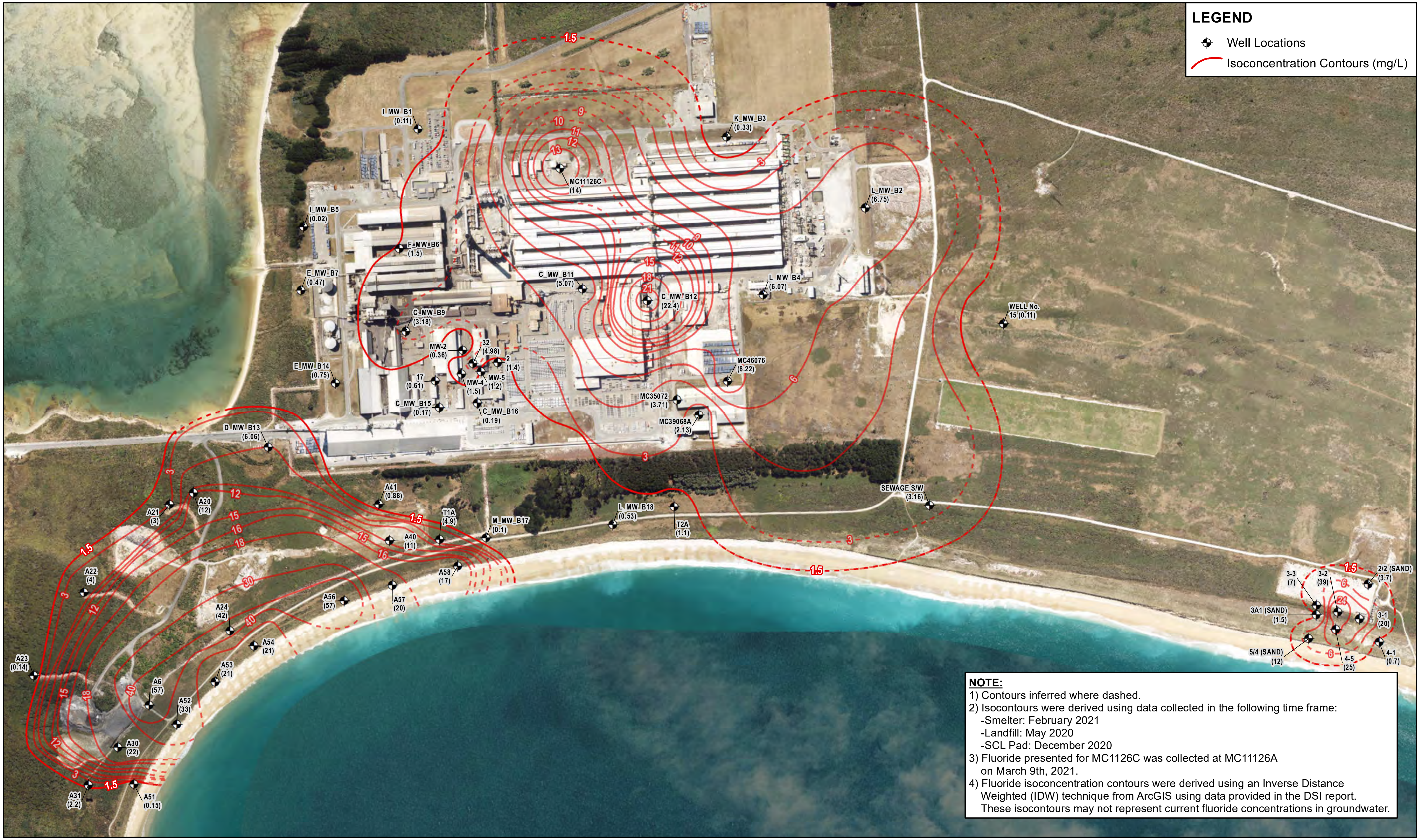
**CMA Assessment Technical Report**
**ES Independent Monitoring Programme**
**Tiwai Point**

**Aluminium Smelter Conceptual Site Model**

**FIGURE 7**



**LEGEND**

- ⊕ Well Locations
- ⁄ Isoconcentration Contours (mg/L)

**NOTE:**

1) Contours inferred where dashed.
2) Isocontours were derived using data collected in the following time frame:
   - -Smelter: February 2021
   - -Landfill: May 2020
   - -SCL Pad: December 2020
3) Fluoride presented for MC1126C was collected at MC11126A on March 9th, 2021.
4) Fluoride isoconcentration contours were derived using an Inverse Distance Weighted (IDW) technique from ArcGIS using data provided in the DSI report. These isocontours may not represent current fluoride concentrations in groundwater.

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# Groundwater Isoconcentrations Historical Fluoride Concentrations

0 62.5 125 250 375 500 Meters
1 cm = 78 meters
[Page Size: A4]

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## FIGURE 8

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
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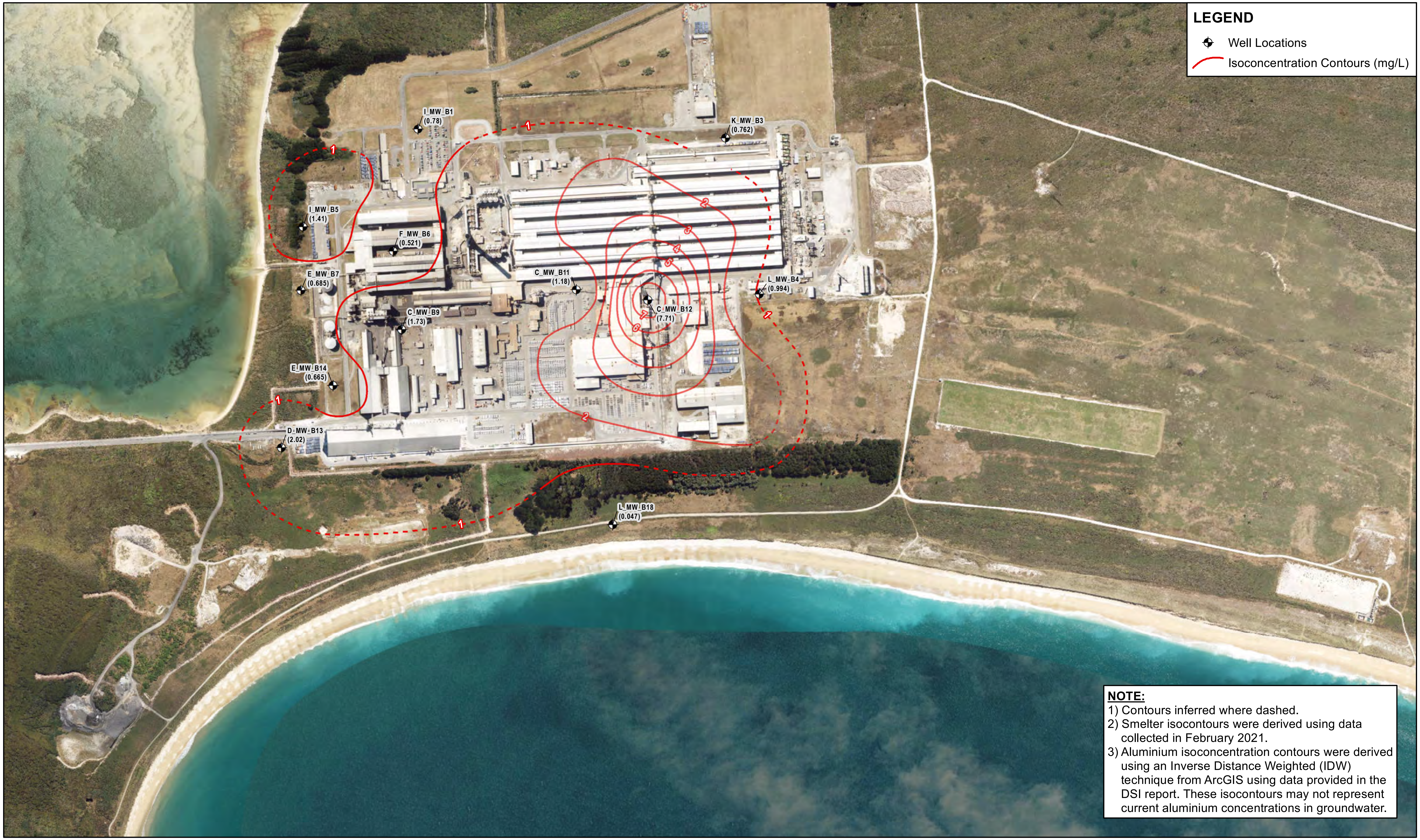
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:7,800 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

N



**LEGEND**

⯐ Well Locations

〜 Isoconcentration Contours (mg/L)

**NOTE:**

1) Contours inferred where dashed.
2) Smelter isocontours were derived using data collected in February 2021.
3) Aluminium isoconcentration contours were derived using an Inverse Distance Weighted (IDW) technique from ArcGIS using data provided in the DSI report. These isocontours may not represent current aluminium concentrations in groundwater.

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## Groundwater Isoconcentrations Historical Aluminium Concentrations

1 cm = 78 meters [Page Size: A4]

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## FIGURE 9

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:7,800 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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**North Drain and West Drain Transect Sampling Stations (January 17 - February 3, 2023)**

1 cm = 14 meters / 1 cm = 18 meters (PANEL A/PANEL B) [Page Size: A4]

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**ENVIRONMENT SOUTHLAND**

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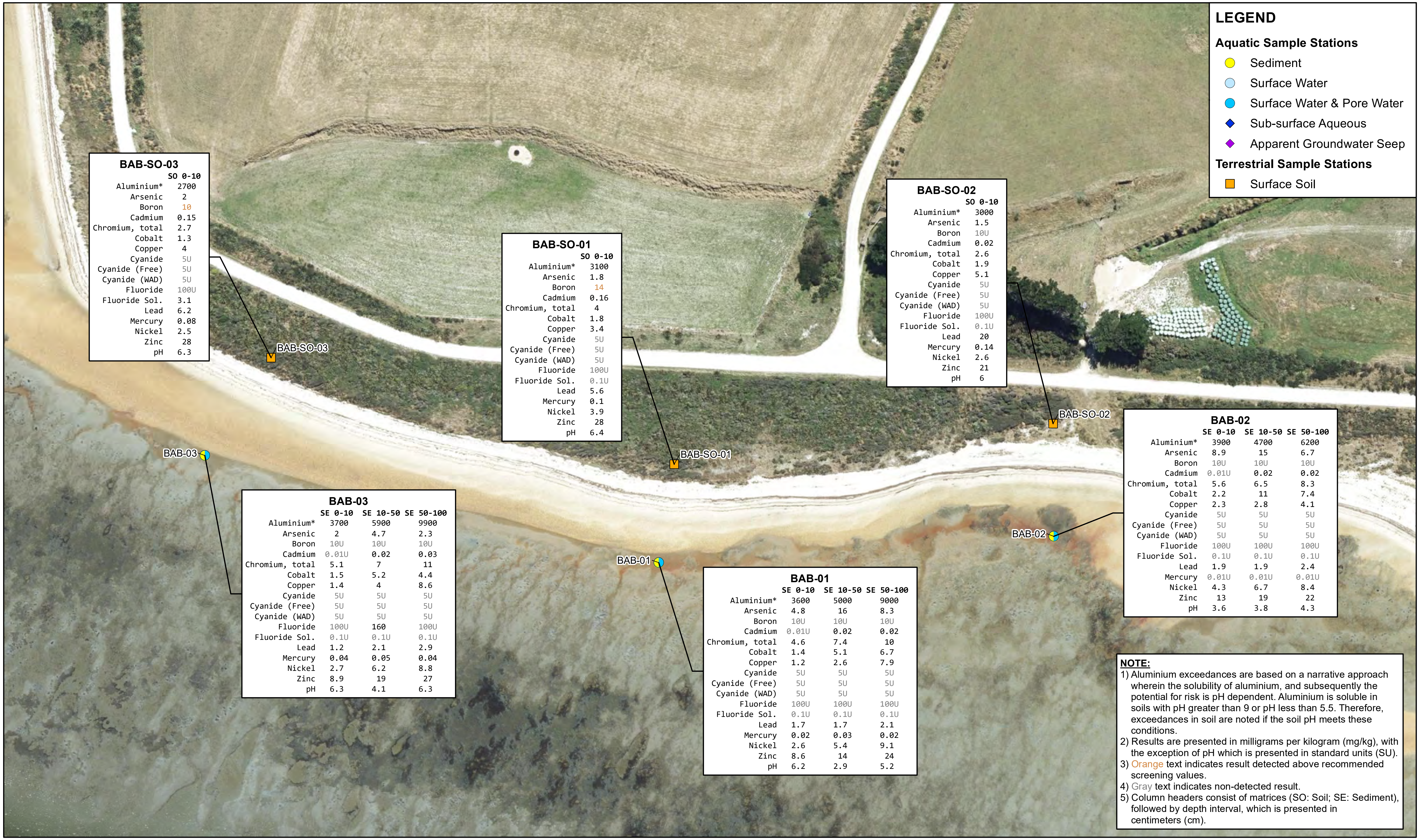
**Figure 10**

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,400/1:1,750 (A/B) |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

N



## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**BAB-SO-03**

| | SO 0-10 |
|---|---|
| Aluminium* | 2700 |
| Arsenic | 2 |
| Boron | 10 |
| Cadmium | 0.15 |
| Chromium, total | 2.7 |
| Cobalt | 1.3 |
| Copper | 4 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 3.1 |
| Lead | 6.2 |
| Mercury | 0.08 |
| Nickel | 2.5 |
| Zinc | 28 |
| pH | 6.3 |

**BAB-SO-01**

| | SO 0-10 |
|---|---|
| Aluminium* | 3100 |
| Arsenic | 1.8 |
| Boron | 14 |
| Cadmium | 0.16 |
| Chromium, total | 4 |
| Cobalt | 1.8 |
| Copper | 3.4 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 0.1U |
| Lead | 5.6 |
| Mercury | 0.1 |
| Nickel | 3.9 |
| Zinc | 28 |
| pH | 6.4 |

**BAB-SO-02**

| | SO 0-10 |
|---|---|
| Aluminium* | 3000 |
| Arsenic | 1.5 |
| Boron | 10U |
| Cadmium | 0.02 |
| Chromium, total | 2.6 |
| Cobalt | 1.9 |
| Copper | 5.1 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 0.1U |
| Lead | 20 |
| Mercury | 0.14 |
| Nickel | 2.6 |
| Zinc | 21 |
| pH | 6 |

**BAB-02**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 3900 | 4700 | 6200 |
| Arsenic | 8.9 | 15 | 6.7 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.01U | 0.02 | 0.02 |
| Chromium, total | 5.6 | 6.5 | 8.3 |
| Cobalt | 2.2 | 11 | 7.4 |
| Copper | 2.3 | 2.8 | 4.1 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 100U | 100U |
| Fluoride Sol. | 0.1U | 0.1U | 0.1U |
| Lead | 1.9 | 1.9 | 2.4 |
| Mercury | 0.01U | 0.01U | 0.01U |
| Nickel | 4.3 | 6.7 | 8.4 |
| Zinc | 13 | 19 | 22 |
| pH | 3.6 | 3.8 | 4.3 |

**BAB-03**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 3700 | 5900 | 9900 |
| Arsenic | 2 | 4.7 | 2.3 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.01U | 0.02 | 0.03 |
| Chromium, total | 5.1 | 7 | 11 |
| Cobalt | 1.5 | 5.2 | 4.4 |
| Copper | 1.4 | 4 | 8.6 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 160 | 100U |
| Fluoride Sol. | 0.1U | 0.1U | 0.1U |
| Lead | 1.2 | 2.1 | 2.9 |
| Mercury | 0.04 | 0.05 | 0.04 |
| Nickel | 2.7 | 6.2 | 8.8 |
| Zinc | 8.9 | 19 | 27 |
| pH | 6.3 | 4.1 | 6.3 |

**BAB-01**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 3600 | 5000 | 9000 |
| Arsenic | 4.8 | 16 | 8.3 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.01U | 0.02 | 0.02 |
| Chromium, total | 4.6 | 7.4 | 10 |
| Cobalt | 1.4 | 5.1 | 6.7 |
| Copper | 1.2 | 2.6 | 7.9 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 100U | 100U |
| Fluoride Sol. | 0.1U | 0.1U | 0.1U |
| Lead | 1.7 | 1.7 | 2.1 |
| Mercury | 0.02 | 0.03 | 0.02 |
| Nickel | 2.6 | 5.4 | 9.1 |
| Zinc | 8.6 | 14 | 24 |
| pH | 6.2 | 2.9 | 5.2 |

**NOTE:**

1) Aluminium exceedances are based on a narrative approach wherein the solubility of aluminium, and subsequently the potential for risk is pH dependent. Aluminium is soluble in soils with pH greater than 9 or pH less than 5.5. Therefore, exceedances in soil are noted if the soil pH meets these conditions.
2) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
3) Orange text indicates result detected above recommended screening values.
4) Gray text indicates non-detected result.
5) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).

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# Awarua Bay Background Assessment Area
# Soil and Sediment Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
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## FIGURE 11A

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
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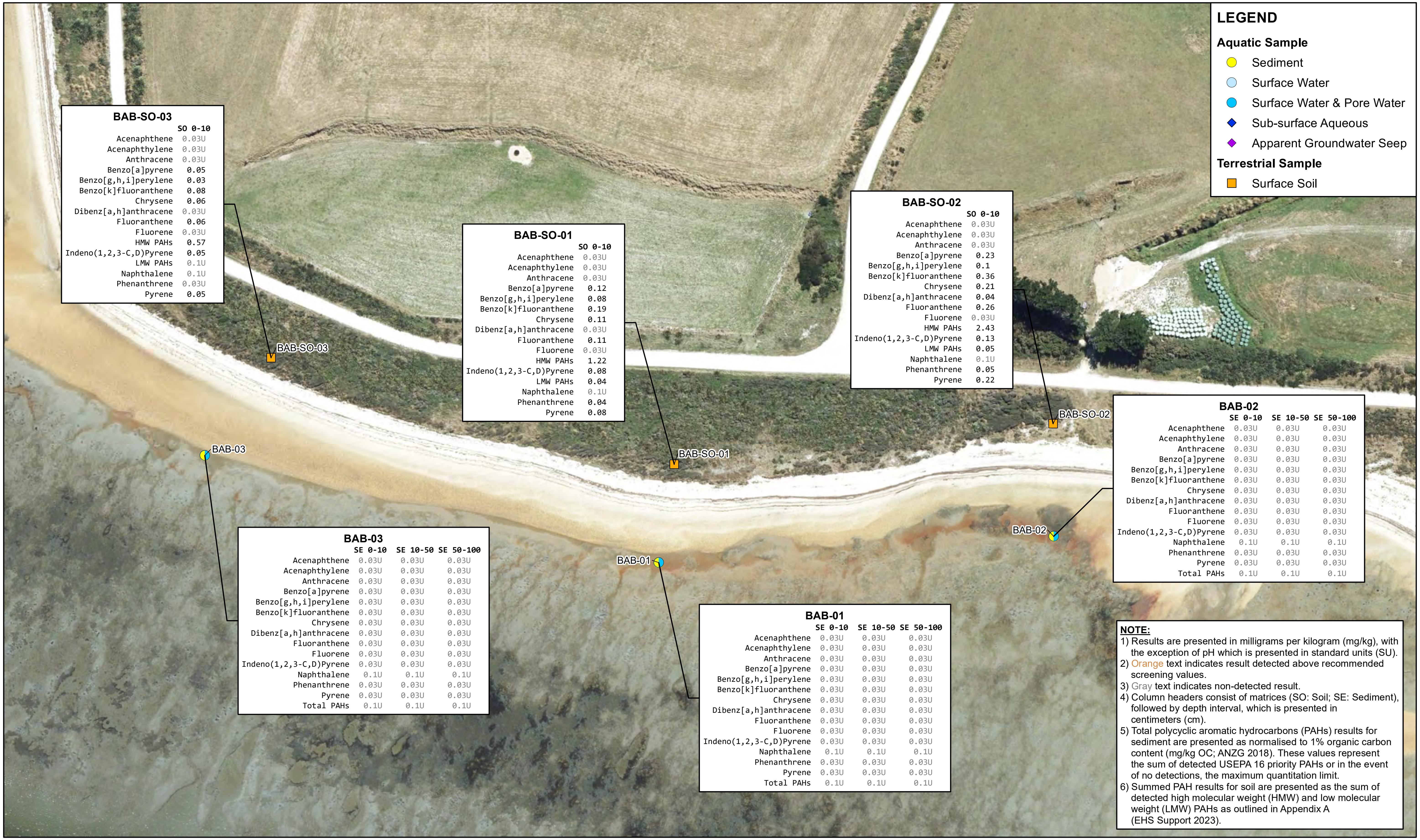
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

N

# Awarua Bay Background Assessment Area
# Soil and Sediment Polycyclic Aromatic Hydrocarbon Results



**BAB-SO-03**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.05 |
| Benzo[g,h,i]perylene | 0.03 |
| Benzo[k]fluoranthene | 0.08 |
| Chrysene | 0.06 |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.06 |
| Fluorene | 0.03U |
| HMW PAHs | 0.57 |
| Indeno(1,2,3-C,D)Pyrene | 0.05 |
| LMW PAHs | 0.1U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.05 |

**BAB-SO-01**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.12 |
| Benzo[g,h,i]perylene | 0.08 |
| Benzo[k]fluoranthene | 0.19 |
| Chrysene | 0.11 |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.11 |
| Fluorene | 0.03U |
| HMW PAHs | 1.22 |
| Indeno(1,2,3-C,D)Pyrene | 0.08 |
| LMW PAHs | 0.04 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.04 |
| Pyrene | 0.08 |

**BAB-SO-02**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.23 |
| Benzo[g,h,i]perylene | 0.1 |
| Benzo[k]fluoranthene | 0.36 |
| Chrysene | 0.21 |
| Dibenz[a,h]anthracene | 0.04 |
| Fluoranthene | 0.26 |
| Fluorene | 0.03U |
| HMW PAHs | 2.43 |
| Indeno(1,2,3-C,D)Pyrene | 0.13 |
| LMW PAHs | 0.05 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.05 |
| Pyrene | 0.22 |

**BAB-02**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.03U | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.03U |
| Total PAHs | 0.1U | 0.1U | 0.1U |

**BAB-03**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.03U | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.03U |
| Total PAHs | 0.1U | 0.1U | 0.1U |

**BAB-01**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.03U | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.03U |
| Total PAHs | 0.1U | 0.1U | 0.1U |

**NOTE:**

1) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
2) Orange text indicates result detected above recommended screening values.
3) Gray text indicates non-detected result.
4) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).
5) Total polycyclic aromatic hydrocarbons (PAHs) results for sediment are presented as normalised to 1% organic carbon content (mg/kg OC; ANZG 2018). These values represent the sum of detected USEPA 16 priority PAHs or in the event of no detections, the maximum quantitation limit.
6) Summed PAH results for soil are presented as the sum of detected high molecular weight (HMW) and low molecular weight (LMW) PAHs as outlined in Appendix A (EHS Support 2023).

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0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 11B

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,200 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

### BAB-03

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.05U |
| Arsenic | 0.002 | 0.002 | 0.023 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 21000 | 21000 | 17000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U | 0.006 |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.95 | 0.95 | 0.7 |
| Iron | 0.05U | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.013 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.002 |
| Vanadium | 0.005U | 0.005U | 0.005 |
| Zinc | 0.005U | 0.005U | 0.005U |

### BAB-01

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.05U |
| Arsenic | 0.002 | 0.002 | 0.001U |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 22000 | 21000 | 19000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.004 | 0.001 | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.95 | 0.96 | 0.52 |
| Iron | 0.05U | 0.05U | 0.28 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.035 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.001 |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.005U |

### BAB-02

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.05U |
| Arsenic | 0.002 | 0.002 | 0.002 |
| Barium | 0.02U | 0.02U | 0.03 |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 22000 | 22000 | 11000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.96 | 0.95 | 0.35 |
| Iron | 0.05U | 0.05U | 0.14 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.015 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.005U |

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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# Awarua Bay Background Assessment Area
# Surface Water and Pore Water Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 11C

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,200 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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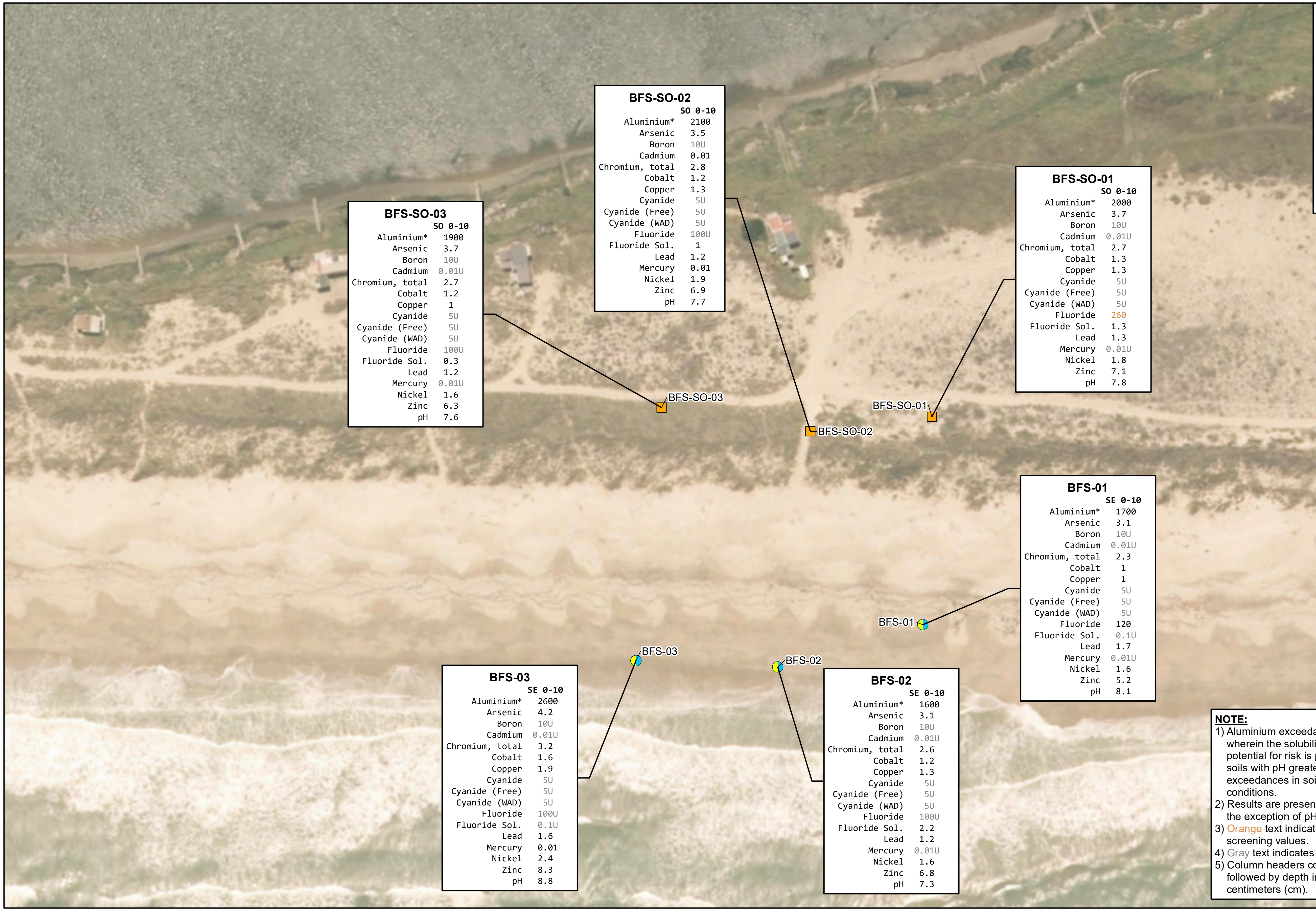

**BFS-SO-03**

| | SO 0-10 |
|---|---|
| Aluminium* | 1900 |
| Arsenic | 3.7 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 2.7 |
| Cobalt | 1.2 |
| Copper | 1 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 0.3 |
| Lead | 1.2 |
| Mercury | 0.01U |
| Nickel | 1.6 |
| Zinc | 6.3 |
| pH | 7.6 |

**BFS-SO-02**

| | SO 0-10 |
|---|---|
| Aluminium* | 2100 |
| Arsenic | 3.5 |
| Boron | 10U |
| Cadmium | 0.01 |
| Chromium, total | 2.8 |
| Cobalt | 1.2 |
| Copper | 1.3 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 1 |
| Lead | 1.2 |
| Mercury | 0.01 |
| Nickel | 1.9 |
| Zinc | 6.9 |
| pH | 7.7 |

**BFS-SO-01**

| | SO 0-10 |
|---|---|
| Aluminium* | 2000 |
| Arsenic | 3.7 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 2.7 |
| Cobalt | 1.3 |
| Copper | 1.3 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 260 |
| Fluoride Sol. | 1.3 |
| Lead | 1.3 |
| Mercury | 0.01U |
| Nickel | 1.8 |
| Zinc | 7.1 |
| pH | 7.8 |

**BFS-01**

| | SE 0-10 |
|---|---|
| Aluminium* | 1700 |
| Arsenic | 3.1 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 2.3 |
| Cobalt | 1 |
| Copper | 1 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 120 |
| Fluoride Sol. | 0.1U |
| Lead | 1.7 |
| Mercury | 0.01U |
| Nickel | 1.6 |
| Zinc | 5.2 |
| pH | 8.1 |

**BFS-03**

| | SE 0-10 |
|---|---|
| Aluminium* | 2600 |
| Arsenic | 4.2 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 3.2 |
| Cobalt | 1.6 |
| Copper | 1.9 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 0.1U |
| Lead | 1.6 |
| Mercury | 0.01 |
| Nickel | 2.4 |
| Zinc | 8.3 |
| pH | 8.8 |

**BFS-02**

| | SE 0-10 |
|---|---|
| Aluminium* | 1600 |
| Arsenic | 3.1 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 2.6 |
| Cobalt | 1.2 |
| Copper | 1.3 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 2.2 |
| Lead | 1.2 |
| Mercury | 0.01U |
| Nickel | 1.6 |
| Zinc | 6.8 |
| pH | 7.3 |

## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ○ Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**NOTE:**

1) Aluminium exceedances are based on a narrative approach wherein the solubility of aluminium, and subsequently the potential for risk is pH dependent. Aluminium is soluble in soils with pH greater than 9 or pH less than 5.5. Therefore, exceedances in soil are noted if the soil pH meets these conditions.
2) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
3) Orange text indicates result detected above recommended screening values.
4) Gray text indicates non-detected result.
5) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).

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# Foveaux Strait Background Assessment Area
# Soil and Sediment Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 12A

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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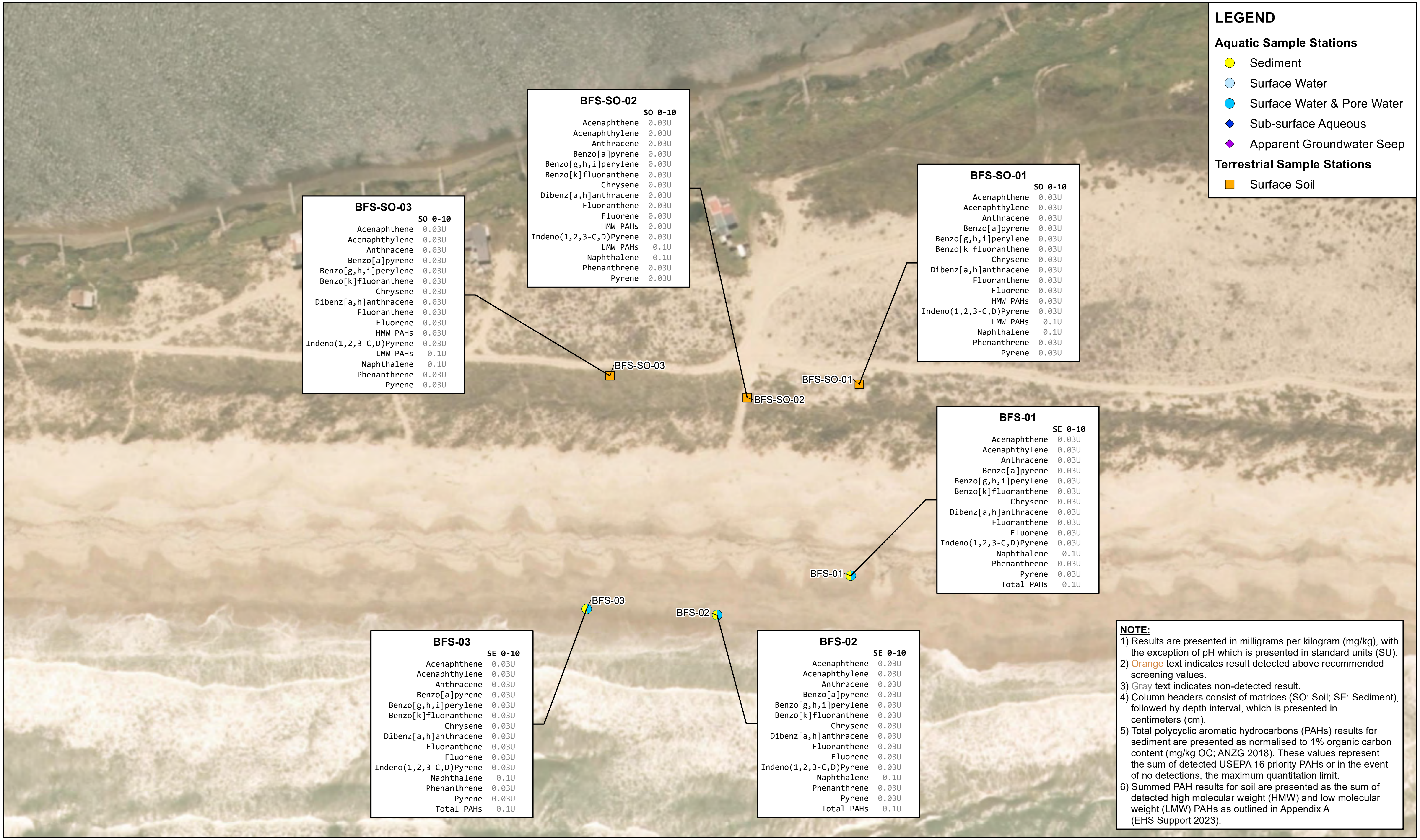

## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**BFS-SO-03**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| HMW PAHs | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| LMW PAHs | 0.1U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |

**BFS-SO-02**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| HMW PAHs | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| LMW PAHs | 0.1U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |

**BFS-SO-01**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| HMW PAHs | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| LMW PAHs | 0.1U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |

**BFS-01**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**BFS-03**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**BFS-02**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**NOTE:**

1) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
2) Orange text indicates result detected above recommended screening values.
3) Gray text indicates non-detected result.
4) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).
5) Total polycyclic aromatic hydrocarbons (PAHs) results for sediment are presented as normalised to 1% organic carbon content (mg/kg OC; ANZG 2018). These values represent the sum of detected USEPA 16 priority PAHs or in the event of no detections, the maximum quantitation limit.
6) Summed PAH results for soil are presented as the sum of detected high molecular weight (HMW) and low molecular weight (LMW) PAHs as outlined in Appendix A (EHS Support 2023).

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# Foveaux Strait Background Assessment Area
# Soil and Sediment Polycyclic Aromatic Hydrocarbon Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 12B

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ○ Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**BFS-03**

| | WPO | WS |
|---|---|---|
| Aluminium | 0.18 | 1.1 |
| Arsenic | 0.004 | 0.005 |
| Barium | 0.02U | 0.02U |
| Beryllium | 0.002 | 0.001U |
| Boron | 3.3 | 8.3 |
| Cadmium | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 20000 |
| Chromium, total | 0.001U | 0.002 |
| Cobalt | 0.002 | 0.001 |
| Copper | 0.001 | 0.001 |
| Cyanide | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U |
| Fluoride | 0.92 | 0.91 |
| Iron | 0.4 | 2.8 |
| Lead | 0.001U | 0.001U |
| Manganese | 0.012 | 0.041 |
| Mercury | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001 |
| Vanadium | 0.005U | 0.008 |
| Zinc | 0.01 | 0.005 |

**BFS-01**

| | WPO | WS |
|---|---|---|
| Aluminium | 0.99 | 0.38 |
| Arsenic | 0.006 | 0.004 |
| Barium | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U |
| Boron | 3.1 | 3.3 |
| Cadmium | 0.0002U | 0.0002U |
| Chloride (As Cl) | 18000 | 18000 |
| Chromium, total | 0.002 | 0.001U |
| Cobalt | 0.001U | 0.001U |
| Copper | 0.002 | 0.001 |
| Cyanide | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U |
| Fluoride | 1.28 | 0.91 |
| Iron | 1.9 | 0.84 |
| Lead | 0.001U | 0.001U |
| Manganese | 0.036 | 0.013 |
| Mercury | 0.0001U | 0.0001U |
| Nickel | 0.002 | 0.001U |
| Vanadium | 0.007 | 0.005U |
| Zinc | 0.006 | 0.005U |

**BFS-02**

| | WPO | WS |
|---|---|---|
| Aluminium | 0.16 | 0.21 |
| Arsenic | 0.004 | 0.004 |
| Barium | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U |
| Boron | 7.9 | 3.2 |
| Cadmium | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 19000 |
| Chromium, total | 0.001 | 0.001U |
| Cobalt | 0.001U | 0.001U |
| Copper | 0.001U | 0.001 |
| Cyanide | 0.011 | 0.005U |
| Cyanide (Free) | 0.005 | 0.005U |
| Fluoride | 0.91 | 0.87 |
| Iron | 0.31 | 0.42 |
| Lead | 0.001U | 0.001U |
| Manganese | 0.016 | 0.009 |
| Mercury | 0.0001U | 0.0001U |
| Nickel | 0.002 | 0.001U |
| Vanadium | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U |

**NOTE:**
1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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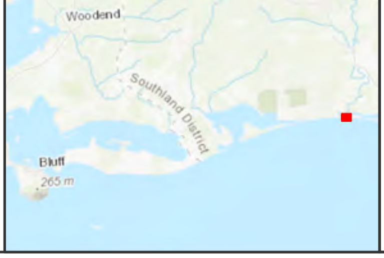
# Foveaux Strait Background Assessment Area
# Surface Water and Pore Water Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**



## FIGURE 12C

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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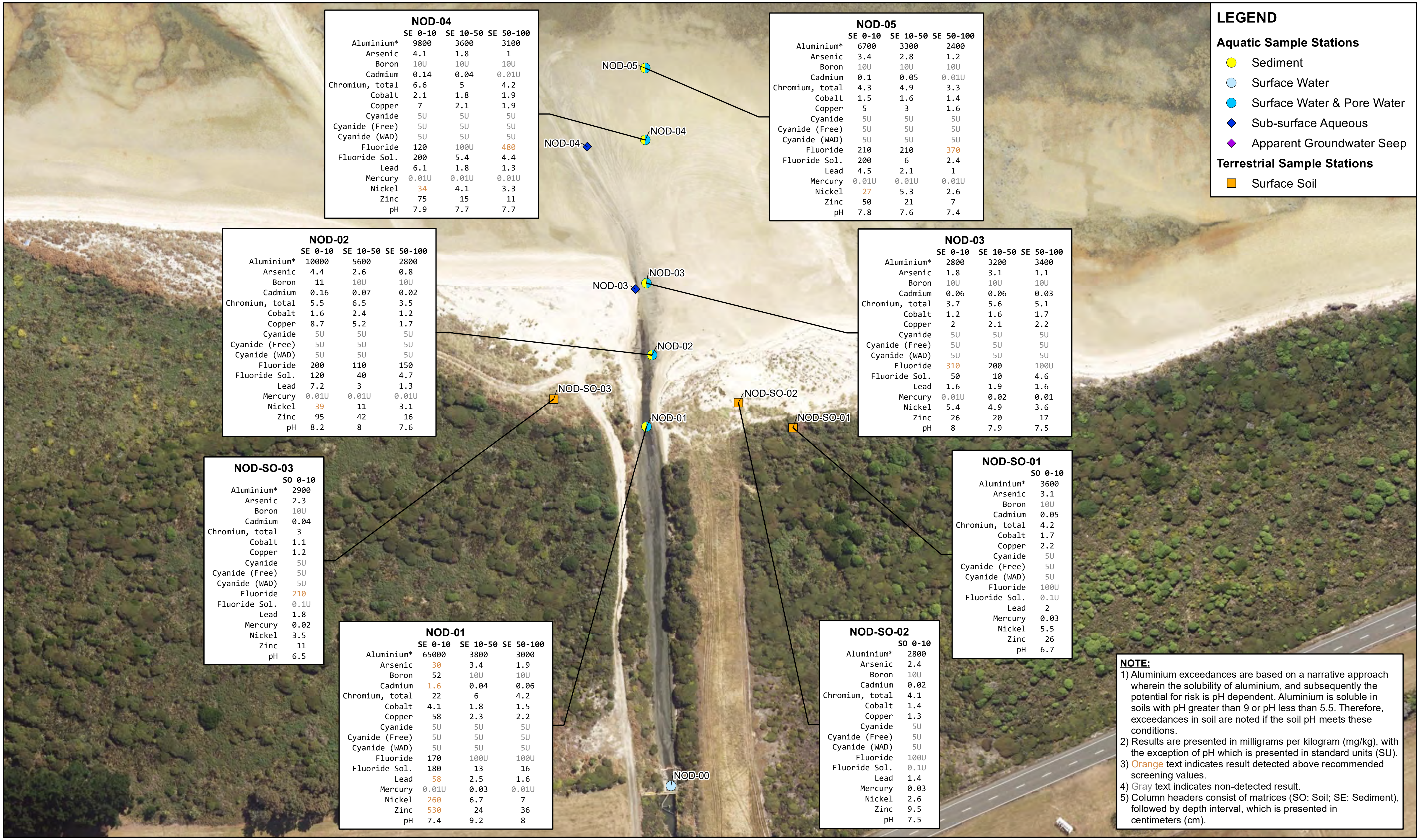

## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

### NOD-04

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 9800 | 3600 | 3100 |
| Arsenic | 4.1 | 1.8 | 1 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.14 | 0.04 | 0.01U |
| Chromium, total | 6.6 | 5 | 4.2 |
| Cobalt | 2.1 | 1.8 | 1.9 |
| Copper | 7 | 2.1 | 1.9 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 120 | 100U | 480 |
| Fluoride Sol. | 200 | 5.4 | 4.4 |
| Lead | 6.1 | 1.8 | 1.3 |
| Mercury | 0.01U | 0.01U | 0.01U |
| Nickel | 34 | 4.1 | 3.3 |
| Zinc | 75 | 15 | 11 |
| pH | 7.9 | 7.7 | 7.7 |

### NOD-05

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 6700 | 3300 | 2400 |
| Arsenic | 3.4 | 2.8 | 1.2 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.1 | 0.05 | 0.01U |
| Chromium, total | 4.3 | 4.9 | 3.3 |
| Cobalt | 1.5 | 1.6 | 1.4 |
| Copper | 5 | 3 | 1.6 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 210 | 210 | 370 |
| Fluoride Sol. | 200 | 6 | 2.4 |
| Lead | 4.5 | 2.1 | 1 |
| Mercury | 0.01U | 0.01U | 0.01U |
| Nickel | 27 | 5.3 | 2.6 |
| Zinc | 50 | 21 | 7 |
| pH | 7.8 | 7.6 | 7.4 |

### NOD-02

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 10000 | 5600 | 2800 |
| Arsenic | 4.4 | 2.6 | 0.8 |
| Boron | 11 | 10U | 10U |
| Cadmium | 0.16 | 0.07 | 0.02 |
| Chromium, total | 5.5 | 6.5 | 3.5 |
| Cobalt | 1.6 | 2.4 | 1.2 |
| Copper | 8.7 | 5.2 | 1.7 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 200 | 110 | 150 |
| Fluoride Sol. | 120 | 40 | 4.7 |
| Lead | 7.2 | 3 | 1.3 |
| Mercury | 0.01U | 0.01U | 0.01U |
| Nickel | 39 | 11 | 3.1 |
| Zinc | 95 | 42 | 16 |
| pH | 8.2 | 8 | 7.6 |

### NOD-03

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 2800 | 3200 | 3400 |
| Arsenic | 1.8 | 3.1 | 1.1 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.06 | 0.06 | 0.03 |
| Chromium, total | 3.7 | 5.6 | 5.1 |
| Cobalt | 1.2 | 1.6 | 1.7 |
| Copper | 2 | 2.1 | 2.2 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 310 | 200 | 100U |
| Fluoride Sol. | 50 | 10 | 4.6 |
| Lead | 1.6 | 1.9 | 1.6 |
| Mercury | 0.01U | 0.02 | 0.01 |
| Nickel | 5.4 | 4.9 | 3.6 |
| Zinc | 26 | 20 | 17 |
| pH | 8 | 7.9 | 7.5 |

### NOD-SO-03

| | SO 0-10 |
|---|---|
| Aluminium* | 2900 |
| Arsenic | 2.3 |
| Boron | 10U |
| Cadmium | 0.04 |
| Chromium, total | 3 |
| Cobalt | 1.1 |
| Copper | 1.2 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 210 |
| Fluoride Sol. | 0.1U |
| Lead | 1.8 |
| Mercury | 0.02 |
| Nickel | 3.5 |
| Zinc | 11 |
| pH | 6.5 |

### NOD-SO-01

| | SO 0-10 |
|---|---|
| Aluminium* | 3600 |
| Arsenic | 3.1 |
| Boron | 10U |
| Cadmium | 0.05 |
| Chromium, total | 4.2 |
| Cobalt | 1.7 |
| Copper | 2.2 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 0.1U |
| Lead | 2 |
| Mercury | 0.03 |
| Nickel | 5.5 |
| Zinc | 26 |
| pH | 6.7 |

### NOD-01

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 65000 | 3800 | 3000 |
| Arsenic | 30 | 3.4 | 1.9 |
| Boron | 52 | 10U | 10U |
| Cadmium | 1.6 | 0.04 | 0.06 |
| Chromium, total | 22 | 6 | 4.2 |
| Cobalt | 4.1 | 1.8 | 1.5 |
| Copper | 58 | 2.3 | 2.2 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 170 | 100U | 100U |
| Fluoride Sol. | 180 | 13 | 16 |
| Lead | 58 | 2.5 | 1.6 |
| Mercury | 0.01U | 0.03 | 0.01U |
| Nickel | 260 | 6.7 | 7 |
| Zinc | 530 | 24 | 36 |
| pH | 7.4 | 9.2 | 8 |

### NOD-SO-02

| | SO 0-10 |
|---|---|
| Aluminium* | 2800 |
| Arsenic | 2.4 |
| Boron | 10U |
| Cadmium | 0.02 |
| Chromium, total | 4.1 |
| Cobalt | 1.4 |
| Copper | 1.3 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 0.1U |
| Lead | 1.4 |
| Mercury | 0.03 |
| Nickel | 2.6 |
| Zinc | 9.5 |
| pH | 7.5 |

**NOTE:**

1) Aluminium exceedances are based on a narrative approach wherein the solubility of aluminium, and subsequently the potential for risk is pH dependent. Aluminium is soluble in soils with pH greater than 9 or pH less than 5.5. Therefore, exceedances in soil are noted if the soil pH meets these conditions.
2) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
3) Orange text indicates result detected above recommended screening values.
4) Gray text indicates non-detected result.
5) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).

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# North Drain Assessment Area
# Soil and Sediment Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 13A

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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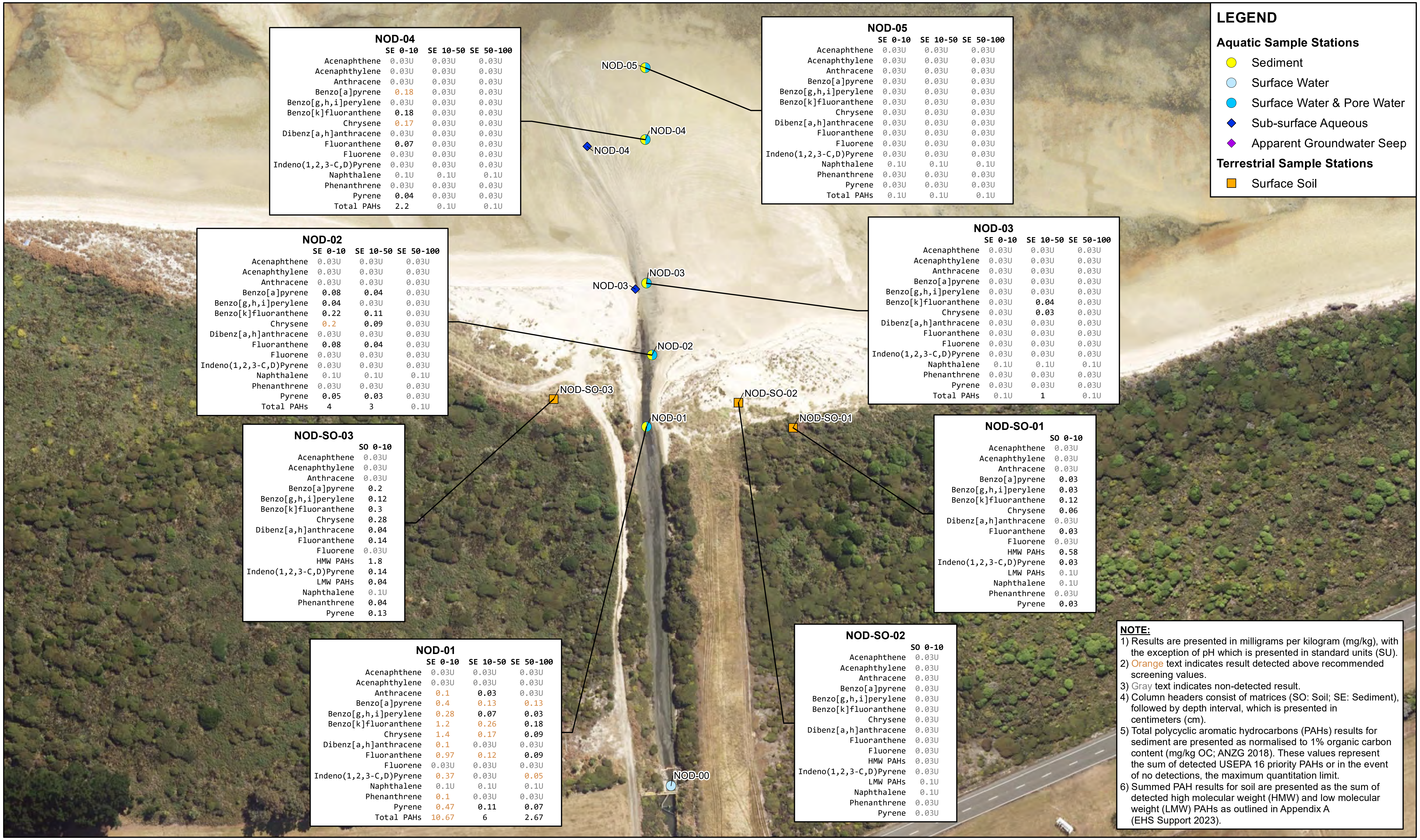

## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

### NOD-04

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.18 | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.18 | 0.03U | 0.03U |
| Chrysene | 0.17 | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.07 | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.04 | 0.03U | 0.03U |
| Total PAHs | 2.2 | 0.1U | 0.1U |

### NOD-05

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.03U | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.03U |
| Total PAHs | 0.1U | 0.1U | 0.1U |

### NOD-02

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.08 | 0.04 | 0.03U |
| Benzo[g,h,i]perylene | 0.04 | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.22 | 0.11 | 0.03U |
| Chrysene | 0.2 | 0.09 | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.08 | 0.04 | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.05 | 0.03 | 0.03U |
| Total PAHs | 4 | 3 | 0.1U |

### NOD-03

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.03U | 0.04 | 0.03U |
| Chrysene | 0.03U | 0.03 | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.03U |
| Total PAHs | 0.1U | 1 | 0.1U |

### NOD-SO-03

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.2 |
| Benzo[g,h,i]perylene | 0.12 |
| Benzo[k]fluoranthene | 0.3 |
| Chrysene | 0.28 |
| Dibenz[a,h]anthracene | 0.04 |
| Fluoranthene | 0.14 |
| Fluorene | 0.03U |
| HMW PAHs | 1.8 |
| Indeno(1,2,3-C,D)Pyrene | 0.14 |
| LMW PAHs | 0.04 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.04 |
| Pyrene | 0.13 |

### NOD-SO-01

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03 |
| Benzo[g,h,i]perylene | 0.03 |
| Benzo[k]fluoranthene | 0.12 |
| Chrysene | 0.06 |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03 |
| Fluorene | 0.03U |
| HMW PAHs | 0.58 |
| Indeno(1,2,3-C,D)Pyrene | 0.03 |
| LMW PAHs | 0.1U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03 |

### NOD-01

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.1 | 0.03 | 0.03U |
| Benzo[a]pyrene | 0.4 | 0.13 | 0.13 |
| Benzo[g,h,i]perylene | 0.28 | 0.07 | 0.03 |
| Benzo[k]fluoranthene | 1.2 | 0.26 | 0.18 |
| Chrysene | 1.4 | 0.17 | 0.09 |
| Dibenz[a,h]anthracene | 0.1 | 0.03U | 0.03U |
| Fluoranthene | 0.97 | 0.12 | 0.09 |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.37 | 0.03U | 0.05 |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.1 | 0.03U | 0.03U |
| Pyrene | 0.47 | 0.11 | 0.07 |
| Total PAHs | 10.67 | 6 | 2.67 |

### NOD-SO-02

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| HMW PAHs | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| LMW PAHs | 0.1U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |

**NOTE:**

1) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
2) Orange text indicates result detected above recommended screening values.
3) Gray text indicates non-detected result.
4) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).
5) Total polycyclic aromatic hydrocarbons (PAHs) results for sediment are presented as normalised to 1% organic carbon content (mg/kg OC; ANZG 2018). These values represent the sum of detected USEPA 16 priority PAHs or in the event of no detections, the maximum quantitation limit.
6) Summed PAH results for soil are presented as the sum of detected high molecular weight (HMW) and low molecular weight (LMW) PAHs as outlined in Appendix A (EHS Support 2023).

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# North Drain Assessment Area
# Soil and Sediment Polycyclic Aromatic Hydrocarbon Results

0 5 10 20 30 40 Meters

1 cm = 12 meters

[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 13B

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,200 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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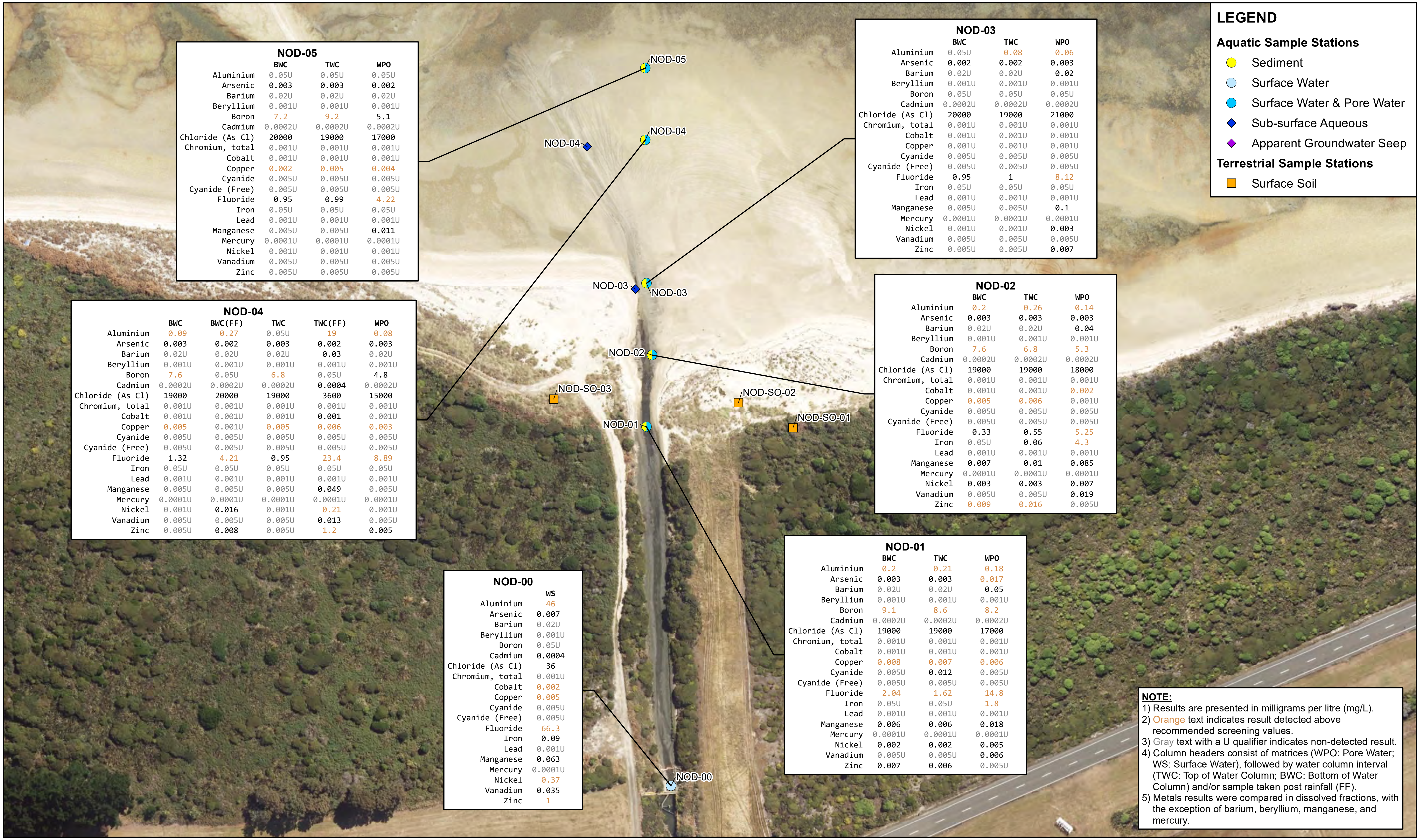

**NOD-05**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.05U |
| Arsenic | 0.003 | 0.003 | 0.002 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 7.2 | 9.2 | 5.1 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 20000 | 19000 | 17000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.002 | 0.005 | 0.004 |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.95 | 0.99 | 4.22 |
| Iron | 0.05U | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.011 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.005U |

**NOD-03**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.08 | 0.06 |
| Arsenic | 0.002 | 0.002 | 0.003 |
| Barium | 0.02U | 0.02U | 0.02 |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 20000 | 19000 | 21000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.95 | 1 | 8.12 |
| Iron | 0.05U | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.1 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.003 |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.007 |

**NOD-04**

| | BWC | BWC(FF) | TWC | TWC(FF) | WPO |
|---|---|---|---|---|---|
| Aluminium | 0.09 | 0.27 | 0.05U | 19 | 0.08 |
| Arsenic | 0.003 | 0.002 | 0.003 | 0.002 | 0.003 |
| Barium | 0.02U | 0.02U | 0.02U | 0.03 | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U | 0.001U | 0.001U |
| Boron | 7.6 | 0.05U | 6.8 | 0.05U | 4.8 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U | 0.0004 | 0.0002U |
| Chloride (As Cl) | 19000 | 20000 | 19000 | 3600 | 15000 |
| Chromium, total | 0.001U | 0.001U | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U | 0.001 | 0.001U |
| Copper | 0.005 | 0.001U | 0.005 | 0.006 | 0.003 |
| Cyanide | 0.005U | 0.005U | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U | 0.005U | 0.005U |
| Fluoride | 1.32 | 4.21 | 0.95 | 23.4 | 8.89 |
| Iron | 0.05U | 0.05U | 0.05U | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.005U | 0.049 | 0.005U |
| Mercury | 0.0001U | 0.0001U | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.016 | 0.001U | 0.21 | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U | 0.013 | 0.005U |
| Zinc | 0.005U | 0.008 | 0.005U | 1.2 | 0.005 |

**NOD-02**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.2 | 0.26 | 0.14 |
| Arsenic | 0.003 | 0.003 | 0.003 |
| Barium | 0.02U | 0.02U | 0.04 |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 7.6 | 6.8 | 5.3 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 19000 | 18000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.002 |
| Copper | 0.005 | 0.006 | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.33 | 0.55 | 5.25 |
| Iron | 0.05U | 0.06 | 4.3 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.007 | 0.01 | 0.085 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.003 | 0.003 | 0.007 |
| Vanadium | 0.005U | 0.005U | 0.019 |
| Zinc | 0.009 | 0.016 | 0.005U |

**NOD-01**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.2 | 0.21 | 0.18 |
| Arsenic | 0.003 | 0.003 | 0.017 |
| Barium | 0.02U | 0.02U | 0.05 |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 9.1 | 8.6 | 8.2 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 19000 | 17000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.008 | 0.007 | 0.006 |
| Cyanide | 0.005U | 0.012 | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 2.04 | 1.62 | 14.8 |
| Iron | 0.05U | 0.05U | 1.8 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.006 | 0.006 | 0.018 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.002 | 0.002 | 0.005 |
| Vanadium | 0.005U | 0.005U | 0.006 |
| Zinc | 0.007 | 0.006 | 0.005U |

**NOD-00**

| | WS |
|---|---|
| Aluminium | 46 |
| Arsenic | 0.007 |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 0.05U |
| Cadmium | 0.0004 |
| Chloride (As Cl) | 36 |
| Chromium, total | 0.001U |
| Cobalt | 0.002 |
| Copper | 0.005 |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 66.3 |
| Iron | 0.09 |
| Lead | 0.001U |
| Manganese | 0.063 |
| Mercury | 0.0001U |
| Nickel | 0.37 |
| Vanadium | 0.035 |
| Zinc | 1 |

**LEGEND**

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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# North Drain Assessment Area
# Surface Water and Pore Water Trace Element/Inorganic Results

0 5 10 20 30 40 Meters

1 cm = 12 meters

[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 13C

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,200 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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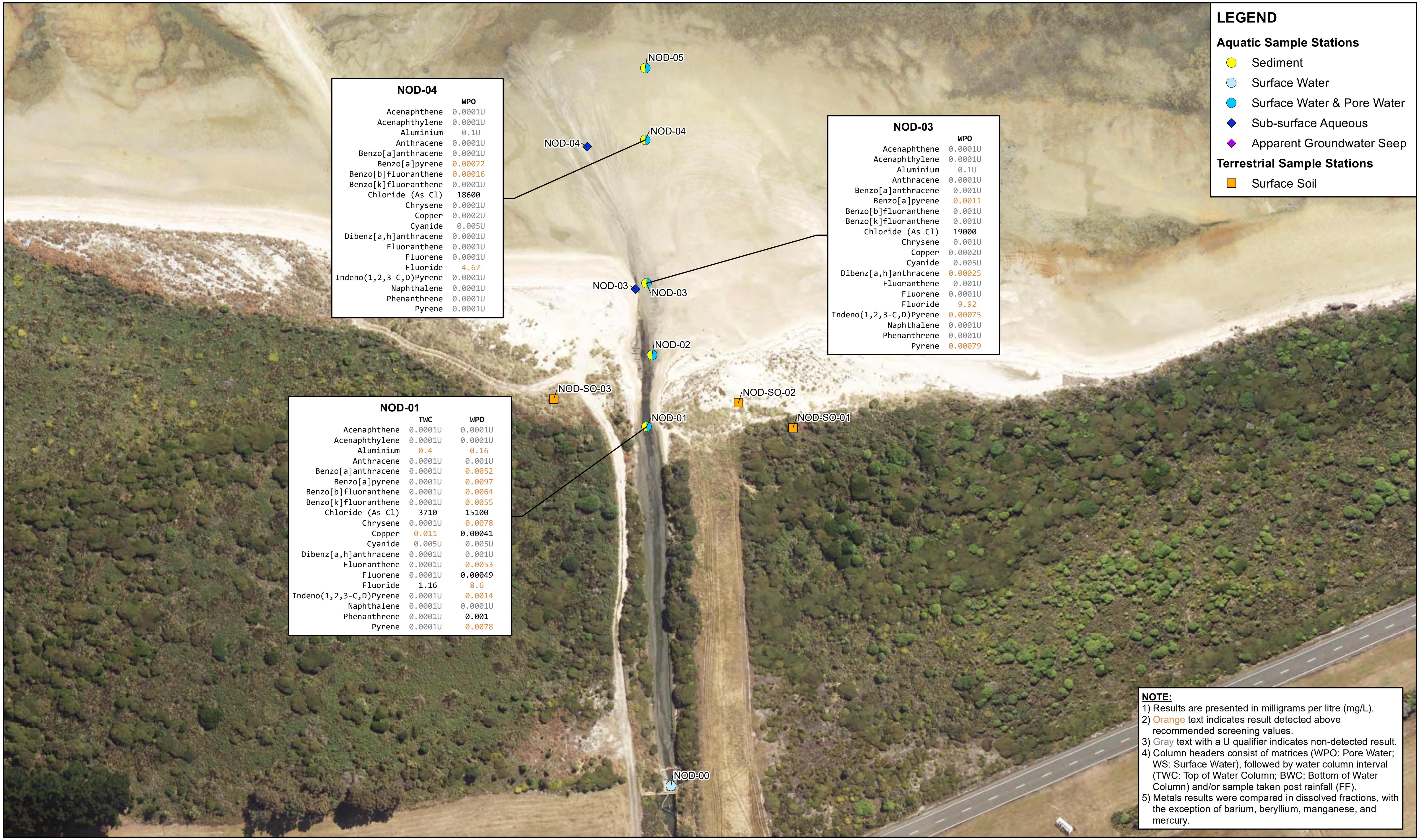

## LEGEND

### Aquatic Sample Stations

| | |
|---|---|
| ● | Sediment |
| ● | Surface Water |
| ● | Surface Water & Pore Water |
| ◆ | Sub-surface Aqueous |
| ◆ | Apparent Groundwater Seep |

### Terrestrial Sample Stations

| | |
|---|---|
| ■ | Surface Soil |

**NOD-04**

| | WPO |
|---|---|
| Acenaphthene | 0.0001U |
| Acenaphthylene | 0.0001U |
| Aluminium | 0.1U |
| Anthracene | 0.0001U |
| Benzo[a]anthracene | 0.0001U |
| Benzo[a]pyrene | 0.00022 |
| Benzo[b]fluoranthene | 0.00016 |
| Benzo[k]fluoranthene | 0.0001U |
| Chloride (As Cl) | 18600 |
| Chrysene | 0.0001U |
| Copper | 0.0002U |
| Cyanide | 0.005U |
| Dibenz[a,h]anthracene | 0.0001U |
| Fluoranthene | 0.0001U |
| Fluorene | 0.0001U |
| Fluoride | 4.67 |
| Indeno(1,2,3-C,D)Pyrene | 0.0001U |
| Naphthalene | 0.0001U |
| Phenanthrene | 0.0001U |
| Pyrene | 0.0001U |

**NOD-03**

| | WPO |
|---|---|
| Acenaphthene | 0.0001U |
| Acenaphthylene | 0.0001U |
| Aluminium | 0.1U |
| Anthracene | 0.0001U |
| Benzo[a]anthracene | 0.001U |
| Benzo[a]pyrene | 0.0011 |
| Benzo[b]fluoranthene | 0.001U |
| Benzo[k]fluoranthene | 0.001U |
| Chloride (As Cl) | 19000 |
| Chrysene | 0.001U |
| Copper | 0.0002U |
| Cyanide | 0.005U |
| Dibenz[a,h]anthracene | 0.00025 |
| Fluoranthene | 0.001U |
| Fluorene | 0.0001U |
| Fluoride | 9.92 |
| Indeno(1,2,3-C,D)Pyrene | 0.00075 |
| Naphthalene | 0.0001U |
| Phenanthrene | 0.0001U |
| Pyrene | 0.00079 |

**NOD-01**

| | TWC | WPO |
|---|---|---|
| Acenaphthene | 0.0001U | 0.0001U |
| Acenaphthylene | 0.0001U | 0.0001U |
| Aluminium | 0.4 | 0.16 |
| Anthracene | 0.0001U | 0.001U |
| Benzo[a]anthracene | 0.0001U | 0.0052 |
| Benzo[a]pyrene | 0.0001U | 0.0097 |
| Benzo[b]fluoranthene | 0.0001U | 0.0064 |
| Benzo[k]fluoranthene | 0.0001U | 0.0055 |
| Chloride (As Cl) | 3710 | 15100 |
| Chrysene | 0.0001U | 0.0078 |
| Copper | 0.011 | 0.00041 |
| Cyanide | 0.005U | 0.005U |
| Dibenz[a,h]anthracene | 0.0001U | 0.001U |
| Fluoranthene | 0.0001U | 0.0053 |
| Fluorene | 0.0001U | 0.00049 |
| Fluoride | 1.16 | 8.6 |
| Indeno(1,2,3-C,D)Pyrene | 0.0001U | 0.0014 |
| Naphthalene | 0.0001U | 0.0001U |
| Phenanthrene | 0.0001U | 0.001 |
| Pyrene | 0.0001U | 0.0078 |

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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# North Drain Assessment Area - May 2023 Resampling Event
# Aqueous Supplemental Sampling Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 13D

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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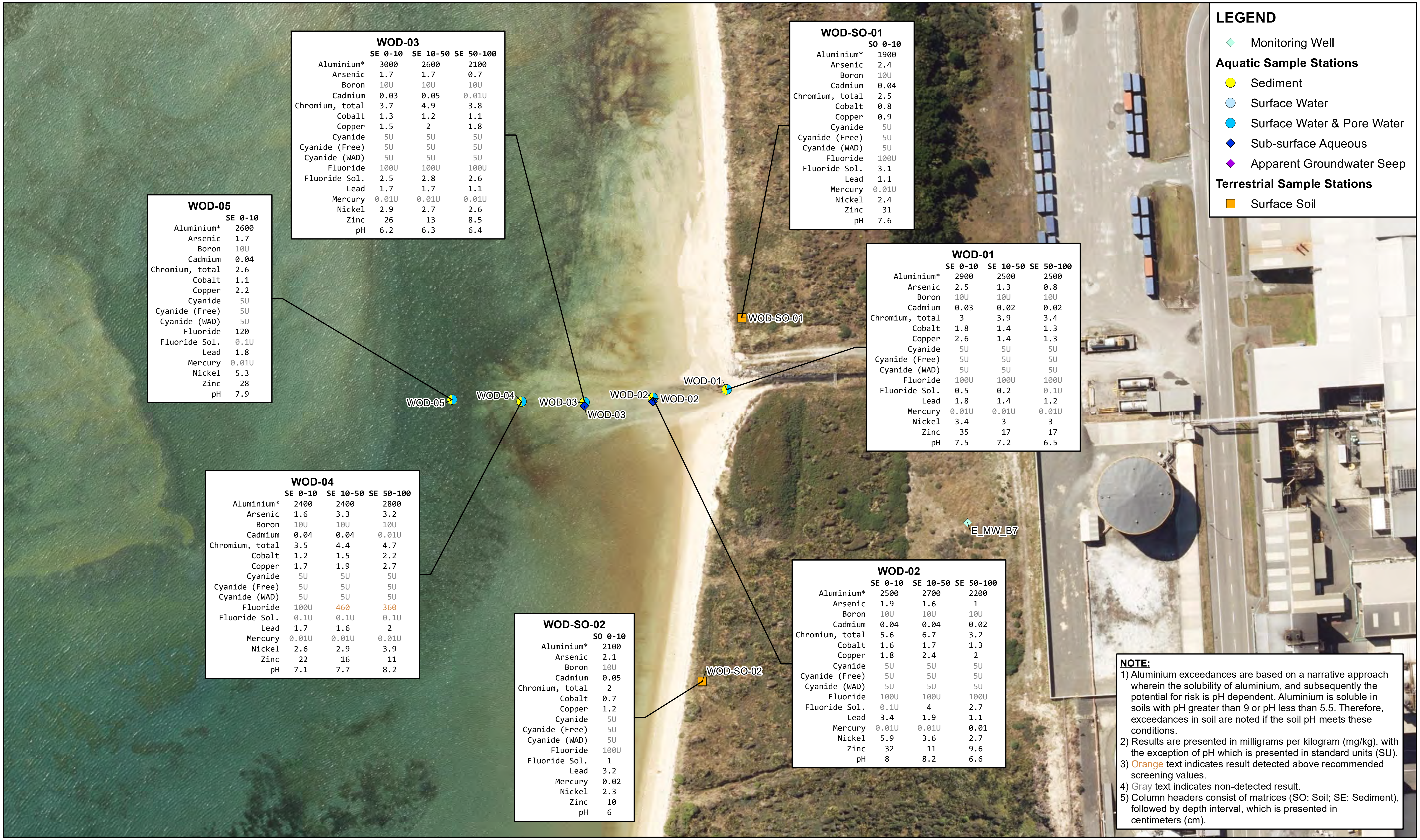

## WOD-03

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 3000 | 2600 | 2100 |
| Arsenic | 1.7 | 1.7 | 0.7 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.03 | 0.05 | 0.01U |
| Chromium, total | 3.7 | 4.9 | 3.8 |
| Cobalt | 1.3 | 1.2 | 1.1 |
| Copper | 1.5 | 2 | 1.8 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 100U | 100U |
| Fluoride Sol. | 2.5 | 2.8 | 2.6 |
| Lead | 1.7 | 1.7 | 1.1 |
| Mercury | 0.01U | 0.01U | 0.01U |
| Nickel | 2.9 | 2.7 | 2.6 |
| Zinc | 26 | 13 | 8.5 |
| pH | 6.2 | 6.3 | 6.4 |

## WOD-SO-01

| | SO 0-10 |
|---|---|
| Aluminium* | 1900 |
| Arsenic | 2.4 |
| Boron | 10U |
| Cadmium | 0.04 |
| Chromium, total | 2.5 |
| Cobalt | 0.8 |
| Copper | 0.9 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 3.1 |
| Lead | 1.1 |
| Mercury | 0.01U |
| Nickel | 2.4 |
| Zinc | 31 |
| pH | 7.6 |

## LEGEND

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment

● Surface Water

● Surface Water & Pore Water

◆ Sub-surface Aqueous

◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

## WOD-05

| | SE 0-10 |
|---|---|
| Aluminium* | 2600 |
| Arsenic | 1.7 |
| Boron | 10U |
| Cadmium | 0.04 |
| Chromium, total | 2.6 |
| Cobalt | 1.1 |
| Copper | 2.2 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 120 |
| Fluoride Sol. | 0.1U |
| Lead | 1.8 |
| Mercury | 0.01U |
| Nickel | 5.3 |
| Zinc | 28 |
| pH | 7.9 |

## WOD-01

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 2900 | 2500 | 2500 |
| Arsenic | 2.5 | 1.3 | 0.8 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.03 | 0.02 | 0.02 |
| Chromium, total | 3 | 3.9 | 3.4 |
| Cobalt | 1.8 | 1.4 | 1.3 |
| Copper | 2.6 | 1.4 | 1.3 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 100U | 100U |
| Fluoride Sol. | 0.5 | 0.2 | 0.1U |
| Lead | 1.8 | 1.4 | 1.2 |
| Mercury | 0.01U | 0.01U | 0.01U |
| Nickel | 3.4 | 3 | 3 |
| Zinc | 35 | 17 | 17 |
| pH | 7.5 | 7.2 | 6.5 |

## WOD-04

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 2400 | 2400 | 2800 |
| Arsenic | 1.6 | 3.3 | 3.2 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.04 | 0.04 | 0.01U |
| Chromium, total | 3.5 | 4.4 | 4.7 |
| Cobalt | 1.2 | 1.5 | 2.2 |
| Copper | 1.7 | 1.9 | 2.7 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 460 | 360 |
| Fluoride Sol. | 0.1U | 0.1U | 0.1U |
| Lead | 1.7 | 1.6 | 2 |
| Mercury | 0.01U | 0.01U | 0.01U |
| Nickel | 2.6 | 2.9 | 3.9 |
| Zinc | 22 | 16 | 11 |
| pH | 7.1 | 7.7 | 8.2 |

## WOD-02

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 2500 | 2700 | 2200 |
| Arsenic | 1.9 | 1.6 | 1 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.04 | 0.04 | 0.02 |
| Chromium, total | 5.6 | 6.7 | 3.2 |
| Cobalt | 1.6 | 1.7 | 1.3 |
| Copper | 1.8 | 2.4 | 2 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 100U | 100U |
| Fluoride Sol. | 0.1U | 4 | 2.7 |
| Lead | 3.4 | 1.9 | 1.1 |
| Mercury | 0.01U | 0.01U | 0.01 |
| Nickel | 5.9 | 3.6 | 2.7 |
| Zinc | 32 | 11 | 9.6 |
| pH | 8 | 8.2 | 6.6 |

## WOD-SO-02

| | SO 0-10 |
|---|---|
| Aluminium* | 2100 |
| Arsenic | 2.1 |
| Boron | 10U |
| Cadmium | 0.05 |
| Chromium, total | 2 |
| Cobalt | 0.7 |
| Copper | 1.2 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 1 |
| Lead | 3.2 |
| Mercury | 0.02 |
| Nickel | 2.3 |
| Zinc | 10 |
| pH | 6 |

**NOTE:**

1) Aluminium exceedances are based on a narrative approach wherein the solubility of aluminium, and subsequently the potential for risk is pH dependent. Aluminium is soluble in soils with pH greater than 9 or pH less than 5.5. Therefore, exceedances in soil are noted if the soil pH meets these conditions.
2) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
3) Orange text indicates result detected above recommended screening values.
4) Gray text indicates non-detected result.
5) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).

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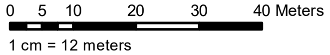
# West Drain Assessment Area
# Soil and Sediment Trace Element/Inorganic Results



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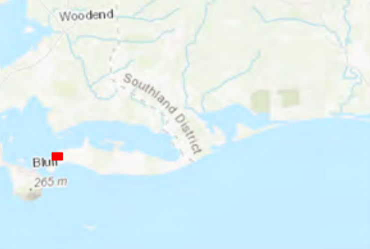
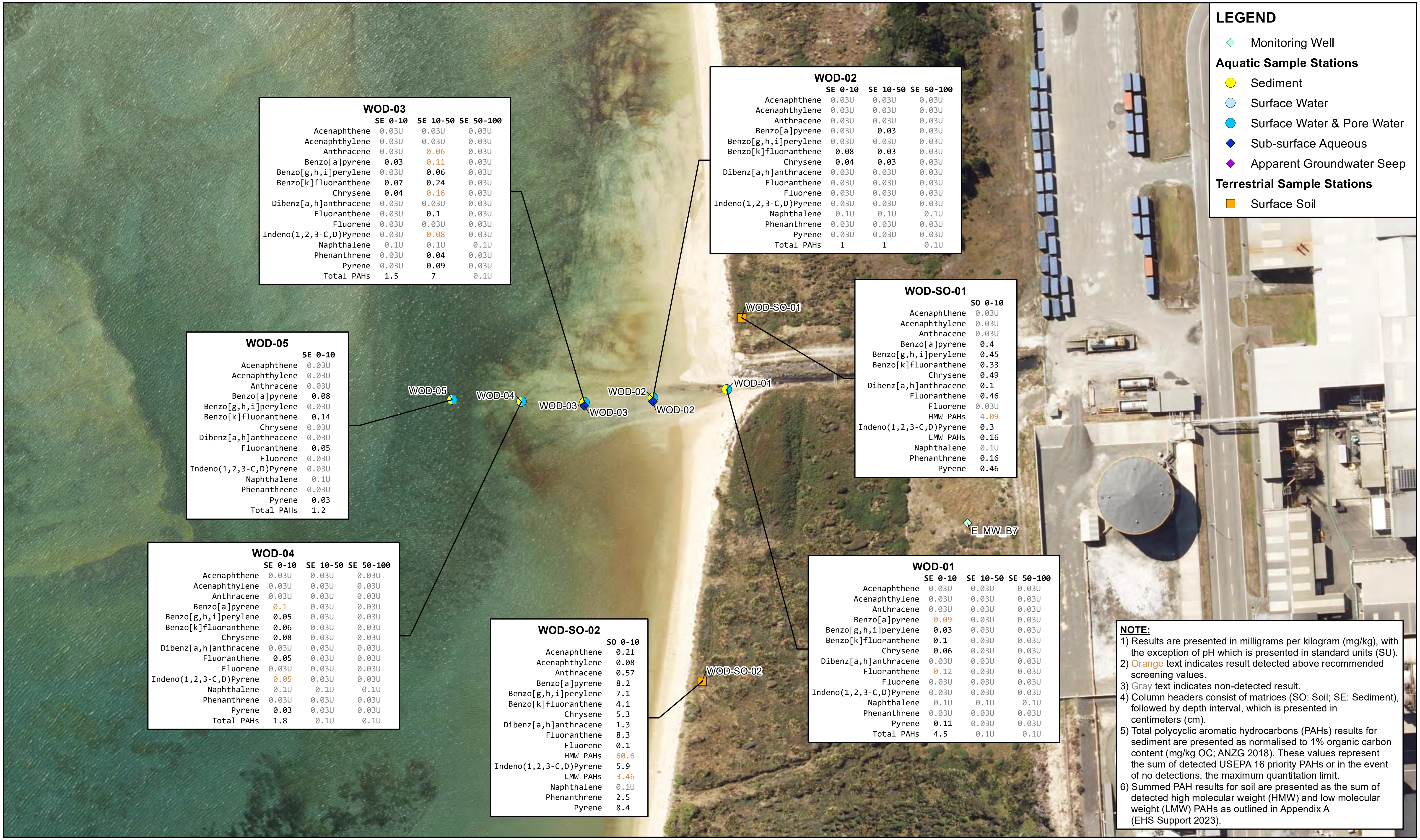
**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**



## FIGURE 14A

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

N



**WOD-03**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.06 | 0.03U |
| Benzo[a]pyrene | 0.03 | 0.11 | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.06 | 0.03U |
| Benzo[k]fluoranthene | 0.07 | 0.24 | 0.03U |
| Chrysene | 0.04 | 0.16 | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.1 | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.08 | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.04 | 0.03U |
| Pyrene | 0.03U | 0.09 | 0.03U |
| Total PAHs | 1.5 | 7 | 0.1U |

**WOD-02**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03 | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.08 | 0.03 | 0.03U |
| Chrysene | 0.04 | 0.03 | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.03U |
| Total PAHs | 1 | 1 | 0.1U |

**LEGEND**

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment

● Surface Water

● Surface Water & Pore Water

◆ Sub-surface Aqueous

◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

**WOD-SO-01**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.4 |
| Benzo[g,h,i]perylene | 0.45 |
| Benzo[k]fluoranthene | 0.33 |
| Chrysene | 0.49 |
| Dibenz[a,h]anthracene | 0.1 |
| Fluoranthene | 0.46 |
| Fluorene | 0.03U |
| HMW PAHs | 4.09 |
| Indeno(1,2,3-C,D)Pyrene | 0.3 |
| LMW PAHs | 0.16 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.16 |
| Pyrene | 0.46 |

**WOD-05**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.08 |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.14 |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.05 |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03 |
| Total PAHs | 1.2 |

**WOD-04**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.1 | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.05 | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.06 | 0.03U | 0.03U |
| Chrysene | 0.08 | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.05 | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.05 | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03 | 0.03U | 0.03U |
| Total PAHs | 1.8 | 0.1U | 0.1U |

**WOD-SO-02**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.21 |
| Acenaphthylene | 0.08 |
| Anthracene | 0.57 |
| Benzo[a]pyrene | 8.2 |
| Benzo[g,h,i]perylene | 7.1 |
| Benzo[k]fluoranthene | 4.1 |
| Chrysene | 5.3 |
| Dibenz[a,h]anthracene | 1.3 |
| Fluoranthene | 8.3 |
| Fluorene | 0.1 |
| HMW PAHs | 60.6 |
| Indeno(1,2,3-C,D)Pyrene | 5.9 |
| LMW PAHs | 3.46 |
| Naphthalene | 0.1U |
| Phenanthrene | 2.5 |
| Pyrene | 8.4 |

**WOD-01**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.09 | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03 | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.1 | 0.03U | 0.03U |
| Chrysene | 0.06 | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.12 | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.11 | 0.03U | 0.03U |
| Total PAHs | 4.5 | 0.1U | 0.1U |

**NOTE:**

1) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
2) Orange text indicates result detected above recommended screening values.
3) Gray text indicates non-detected result.
4) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).
5) Total polycyclic aromatic hydrocarbons (PAHs) results for sediment are presented as normalised to 1% organic carbon content (mg/kg OC; ANZG 2018). These values represent the sum of detected USEPA 16 priority PAHs or in the event of no detections, the maximum quantitation limit.
6) Summed PAH results for soil are presented as the sum of detected high molecular weight (HMW) and low molecular weight (LMW) PAHs as outlined in Appendix A (EHS Support 2023).

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## West Drain Assessment Area
## Soil and Sediment Polycyclic Aromatic Hydrocarbon Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 14B

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,200 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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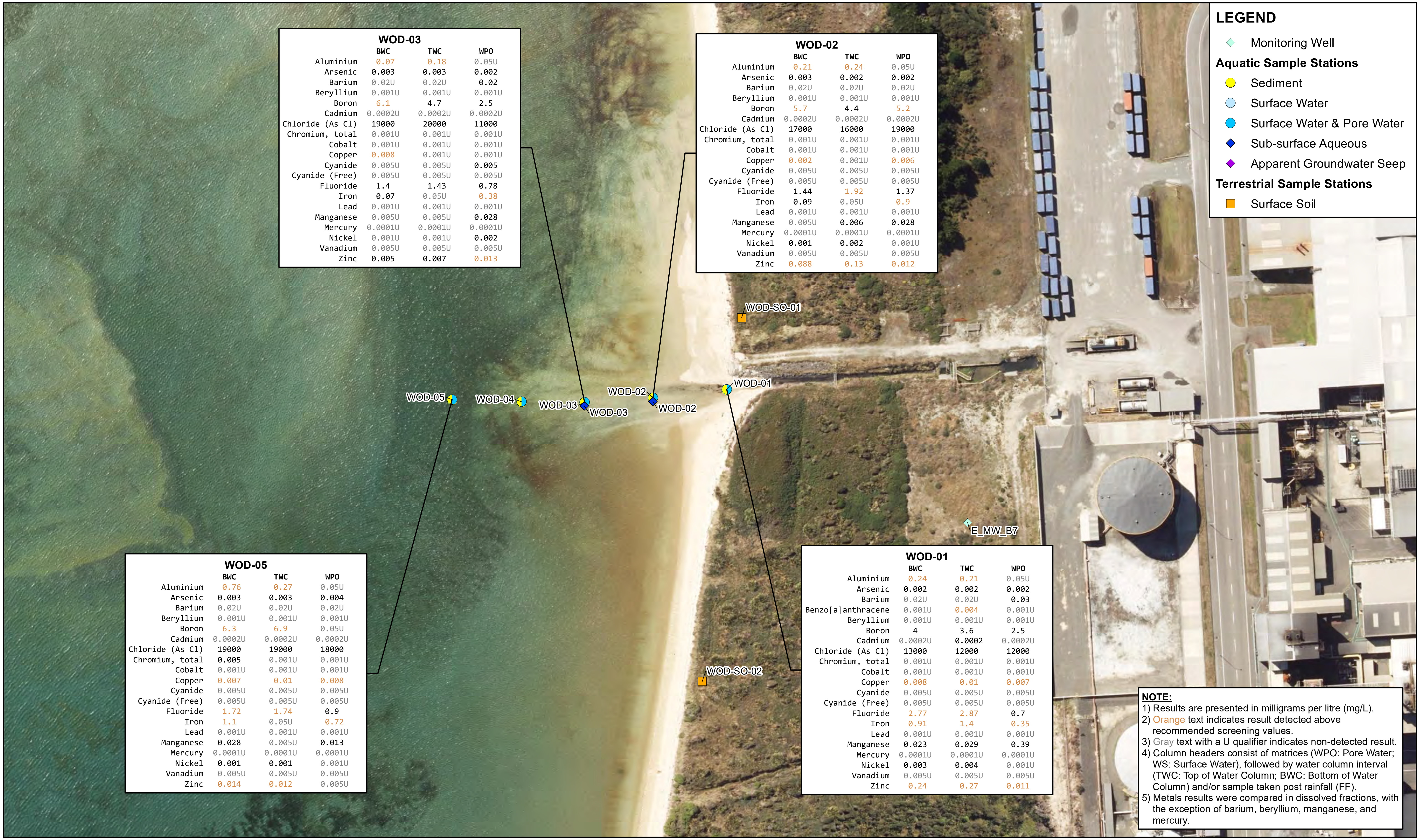

**WOD-03**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.07 | 0.18 | 0.05U |
| Arsenic | 0.003 | 0.003 | 0.002 |
| Barium | 0.02U | 0.02U | 0.02 |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 6.1 | 4.7 | 2.5 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 20000 | 11000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.008 | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005 |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 1.4 | 1.43 | 0.78 |
| Iron | 0.07 | 0.05U | 0.38 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.028 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.002 |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005 | 0.007 | 0.013 |

**WOD-02**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.21 | 0.24 | 0.05U |
| Arsenic | 0.003 | 0.002 | 0.002 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 5.7 | 4.4 | 5.2 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 17000 | 16000 | 19000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.002 | 0.001U | 0.006 |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 1.44 | 1.92 | 1.37 |
| Iron | 0.09 | 0.05U | 0.9 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.006 | 0.028 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001 | 0.002 | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.088 | 0.13 | 0.012 |

## LEGEND

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment

● Surface Water

● Surface Water & Pore Water

◆ Sub-surface Aqueous

◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

**WOD-05**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.76 | 0.27 | 0.05U |
| Arsenic | 0.003 | 0.003 | 0.004 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 6.3 | 6.9 | 0.05U |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 19000 | 18000 |
| Chromium, total | 0.005 | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.007 | 0.01 | 0.008 |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 1.72 | 1.74 | 0.9 |
| Iron | 1.1 | 0.05U | 0.72 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.028 | 0.005U | 0.013 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001 | 0.001 | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.014 | 0.012 | 0.005U |

**WOD-01**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.24 | 0.21 | 0.05U |
| Arsenic | 0.002 | 0.002 | 0.002 |
| Barium | 0.02U | 0.02U | 0.03 |
| Benzo[a]anthracene | 0.001U | 0.004 | 0.001U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 4 | 3.6 | 2.5 |
| Cadmium | 0.0002U | 0.0002 | 0.0002U |
| Chloride (As Cl) | 13000 | 12000 | 12000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.008 | 0.01 | 0.007 |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 2.77 | 2.87 | 0.7 |
| Iron | 0.91 | 1.4 | 0.35 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.023 | 0.029 | 0.39 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.003 | 0.004 | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.24 | 0.27 | 0.011 |

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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# West Drain Assessment Area
# Surface Water and Pore Water Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 14C

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,200 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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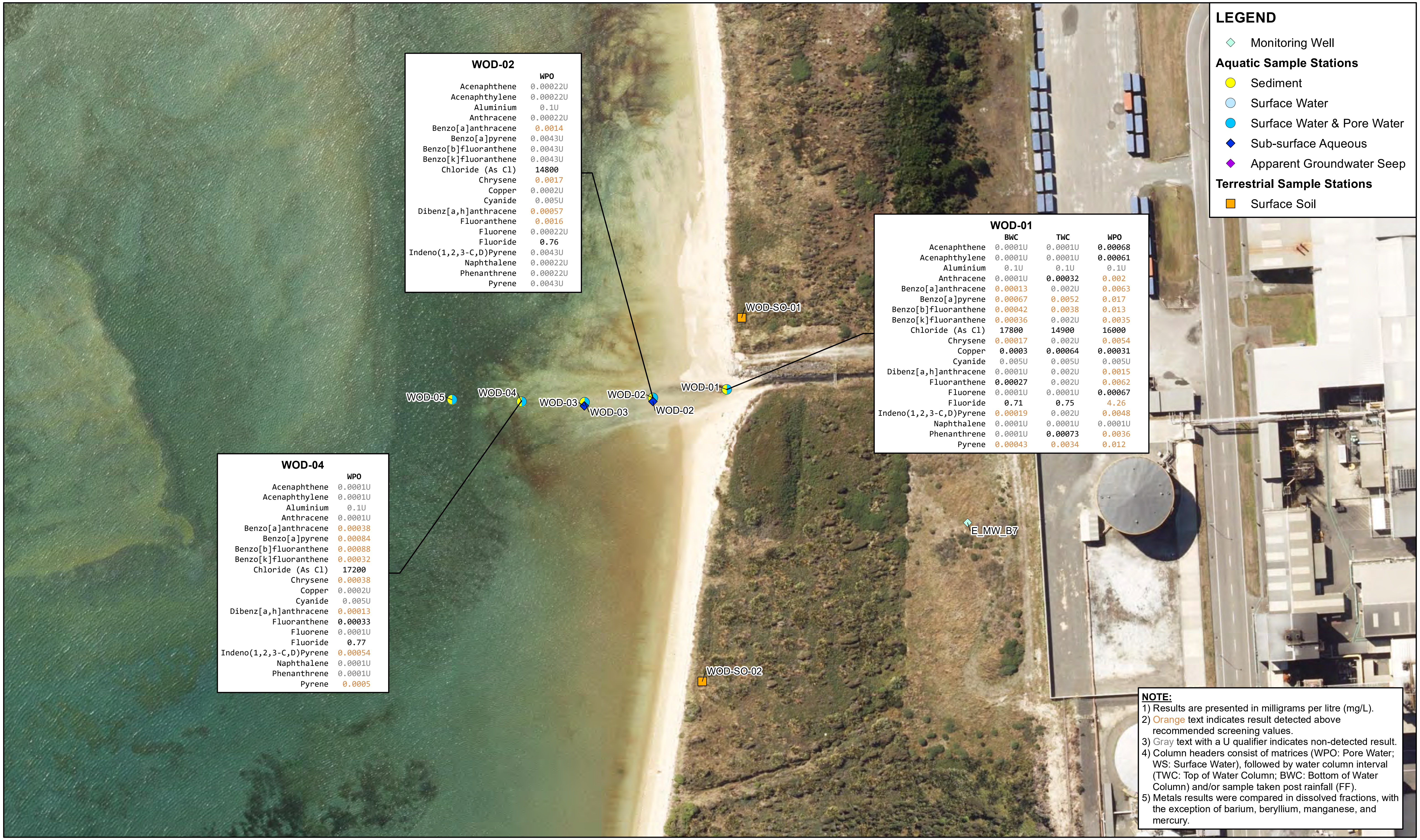

**WOD-02**

| | WPO |
|---|---|
| Acenaphthene | 0.00022U |
| Acenaphthylene | 0.00022U |
| Aluminium | 0.1U |
| Anthracene | 0.00022U |
| Benzo[a]anthracene | 0.0014 |
| Benzo[a]pyrene | 0.0043U |
| Benzo[b]fluoranthene | 0.0043U |
| Benzo[k]fluoranthene | 0.0043U |
| Chloride (As Cl) | 14800 |
| Chrysene | 0.0017 |
| Copper | 0.0002U |
| Cyanide | 0.005U |
| Dibenz[a,h]anthracene | 0.00057 |
| Fluoranthene | 0.0016 |
| Fluorene | 0.00022U |
| Fluoride | 0.76 |
| Indeno(1,2,3-C,D)Pyrene | 0.0043U |
| Naphthalene | 0.00022U |
| Phenanthrene | 0.00022U |
| Pyrene | 0.0043U |

**WOD-01**

| | BWC | TWC | WPO |
|---|---|---|---|
| Acenaphthene | 0.0001U | 0.0001U | 0.00068 |
| Acenaphthylene | 0.0001U | 0.0001U | 0.00061 |
| Aluminium | 0.1U | 0.1U | 0.1U |
| Anthracene | 0.0001U | 0.00032 | 0.002 |
| Benzo[a]anthracene | 0.00013 | 0.002U | 0.0063 |
| Benzo[a]pyrene | 0.00067 | 0.0052 | 0.017 |
| Benzo[b]fluoranthene | 0.00042 | 0.0038 | 0.013 |
| Benzo[k]fluoranthene | 0.00036 | 0.002U | 0.0035 |
| Chloride (As Cl) | 17800 | 14900 | 16000 |
| Chrysene | 0.00017 | 0.002U | 0.0054 |
| Copper | 0.0003 | 0.00064 | 0.00031 |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Dibenz[a,h]anthracene | 0.0001U | 0.002U | 0.0015 |
| Fluoranthene | 0.00027 | 0.002U | 0.0062 |
| Fluorene | 0.0001U | 0.0001U | 0.00067 |
| Fluoride | 0.71 | 0.75 | 4.26 |
| Indeno(1,2,3-C,D)Pyrene | 0.00019 | 0.002U | 0.0048 |
| Naphthalene | 0.0001U | 0.0001U | 0.0001U |
| Phenanthrene | 0.0001U | 0.00073 | 0.0036 |
| Pyrene | 0.00043 | 0.0034 | 0.012 |

**WOD-04**

| | WPO |
|---|---|
| Acenaphthene | 0.0001U |
| Acenaphthylene | 0.0001U |
| Aluminium | 0.1U |
| Anthracene | 0.0001U |
| Benzo[a]anthracene | 0.00038 |
| Benzo[a]pyrene | 0.00084 |
| Benzo[b]fluoranthene | 0.00088 |
| Benzo[k]fluoranthene | 0.00032 |
| Chloride (As Cl) | 17200 |
| Chrysene | 0.00038 |
| Copper | 0.0002U |
| Cyanide | 0.005U |
| Dibenz[a,h]anthracene | 0.00013 |
| Fluoranthene | 0.00033 |
| Fluorene | 0.0001U |
| Fluoride | 0.77 |
| Indeno(1,2,3-C,D)Pyrene | 0.00054 |
| Naphthalene | 0.0001U |
| Phenanthrene | 0.0001U |
| Pyrene | 0.0005 |

**LEGEND**

- ◇ Monitoring Well

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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# West Drain Assessment Area - May 2023 Resampling Event
# Aqueous Supplemental Sampling Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 14D

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,200 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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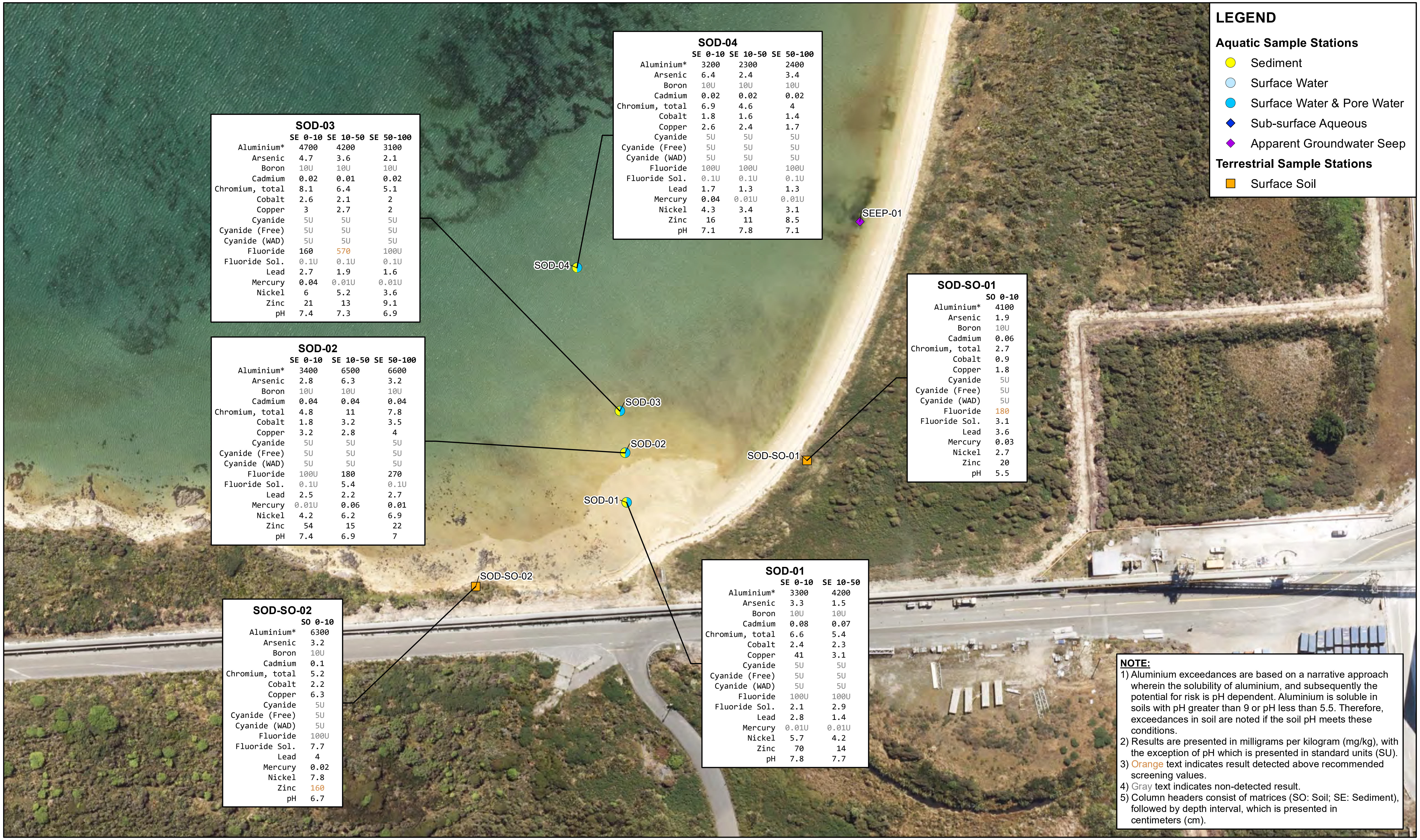

## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**SOD-04**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 3200 | 2300 | 2400 |
| Arsenic | 6.4 | 2.4 | 3.4 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.02 | 0.02 | 0.02 |
| Chromium, total | 6.9 | 4.6 | 4 |
| Cobalt | 1.8 | 1.6 | 1.4 |
| Copper | 2.6 | 2.4 | 1.7 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 100U | 100U |
| Fluoride Sol. | 0.1U | 0.1U | 0.1U |
| Lead | 1.7 | 1.3 | 1.3 |
| Mercury | 0.04 | 0.01U | 0.01U |
| Nickel | 4.3 | 3.4 | 3.1 |
| Zinc | 16 | 11 | 8.5 |
| pH | 7.1 | 7.8 | 7.1 |

**SOD-03**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 4700 | 4200 | 3100 |
| Arsenic | 4.7 | 3.6 | 2.1 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.02 | 0.01 | 0.02 |
| Chromium, total | 8.1 | 6.4 | 5.1 |
| Cobalt | 2.6 | 2.1 | 2 |
| Copper | 3 | 2.7 | 2 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 160 | 570 | 100U |
| Fluoride Sol. | 0.1U | 0.1U | 0.1U |
| Lead | 2.7 | 1.9 | 1.6 |
| Mercury | 0.04 | 0.01U | 0.01U |
| Nickel | 6 | 5.2 | 3.6 |
| Zinc | 21 | 13 | 9.1 |
| pH | 7.4 | 7.3 | 6.9 |

**SOD-SO-01**

| | SO 0-10 |
|---|---|
| Aluminium* | 4100 |
| Arsenic | 1.9 |
| Boron | 10U |
| Cadmium | 0.06 |
| Chromium, total | 2.7 |
| Cobalt | 0.9 |
| Copper | 1.8 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 180 |
| Fluoride Sol. | 3.1 |
| Lead | 3.6 |
| Mercury | 0.03 |
| Nickel | 2.7 |
| Zinc | 20 |
| pH | 5.5 |

**SOD-02**

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 3400 | 6500 | 6600 |
| Arsenic | 2.8 | 6.3 | 3.2 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.04 | 0.04 | 0.04 |
| Chromium, total | 4.8 | 11 | 7.8 |
| Cobalt | 1.8 | 3.2 | 3.5 |
| Copper | 3.2 | 2.8 | 4 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 180 | 270 |
| Fluoride Sol. | 0.1U | 5.4 | 0.1U |
| Lead | 2.5 | 2.2 | 2.7 |
| Mercury | 0.01U | 0.06 | 0.01 |
| Nickel | 4.2 | 6.2 | 6.9 |
| Zinc | 54 | 15 | 22 |
| pH | 7.4 | 6.9 | 7 |

**SOD-01**

| | SE 0-10 | SE 10-50 |
|---|---|---|
| Aluminium* | 3300 | 4200 |
| Arsenic | 3.3 | 1.5 |
| Boron | 10U | 10U |
| Cadmium | 0.08 | 0.07 |
| Chromium, total | 6.6 | 5.4 |
| Cobalt | 2.4 | 2.3 |
| Copper | 41 | 3.1 |
| Cyanide | 5U | 5U |
| Cyanide (Free) | 5U | 5U |
| Cyanide (WAD) | 5U | 5U |
| Fluoride | 100U | 100U |
| Fluoride Sol. | 2.1 | 2.9 |
| Lead | 2.8 | 1.4 |
| Mercury | 0.01U | 0.01U |
| Nickel | 5.7 | 4.2 |
| Zinc | 70 | 14 |
| pH | 7.8 | 7.7 |

**SOD-SO-02**

| | SO 0-10 |
|---|---|
| Aluminium* | 6300 |
| Arsenic | 3.2 |
| Boron | 10U |
| Cadmium | 0.1 |
| Chromium, total | 5.2 |
| Cobalt | 2.2 |
| Copper | 6.3 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 7.7 |
| Lead | 4 |
| Mercury | 0.02 |
| Nickel | 7.8 |
| Zinc | 160 |
| pH | 6.7 |

**NOTE:**

1) Aluminium exceedances are based on a narrative approach wherein the solubility of aluminium, and subsequently the potential for risk is pH dependent. Aluminium is soluble in soils with pH greater than 9 or pH less than 5.5. Therefore, exceedances in soil are noted if the soil pH meets these conditions.
2) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
3) Orange text indicates result detected above recommended screening values.
4) Gray text indicates non-detected result.
5) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).

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## South Drain Assessment Area
## Soil and Sediment Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 15A

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,200 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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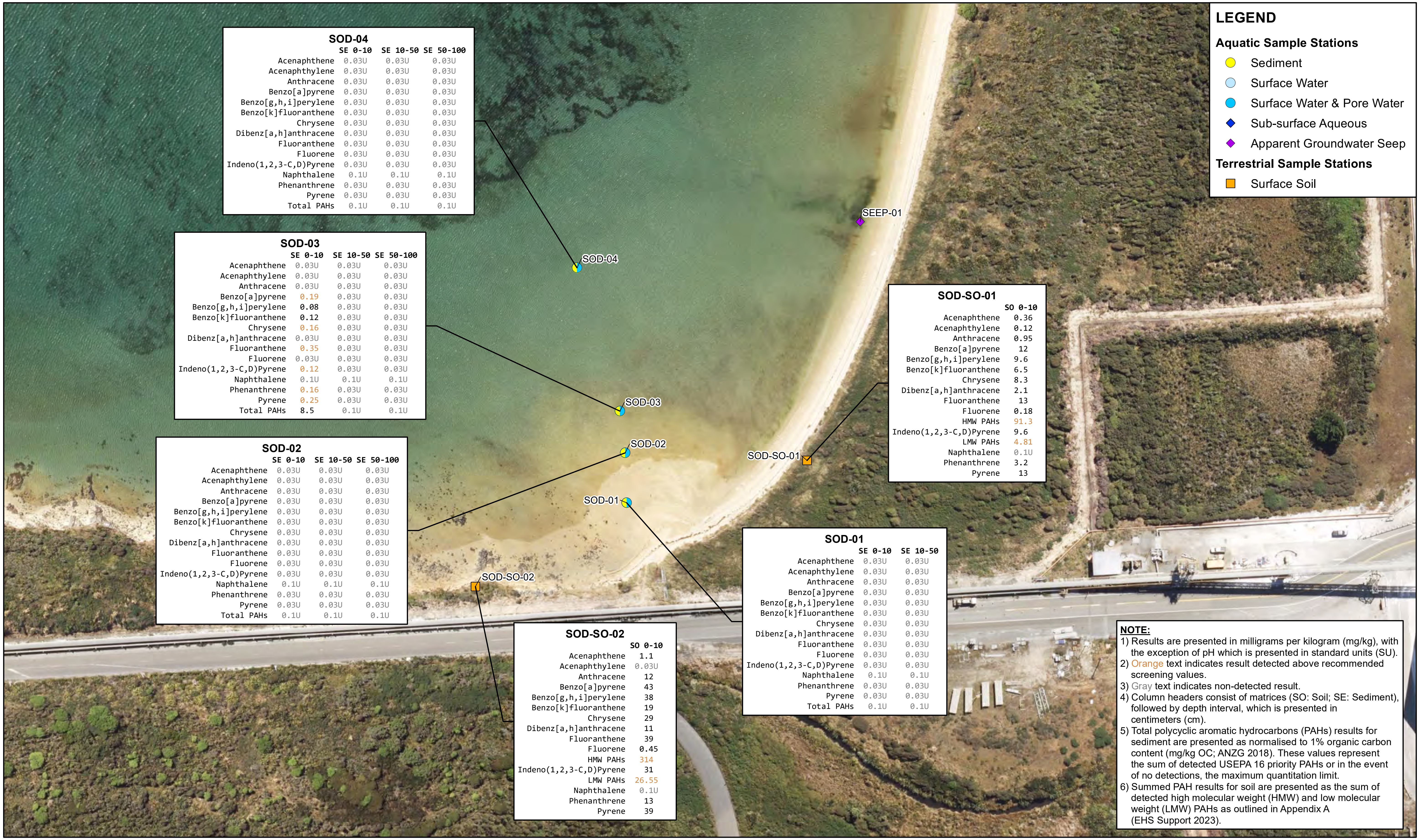

### SOD-04

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.03U | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.03U |
| Total PAHs | 0.1U | 0.1U | 0.1U |

### SOD-03

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.19 | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.08 | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.12 | 0.03U | 0.03U |
| Chrysene | 0.16 | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.35 | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.12 | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.16 | 0.03U | 0.03U |
| Pyrene | 0.25 | 0.03U | 0.03U |
| Total PAHs | 8.5 | 0.1U | 0.1U |

### SOD-02

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.03U | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.03U |
| Total PAHs | 0.1U | 0.1U | 0.1U |

### SOD-SO-01

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.36 |
| Acenaphthylene | 0.12 |
| Anthracene | 0.95 |
| Benzo[a]pyrene | 12 |
| Benzo[g,h,i]perylene | 9.6 |
| Benzo[k]fluoranthene | 6.5 |
| Chrysene | 8.3 |
| Dibenz[a,h]anthracene | 2.1 |
| Fluoranthene | 13 |
| Fluorene | 0.18 |
| HMW PAHs | 91.3 |
| Indeno(1,2,3-C,D)Pyrene | 9.6 |
| LMW PAHs | 4.81 |
| Naphthalene | 0.1U |
| Phenanthrene | 3.2 |
| Pyrene | 13 |

### SOD-01

| | SE 0-10 | SE 10-50 |
|---|---|---|
| Acenaphthene | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U |
| Total PAHs | 0.1U | 0.1U |

### SOD-SO-02

| | SO 0-10 |
|---|---|
| Acenaphthene | 1.1 |
| Acenaphthylene | 0.03U |
| Anthracene | 12 |
| Benzo[a]pyrene | 43 |
| Benzo[g,h,i]perylene | 38 |
| Benzo[k]fluoranthene | 19 |
| Chrysene | 29 |
| Dibenz[a,h]anthracene | 11 |
| Fluoranthene | 39 |
| Fluorene | 0.45 |
| HMW PAHs | 314 |
| Indeno(1,2,3-C,D)Pyrene | 31 |
| LMW PAHs | 26.55 |
| Naphthalene | 0.1U |
| Phenanthrene | 13 |
| Pyrene | 39 |

## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**NOTE:**

1) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
2) Orange text indicates result detected above recommended screening values.
3) Gray text indicates non-detected result.
4) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).
5) Total polycyclic aromatic hydrocarbons (PAHs) results for sediment are presented as normalised to 1% organic carbon content (mg/kg OC; ANZG 2018). These values represent the sum of detected USEPA 16 priority PAHs or in the event of no detections, the maximum quantitation limit.
6) Summed PAH results for soil are presented as the sum of detected high molecular weight (HMW) and low molecular weight (LMW) PAHs as outlined in Appendix A (EHS Support 2023).

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# South Drain Assessment Area
# Soil and Sediment Polycyclic Aromatic Hydrocarbon Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 15B

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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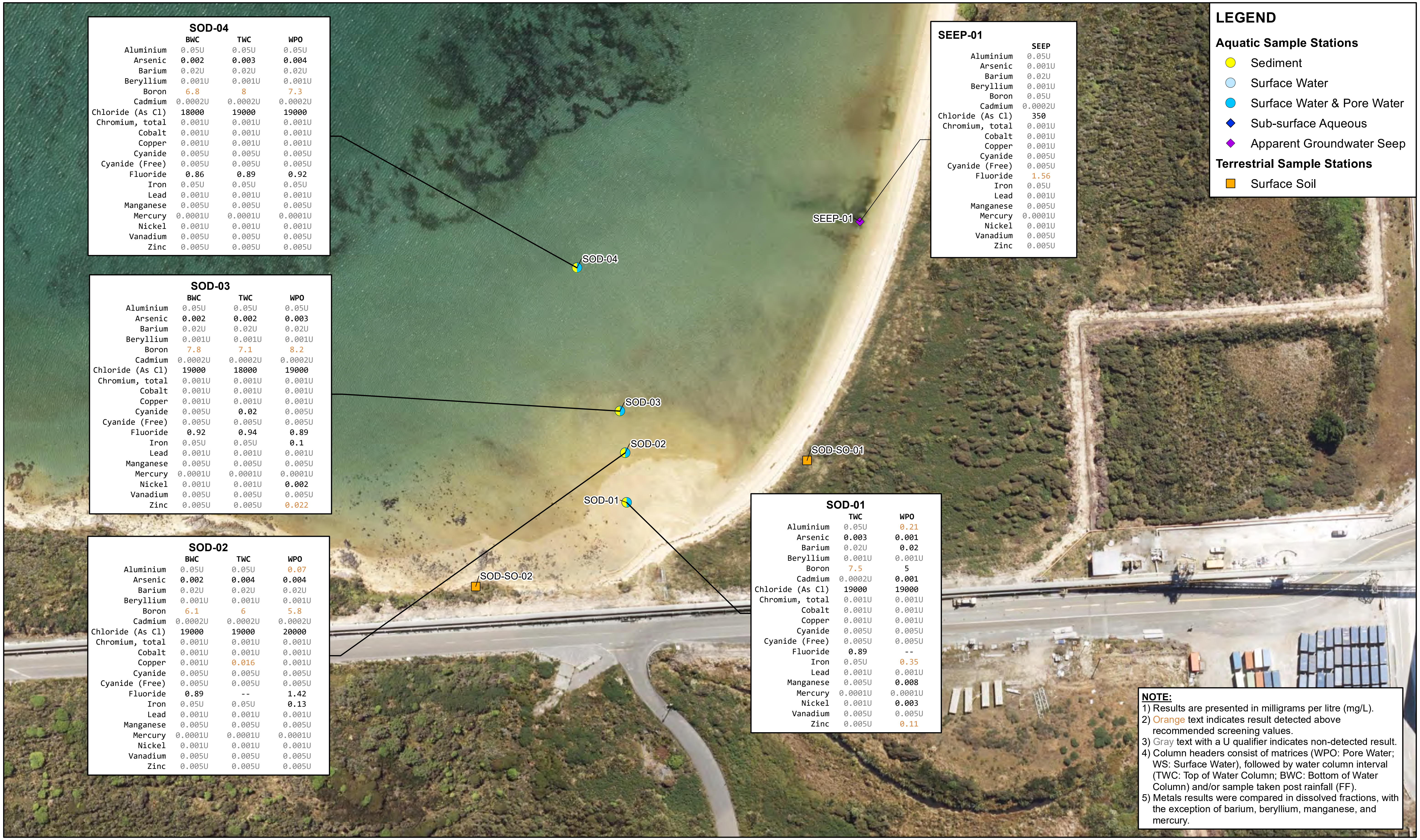

**SOD-04**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.05U |
| Arsenic | 0.002 | 0.003 | 0.004 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 6.8 | 8 | 7.3 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 18000 | 19000 | 19000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.86 | 0.89 | 0.92 |
| Iron | 0.05U | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.005U |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.005U |

**SEEP-01**

| | SEEP |
|---|---|
| Aluminium | 0.05U |
| Arsenic | 0.001U |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 0.05U |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 350 |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.001U |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 1.56 |
| Iron | 0.05U |
| Lead | 0.001U |
| Manganese | 0.005U |
| Mercury | 0.0001U |
| Nickel | 0.001U |
| Vanadium | 0.005U |
| Zinc | 0.005U |

**SOD-03**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.05U |
| Arsenic | 0.002 | 0.002 | 0.003 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 7.8 | 7.1 | 8.2 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 18000 | 19000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.02 | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.92 | 0.94 | 0.89 |
| Iron | 0.05U | 0.05U | 0.1 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.005U |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.002 |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.022 |

**SOD-02**

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.07 |
| Arsenic | 0.002 | 0.004 | 0.004 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 6.1 | 6 | 5.8 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 19000 | 20000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.001U | 0.016 | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.89 | -- | 1.42 |
| Iron | 0.05U | 0.05U | 0.13 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.005U |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.005U |

**SOD-01**

| | TWC | WPO |
|---|---|---|
| Aluminium | 0.05U | 0.21 |
| Arsenic | 0.003 | 0.001 |
| Barium | 0.02U | 0.02 |
| Beryllium | 0.001U | 0.001U |
| Boron | 7.5 | 5 |
| Cadmium | 0.0002U | 0.001 |
| Chloride (As Cl) | 19000 | 19000 |
| Chromium, total | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U |
| Fluoride | 0.89 | -- |
| Iron | 0.05U | 0.35 |
| Lead | 0.001U | 0.001U |
| Manganese | 0.005U | 0.008 |
| Mercury | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.003 |
| Vanadium | 0.005U | 0.005U |
| Zinc | 0.005U | 0.11 |

## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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# South Drain Assessment Area
# Surface Water and Pore Water Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 15C

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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**SOD-03**

| | WPO |
|---|---|
| Acenaphthene | 0.0001U |
| Acenaphthylene | 0.0001U |
| Aluminium | 0.1U |
| Anthracene | 0.0001U |
| Benzo[a]anthracene | 0.0001U |
| Benzo[a]pyrene | 0.0001U |
| Benzo[b]fluoranthene | 0.0001U |
| Benzo[k]fluoranthene | 0.0001U |
| Chloride (As Cl) | 18400 |
| Chrysene | 0.0001U |
| Copper | 0.00034 |
| Cyanide | 0.005U |
| Dibenz[a,h]anthracene | 0.0001U |
| Fluoranthene | 0.0001U |
| Fluorene | 0.0001U |
| Fluoride | 1.45 |
| Indeno(1,2,3-C,D)Pyrene | 0.0001U |
| Naphthalene | 0.0001U |
| Phenanthrene | 0.0001U |
| Pyrene | 0.0001U |

**SOD-01**

| | WPO |
|---|---|
| Acenaphthene | 0.0001U |
| Acenaphthylene | 0.0001U |
| Aluminium | 0.1U |
| Anthracene | 0.0001U |
| Benzo[a]anthracene | 0.0001U |
| Benzo[a]pyrene | 0.0001U |
| Benzo[b]fluoranthene | 0.0001U |
| Benzo[k]fluoranthene | 0.0001U |
| Chloride (As Cl) | 16000 |
| Chrysene | 0.0001U |
| Copper | 0.0011 |
| Cyanide | 0.005U |
| Dibenz[a,h]anthracene | 0.0001U |
| Fluoranthene | 0.0001U |
| Fluorene | 0.0001U |
| Fluoride | 3.07 |
| Indeno(1,2,3-C,D)Pyrene | 0.0001U |
| Naphthalene | 0.0001U |
| Phenanthrene | 0.0001U |
| Pyrene | 0.0001U |

## LEGEND

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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# South Drain Assessment Area - May 2023 Resampling Event
# Aqueous Supplemental Sampling Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 15D

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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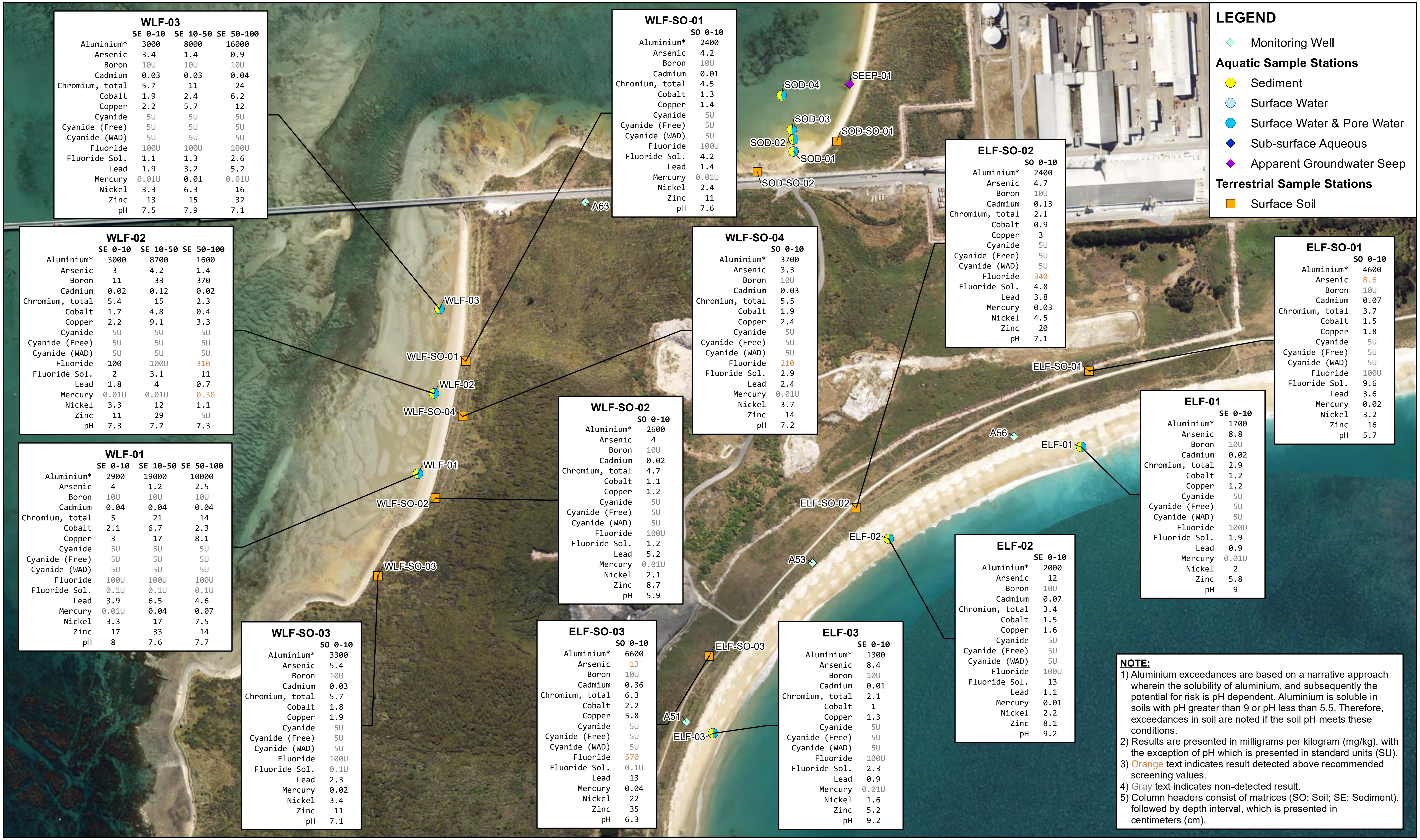

## LEGEND

| | |
|---|---|
| ◇ | Monitoring Well |
| **Aquatic Sample Stations** | |
| ● | Sediment |
| ● | Surface Water |
| ● | Surface Water & Pore Water |
| ◆ | Sub-surface Aqueous |
| ◆ | Apparent Groundwater Seep |
| **Terrestrial Sample Stations** | |
| ■ | Surface Soil |

### WLF-03

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 3000 | 8000 | 16000 |
| Arsenic | 3.4 | 1.4 | 0.9 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.03 | 0.03 | 0.04 |
| Chromium, total | 5.7 | 11 | 24 |
| Cobalt | 1.9 | 2.4 | 6.2 |
| Copper | 2.2 | 5.7 | 12 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 100U | 100U |
| Fluoride Sol. | 1.1 | 1.3 | 2.6 |
| Lead | 1.9 | 3.2 | 5.2 |
| Mercury | 0.01U | 0.01 | 0.01U |
| Nickel | 3.3 | 6.3 | 16 |
| Zinc | 13 | 15 | 32 |
| pH | 7.5 | 7.9 | 7.1 |

### WLF-02

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 3000 | 8700 | 1600 |
| Arsenic | 3 | 4.2 | 1.4 |
| Boron | 11 | 33 | 370 |
| Cadmium | 0.02 | 0.12 | 0.02 |
| Chromium, total | 5.4 | 15 | 2.3 |
| Cobalt | 1.7 | 4.8 | 0.4 |
| Copper | 2.2 | 9.1 | 3.3 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100 | 100U | 310 |
| Fluoride Sol. | 2 | 3.1 | 11 |
| Lead | 1.8 | 4 | 0.7 |
| Mercury | 0.01U | 0.01U | 0.38 |
| Nickel | 3.3 | 12 | 1.1 |
| Zinc | 11 | 29 | 5U |
| pH | 7.3 | 7.7 | 7.3 |

### WLF-01

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Aluminium* | 2900 | 19000 | 10000 |
| Arsenic | 4 | 1.2 | 2.5 |
| Boron | 10U | 10U | 10U |
| Cadmium | 0.04 | 0.04 | 0.04 |
| Chromium, total | 5 | 21 | 14 |
| Cobalt | 2.1 | 6.7 | 2.3 |
| Copper | 3 | 17 | 8.1 |
| Cyanide | 5U | 5U | 5U |
| Cyanide (Free) | 5U | 5U | 5U |
| Cyanide (WAD) | 5U | 5U | 5U |
| Fluoride | 100U | 100U | 100U |
| Fluoride Sol. | 0.1U | 0.1U | 0.1U |
| Lead | 3.9 | 6.5 | 4.6 |
| Mercury | 0.01U | 0.04 | 0.07 |
| Nickel | 3.3 | 17 | 7.5 |
| Zinc | 17 | 33 | 14 |
| pH | 8 | 7.6 | 7.7 |

### WLF-SO-01

| | SO 0-10 |
|---|---|
| Aluminium* | 2400 |
| Arsenic | 4.2 |
| Boron | 10U |
| Cadmium | 0.01 |
| Chromium, total | 4.5 |
| Cobalt | 1.3 |
| Copper | 1.4 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 4.2 |
| Lead | 1.4 |
| Mercury | 0.01U |
| Nickel | 2.4 |
| Zinc | 11 |
| pH | 7.6 |

### WLF-SO-04

| | SO 0-10 |
|---|---|
| Aluminium* | 3700 |
| Arsenic | 3.3 |
| Boron | 10U |
| Cadmium | 0.03 |
| Chromium, total | 5.5 |
| Cobalt | 1.9 |
| Copper | 2.4 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 210 |
| Fluoride Sol. | 2.9 |
| Lead | 2.4 |
| Mercury | 0.01U |
| Nickel | 3.7 |
| Zinc | 14 |
| pH | 7.2 |

### WLF-SO-02

| | SO 0-10 |
|---|---|
| Aluminium* | 2600 |
| Arsenic | 4 |
| Boron | 10U |
| Cadmium | 0.02 |
| Chromium, total | 4.7 |
| Cobalt | 1.1 |
| Copper | 1.2 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 1.2 |
| Lead | 5.2 |
| Mercury | 0.01U |
| Nickel | 2.1 |
| Zinc | 8.7 |
| pH | 5.9 |

### WLF-SO-03

| | SO 0-10 |
|---|---|
| Aluminium* | 3300 |
| Arsenic | 5.4 |
| Boron | 10U |
| Cadmium | 0.03 |
| Chromium, total | 5.7 |
| Cobalt | 1.8 |
| Copper | 1.9 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 0.1U |
| Lead | 2.3 |
| Mercury | 0.02 |
| Nickel | 3.4 |
| Zinc | 11 |
| pH | 7.1 |

### ELF-SO-03

| | SO 0-10 |
|---|---|
| Aluminium* | 6600 |
| Arsenic | 13 |
| Boron | 10U |
| Cadmium | 0.36 |
| Chromium, total | 6.3 |
| Cobalt | 2.2 |
| Copper | 5.8 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 570 |
| Fluoride Sol. | 0.1U |
| Lead | 13 |
| Mercury | 0.04 |
| Nickel | 22 |
| Zinc | 35 |
| pH | 6.3 |

### ELF-SO-02

| | SO 0-10 |
|---|---|
| Aluminium* | 2400 |
| Arsenic | 4.7 |
| Boron | 10U |
| Cadmium | 0.13 |
| Chromium, total | 2.1 |
| Cobalt | 0.9 |
| Copper | 3 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 340 |
| Fluoride Sol. | 4.8 |
| Lead | 3.8 |
| Mercury | 0.03 |
| Nickel | 4.5 |
| Zinc | 20 |
| pH | 7.1 |

### ELF-SO-01

| | SO 0-10 |
|---|---|
| Aluminium* | 4600 |
| Arsenic | 8.6 |
| Boron | 10U |
| Cadmium | 0.07 |
| Chromium, total | 3.7 |
| Cobalt | 1.5 |
| Copper | 1.8 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 9.6 |
| Lead | 3.6 |
| Mercury | 0.02 |
| Nickel | 3.2 |
| Zinc | 16 |
| pH | 5.7 |

### ELF-01

| | SE 0-10 |
|---|---|
| Aluminium* | 1700 |
| Arsenic | 8.8 |
| Boron | 10U |
| Cadmium | 0.02 |
| Chromium, total | 2.9 |
| Cobalt | 1.2 |
| Copper | 1.2 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 1.9 |
| Lead | 0.9 |
| Mercury | 0.01U |
| Nickel | 2 |
| Zinc | 5.8 |
| pH | 9 |

### ELF-02

| | SE 0-10 |
|---|---|
| Aluminium* | 2000 |
| Arsenic | 12 |
| Boron | 10U |
| Cadmium | 0.07 |
| Chromium, total | 3.4 |
| Cobalt | 1.5 |
| Copper | 1.6 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 13 |
| Lead | 1.1 |
| Mercury | 0.01 |
| Nickel | 2.2 |
| Zinc | 8.1 |
| pH | 9.2 |

### ELF-03

| | SE 0-10 |
|---|---|
| Aluminium* | 1300 |
| Arsenic | 8.4 |
| Boron | 10U |
| Cadmium | 0.01 |
| Chromium, total | 2.1 |
| Cobalt | 1 |
| Copper | 1.3 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 2.3 |
| Lead | 0.9 |
| Mercury | 0.01U |
| Nickel | 1.6 |
| Zinc | 5.2 |
| pH | 9.2 |

**NOTE:**

1) Aluminium exceedances are based on a narrative approach wherein the solubility of aluminium, and subsequently the potential for risk is pH dependent. Aluminium is soluble in soils with pH greater than 9 or pH less than 5.5. Therefore, exceedances in soil are noted if the soil pH meets these conditions.
2) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
3) Orange text indicates result detected above recommended screening values.
4) Gray text indicates non-detected result.
5) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).

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# Landfill Assessment Area
# Soil and Sediment Trace Element/Inorganic Results

0 40 80 160 240 320 Meters
1 cm = 50 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 16A

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:5,000 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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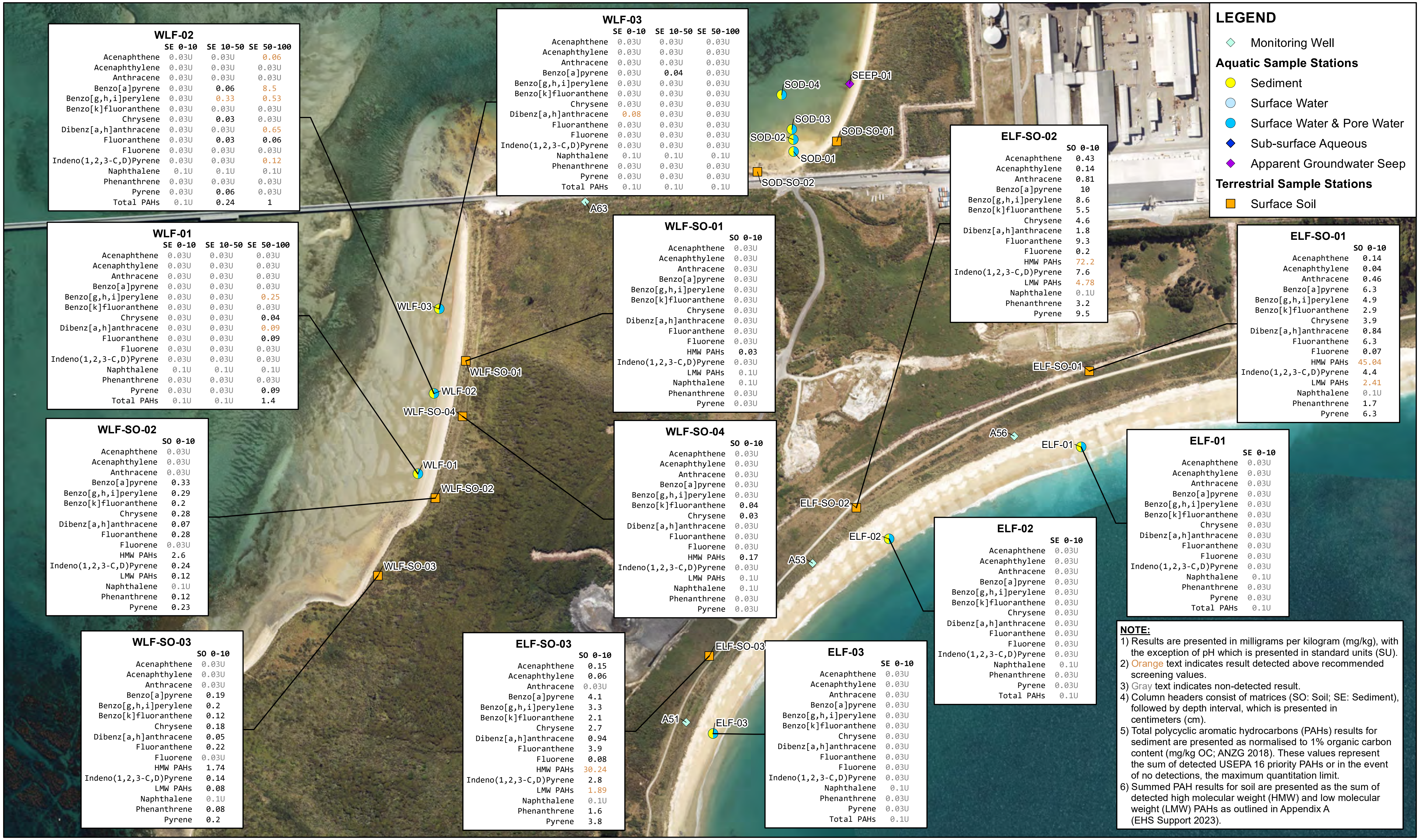

## WLF-02

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.06 |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.06 | 8.5 |
| Benzo[g,h,i]perylene | 0.03U | 0.33 | 0.53 |
| Benzo[k]fluoranthene | 0.03U | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03 | 0.03U |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.65 |
| Fluoranthene | 0.03U | 0.03 | 0.06 |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.12 |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.06 | 0.03U |
| Total PAHs | 0.1U | 0.24 | 1 |

## WLF-03

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.04 | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.03U |
| Benzo[k]fluoranthene | 0.03U | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03U | 0.03U |
| Dibenz[a,h]anthracene | 0.08 | 0.03U | 0.03U |
| Fluoranthene | 0.03U | 0.03U | 0.03U |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.03U |
| Total PAHs | 0.1U | 0.1U | 0.1U |

## LEGEND

◇ Monitoring Well

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

## ELF-SO-02

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.43 |
| Acenaphthylene | 0.14 |
| Anthracene | 0.81 |
| Benzo[a]pyrene | 10 |
| Benzo[g,h,i]perylene | 8.6 |
| Benzo[k]fluoranthene | 5.5 |
| Chrysene | 4.6 |
| Dibenz[a,h]anthracene | 1.8 |
| Fluoranthene | 9.3 |
| Fluorene | 0.2 |
| HMW PAHs | 72.2 |
| Indeno(1,2,3-C,D)Pyrene | 7.6 |
| LMW PAHs | 4.78 |
| Naphthalene | 0.1U |
| Phenanthrene | 3.2 |
| Pyrene | 9.5 |

## WLF-01

| | SE 0-10 | SE 10-50 | SE 50-100 |
|---|---|---|---|
| Acenaphthene | 0.03U | 0.03U | 0.03U |
| Acenaphthylene | 0.03U | 0.03U | 0.03U |
| Anthracene | 0.03U | 0.03U | 0.03U |
| Benzo[a]pyrene | 0.03U | 0.03U | 0.03U |
| Benzo[g,h,i]perylene | 0.03U | 0.03U | 0.25 |
| Benzo[k]fluoranthene | 0.03U | 0.03U | 0.03U |
| Chrysene | 0.03U | 0.03U | 0.04 |
| Dibenz[a,h]anthracene | 0.03U | 0.03U | 0.09 |
| Fluoranthene | 0.03U | 0.03U | 0.09 |
| Fluorene | 0.03U | 0.03U | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U | 0.03U | 0.03U |
| Naphthalene | 0.1U | 0.1U | 0.1U |
| Phenanthrene | 0.03U | 0.03U | 0.03U |
| Pyrene | 0.03U | 0.03U | 0.09 |
| Total PAHs | 0.1U | 0.1U | 1.4 |

## WLF-SO-01

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| HMW PAHs | 0.03 |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| LMW PAHs | 0.1U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |

## ELF-SO-01

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.14 |
| Acenaphthylene | 0.04 |
| Anthracene | 0.46 |
| Benzo[a]pyrene | 6.3 |
| Benzo[g,h,i]perylene | 4.9 |
| Benzo[k]fluoranthene | 2.9 |
| Chrysene | 3.9 |
| Dibenz[a,h]anthracene | 0.84 |
| Fluoranthene | 6.3 |
| Fluorene | 0.07 |
| HMW PAHs | 45.04 |
| Indeno(1,2,3-C,D)Pyrene | 4.4 |
| LMW PAHs | 2.41 |
| Naphthalene | 0.1U |
| Phenanthrene | 1.7 |
| Pyrene | 6.3 |

## WLF-SO-02

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.33 |
| Benzo[g,h,i]perylene | 0.29 |
| Benzo[k]fluoranthene | 0.2 |
| Chrysene | 0.28 |
| Dibenz[a,h]anthracene | 0.07 |
| Fluoranthene | 0.28 |
| Fluorene | 0.03U |
| HMW PAHs | 2.6 |
| Indeno(1,2,3-C,D)Pyrene | 0.24 |
| LMW PAHs | 0.12 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.12 |
| Pyrene | 0.23 |

## WLF-SO-04

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.04 |
| Chrysene | 0.03 |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| HMW PAHs | 0.17 |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| LMW PAHs | 0.1U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |

## ELF-01

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

## ELF-02

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

## WLF-SO-03

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.19 |
| Benzo[g,h,i]perylene | 0.2 |
| Benzo[k]fluoranthene | 0.12 |
| Chrysene | 0.18 |
| Dibenz[a,h]anthracene | 0.05 |
| Fluoranthene | 0.22 |
| Fluorene | 0.03U |
| HMW PAHs | 1.74 |
| Indeno(1,2,3-C,D)Pyrene | 0.14 |
| LMW PAHs | 0.08 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.08 |
| Pyrene | 0.2 |

## ELF-SO-03

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.15 |
| Acenaphthylene | 0.06 |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 4.1 |
| Benzo[g,h,i]perylene | 3.3 |
| Benzo[k]fluoranthene | 2.1 |
| Chrysene | 2.7 |
| Dibenz[a,h]anthracene | 0.94 |
| Fluoranthene | 3.9 |
| Fluorene | 0.08 |
| HMW PAHs | 30.24 |
| Indeno(1,2,3-C,D)Pyrene | 2.8 |
| LMW PAHs | 1.89 |
| Naphthalene | 0.1U |
| Phenanthrene | 1.6 |
| Pyrene | 3.8 |

## ELF-03

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**NOTE:**

1) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
2) Orange text indicates result detected above recommended screening values.
3) Gray text indicates non-detected result.
4) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).
5) Total polycyclic aromatic hydrocarbons (PAHs) results for sediment are presented as normalised to 1% organic carbon content (mg/kg OC; ANZG 2018). These values represent the sum of detected USEPA 16 priority PAHs or in the event of no detections, the maximum quantitation limit.
6) Summed PAH results for soil are presented as the sum of detected high molecular weight (HMW) and low molecular weight (LMW) PAHs as outlined in Appendix A (EHS Support 2023).

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# Landfill Assessment Area
# Soil and Sediment Polycyclic Aromatic Hydrocarbon Results

0 40 80 160 240 320 Meters

1 cm = 50 meters [Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 16B

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:5,000 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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## LEGEND

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment

○ Surface Water

● Surface Water & Pore Water

◆ Sub-surface Aqueous

◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

### WLF-03

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.05U |
| Arsenic | 0.002 | 0.002 | 0.002 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 20000 | 19000 | 20000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.89 | 0.89 | 0.92 |
| Iron | 0.05U | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.005U |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.005U |

### WLF-02

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.05U |
| Arsenic | 0.002 | 0.002 | 0.005 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 19000 | 18000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.88 | 0.88 | 1.45 |
| Iron | 0.05U | 0.05U | 0.05 |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.036 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.005U |

### WLF-01

| | BWC | TWC | WPO |
|---|---|---|---|
| Aluminium | 0.05U | 0.05U | 0.05U |
| Arsenic | 0.002 | 0.002 | 0.007 |
| Barium | 0.02U | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U | 0.001U |
| Boron | 7.7 | 6.6 | 7.3 |
| Cadmium | 0.0002U | 0.0002U | 0.0002U |
| Chloride (As Cl) | 18000 | 19000 | 18000 |
| Chromium, total | 0.001U | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U | 0.005U |
| Fluoride | 0.9 | -- | 0.95 |
| Iron | 0.05U | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U | 0.007 |
| Mercury | 0.0001U | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U | 0.005U |

### ELF-02

| | WPO | WS |
|---|---|---|
| Aluminium | 0.05U | 0.05U |
| Arsenic | 0.001 | 0.001 |
| Barium | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U |
| Chloride (As Cl) | 20000 | 20000 |
| Chromium, total | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U |
| Fluoride | 0.9 | 0.89 |
| Iron | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U |
| Mercury | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U |

### ELF-01

| | WPO | WS |
|---|---|---|
| Aluminium | 0.05U | 0.05U |
| Arsenic | 0.001 | 0.001 |
| Barium | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U |
| Chloride (As Cl) | 20000 | 20000 |
| Chromium, total | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U |
| Fluoride | 0.89 | 0.88 |
| Iron | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U |
| Mercury | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U |

### ELF-03

| | WPO | WS |
|---|---|---|
| Aluminium | 0.05U | 0.05U |
| Arsenic | 0.002 | 0.001 |
| Barium | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U |
| Chloride (As Cl) | 20000 | 20000 |
| Chromium, total | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U |
| Copper | 0.001 | 0.001U |
| Cyanide | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U |
| Fluoride | 0.88 | 0.87 |
| Iron | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U |
| Mercury | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U |

**NOTE:**
1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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## Landfill Assessment Area
## Surface Water and Pore Water Trace Element/Inorganic Results

1 cm = 50 meters [Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 16C

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:5,000 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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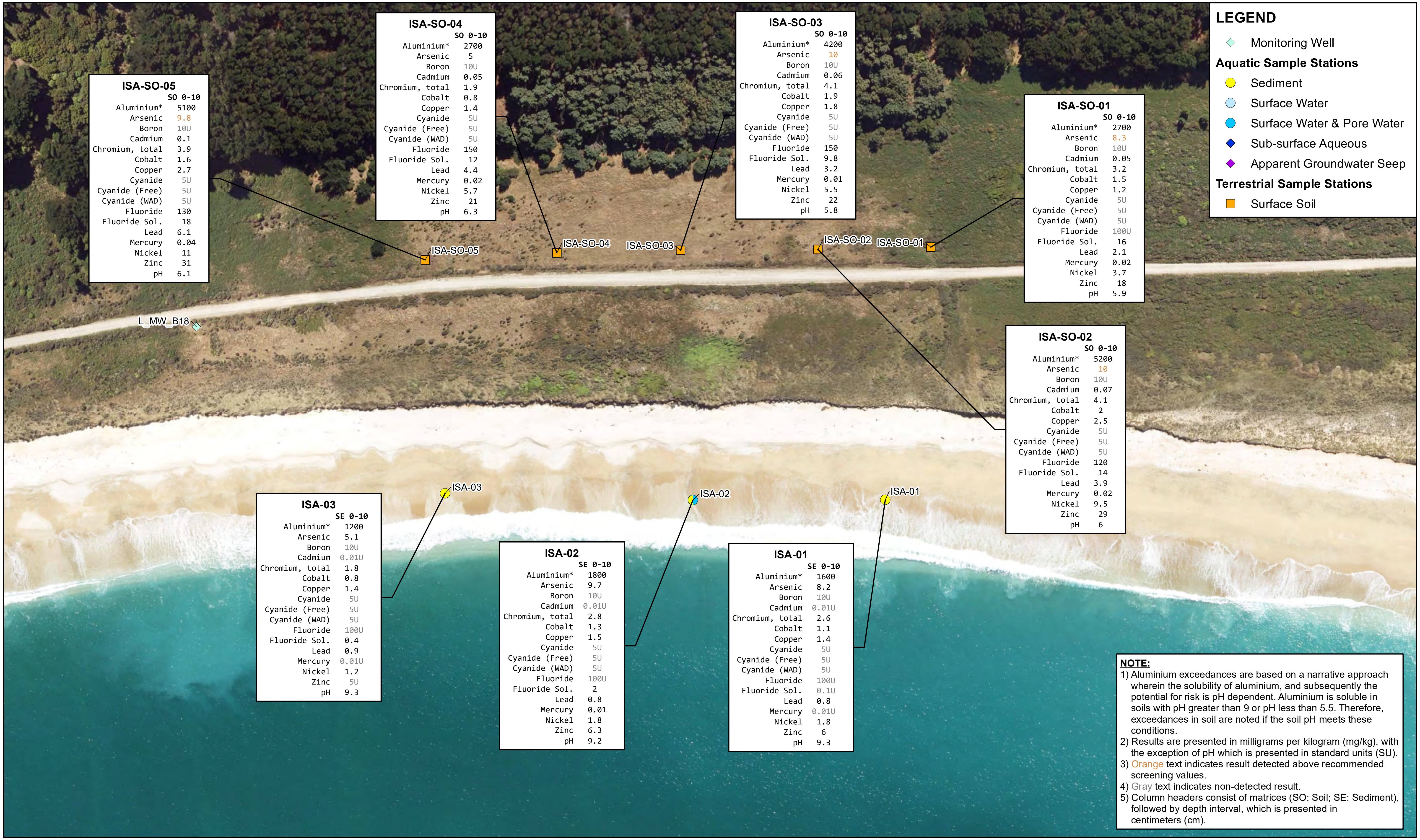

**ISA-SO-05**

| | SO 0-10 |
|---|---|
| Aluminium* | 5100 |
| Arsenic | 9.8 |
| Boron | 10U |
| Cadmium | 0.1 |
| Chromium, total | 3.9 |
| Cobalt | 1.6 |
| Copper | 2.7 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 130 |
| Fluoride Sol. | 18 |
| Lead | 6.1 |
| Mercury | 0.04 |
| Nickel | 11 |
| Zinc | 31 |
| pH | 6.1 |

**ISA-SO-04**

| | SO 0-10 |
|---|---|
| Aluminium* | 2700 |
| Arsenic | 5 |
| Boron | 10U |
| Cadmium | 0.05 |
| Chromium, total | 1.9 |
| Cobalt | 0.8 |
| Copper | 1.4 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 150 |
| Fluoride Sol. | 12 |
| Lead | 4.4 |
| Mercury | 0.02 |
| Nickel | 5.7 |
| Zinc | 21 |
| pH | 6.3 |

**ISA-SO-03**

| | SO 0-10 |
|---|---|
| Aluminium* | 4200 |
| Arsenic | 10 |
| Boron | 10U |
| Cadmium | 0.06 |
| Chromium, total | 4.1 |
| Cobalt | 1.9 |
| Copper | 1.8 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 150 |
| Fluoride Sol. | 9.8 |
| Lead | 3.2 |
| Mercury | 0.01 |
| Nickel | 5.5 |
| Zinc | 22 |
| pH | 5.8 |

**ISA-SO-01**

| | SO 0-10 |
|---|---|
| Aluminium* | 2700 |
| Arsenic | 8.3 |
| Boron | 10U |
| Cadmium | 0.05 |
| Chromium, total | 3.2 |
| Cobalt | 1.5 |
| Copper | 1.2 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 16 |
| Lead | 2.1 |
| Mercury | 0.02 |
| Nickel | 3.7 |
| Zinc | 18 |
| pH | 5.9 |

**ISA-SO-02**

| | SO 0-10 |
|---|---|
| Aluminium* | 5200 |
| Arsenic | 10 |
| Boron | 10U |
| Cadmium | 0.07 |
| Chromium, total | 4.1 |
| Cobalt | 2 |
| Copper | 2.5 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 120 |
| Fluoride Sol. | 14 |
| Lead | 3.9 |
| Mercury | 0.02 |
| Nickel | 9.5 |
| Zinc | 29 |
| pH | 6 |

**ISA-03**

| | SE 0-10 |
|---|---|
| Aluminium* | 1200 |
| Arsenic | 5.1 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 1.8 |
| Cobalt | 0.8 |
| Copper | 1.4 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 0.4 |
| Lead | 0.9 |
| Mercury | 0.01U |
| Nickel | 1.2 |
| Zinc | 5U |
| pH | 9.3 |

**ISA-02**

| | SE 0-10 |
|---|---|
| Aluminium* | 1800 |
| Arsenic | 9.7 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 2.8 |
| Cobalt | 1.3 |
| Copper | 1.5 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 2 |
| Lead | 0.8 |
| Mercury | 0.01 |
| Nickel | 1.8 |
| Zinc | 6.3 |
| pH | 9.2 |

**ISA-01**

| | SE 0-10 |
|---|---|
| Aluminium* | 1600 |
| Arsenic | 8.2 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 2.6 |
| Cobalt | 1.1 |
| Copper | 1.4 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 0.1U |
| Lead | 0.8 |
| Mercury | 0.01U |
| Nickel | 1.8 |
| Zinc | 6 |
| pH | 9.3 |

**LEGEND**

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment
○ Surface Water
● Surface Water & Pore Water
◆ Sub-surface Aqueous
◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

**NOTE:**

1) Aluminium exceedances are based on a narrative approach wherein the solubility of aluminium, and subsequently the potential for risk is pH dependent. Aluminium is soluble in soils with pH greater than 9 or pH less than 5.5. Therefore, exceedances in soil are noted if the soil pH meets these conditions.
2) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
3) Orange text indicates result detected above recommended screening values.
4) Gray text indicates non-detected result.
5) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).

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# Inalco Assessment Area
# Soil and Sediment Trace Element/Inorganic Results

0 10 20 40 60 80 Meters
1 cm = 15 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 17A

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,500 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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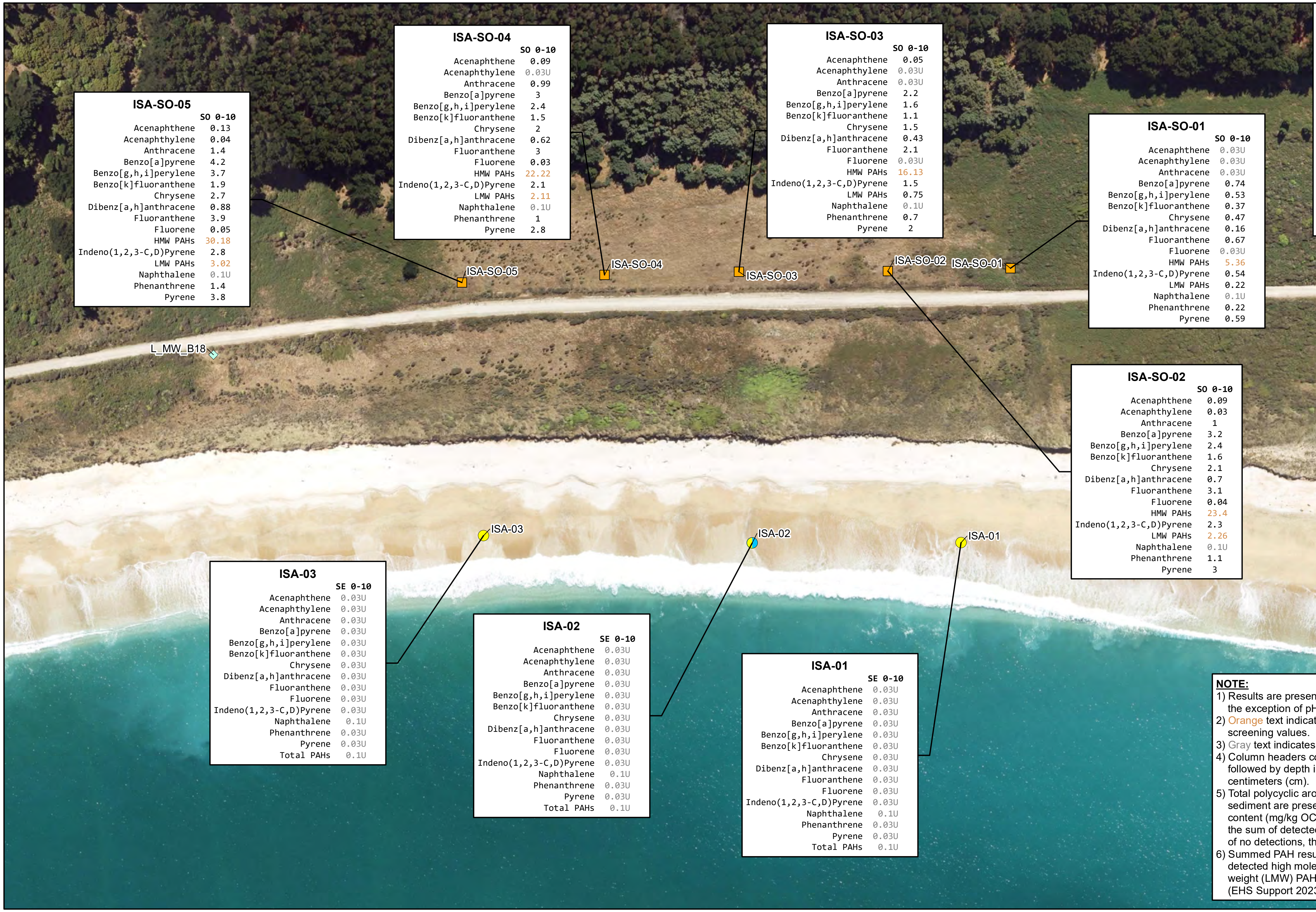

**ISA-SO-05**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.13 |
| Acenaphthylene | 0.04 |
| Anthracene | 1.4 |
| Benzo[a]pyrene | 4.2 |
| Benzo[g,h,i]perylene | 3.7 |
| Benzo[k]fluoranthene | 1.9 |
| Chrysene | 2.7 |
| Dibenz[a,h]anthracene | 0.88 |
| Fluoranthene | 3.9 |
| Fluorene | 0.05 |
| HMW PAHs | 30.18 |
| Indeno(1,2,3-C,D)Pyrene | 2.8 |
| LMW PAHs | 3.02 |
| Naphthalene | 0.1U |
| Phenanthrene | 1.4 |
| Pyrene | 3.8 |

**ISA-SO-04**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.09 |
| Acenaphthylene | 0.03U |
| Anthracene | 0.99 |
| Benzo[a]pyrene | 3 |
| Benzo[g,h,i]perylene | 2.4 |
| Benzo[k]fluoranthene | 1.5 |
| Chrysene | 2 |
| Dibenz[a,h]anthracene | 0.62 |
| Fluoranthene | 3 |
| Fluorene | 0.03 |
| HMW PAHs | 22.22 |
| Indeno(1,2,3-C,D)Pyrene | 2.1 |
| LMW PAHs | 2.11 |
| Naphthalene | 0.1U |
| Phenanthrene | 1 |
| Pyrene | 2.8 |

**ISA-SO-03**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.05 |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 2.2 |
| Benzo[g,h,i]perylene | 1.6 |
| Benzo[k]fluoranthene | 1.1 |
| Chrysene | 1.5 |
| Dibenz[a,h]anthracene | 0.43 |
| Fluoranthene | 2.1 |
| Fluorene | 0.03U |
| HMW PAHs | 16.13 |
| Indeno(1,2,3-C,D)Pyrene | 1.5 |
| LMW PAHs | 0.75 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.7 |
| Pyrene | 2 |

**ISA-SO-01**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.74 |
| Benzo[g,h,i]perylene | 0.53 |
| Benzo[k]fluoranthene | 0.37 |
| Chrysene | 0.47 |
| Dibenz[a,h]anthracene | 0.16 |
| Fluoranthene | 0.67 |
| Fluorene | 0.03U |
| HMW PAHs | 5.36 |
| Indeno(1,2,3-C,D)Pyrene | 0.54 |
| LMW PAHs | 0.22 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.22 |
| Pyrene | 0.59 |

**ISA-SO-02**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.09 |
| Acenaphthylene | 0.03 |
| Anthracene | 1 |
| Benzo[a]pyrene | 3.2 |
| Benzo[g,h,i]perylene | 2.4 |
| Benzo[k]fluoranthene | 1.6 |
| Chrysene | 2.1 |
| Dibenz[a,h]anthracene | 0.7 |
| Fluoranthene | 3.1 |
| Fluorene | 0.04 |
| HMW PAHs | 23.4 |
| Indeno(1,2,3-C,D)Pyrene | 2.3 |
| LMW PAHs | 2.26 |
| Naphthalene | 0.1U |
| Phenanthrene | 1.1 |
| Pyrene | 3 |

**ISA-03**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**ISA-02**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**ISA-01**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**LEGEND**

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment

● Surface Water

● Surface Water & Pore Water

◆ Sub-surface Aqueous

◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

**NOTE:**

1) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
2) Orange text indicates result detected above recommended screening values.
3) Gray text indicates non-detected result.
4) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).
5) Total polycyclic aromatic hydrocarbons (PAHs) results for sediment are presented as normalised to 1% organic carbon content (mg/kg OC; ANZG 2018). These values represent the sum of detected USEPA 16 priority PAHs or in the event of no detections, the maximum quantitation limit.
6) Summed PAH results for soil are presented as the sum of detected high molecular weight (HMW) and low molecular weight (LMW) PAHs as outlined in Appendix A (EHS Support 2023).

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## Inalco Assessment Area
## Soil and Sediment Polycyclic Aromatic Hydrocarbon Results

0 10 20 40 60 80 Meters
1 cm = 15 meters [Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 17B

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,500 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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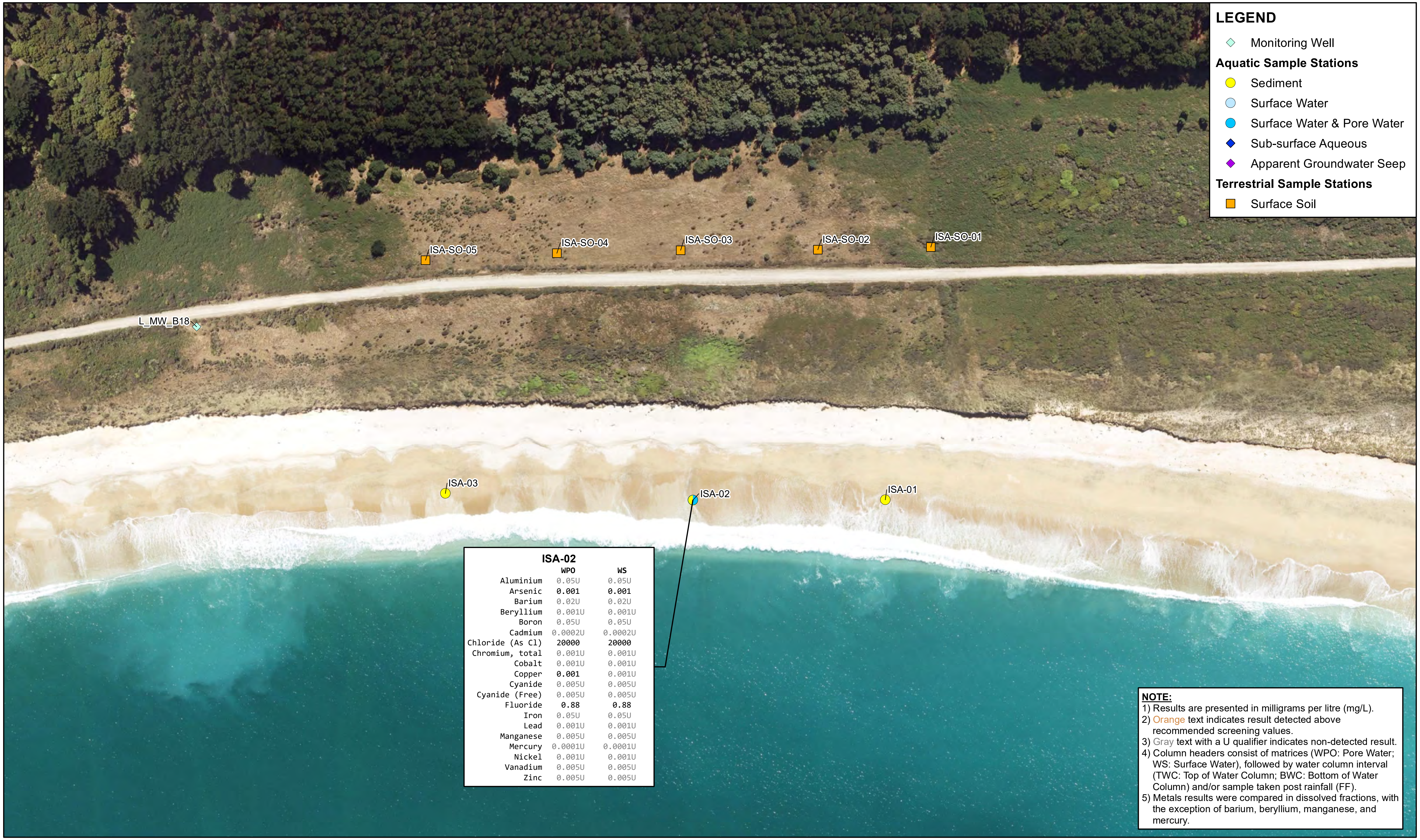

**LEGEND**

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment

● Surface Water

● Surface Water & Pore Water

◆ Sub-surface Aqueous

◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

**ISA-02**

| | WPO | WS |
|---|---|---|
| Aluminium | 0.05U | 0.05U |
| Arsenic | 0.001 | 0.001 |
| Barium | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U |
| Boron | 0.05U | 0.05U |
| Cadmium | 0.0002U | 0.0002U |
| Chloride (As Cl) | 20000 | 20000 |
| Chromium, total | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U |
| Copper | 0.001 | 0.001U |
| Cyanide | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U |
| Fluoride | 0.88 | 0.88 |
| Iron | 0.05U | 0.05U |
| Lead | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U |
| Mercury | 0.0001U | 0.0001U |
| Nickel | 0.001U | 0.001U |
| Vanadium | 0.005U | 0.005U |
| Zinc | 0.005U | 0.005U |

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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# Inalco Assessment Area
# Surface Water and Pore Water Trace Element/Inorganic Results

0 10 20 40 60 80 Meters
1 cm = 15 meters [Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 17C

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,500 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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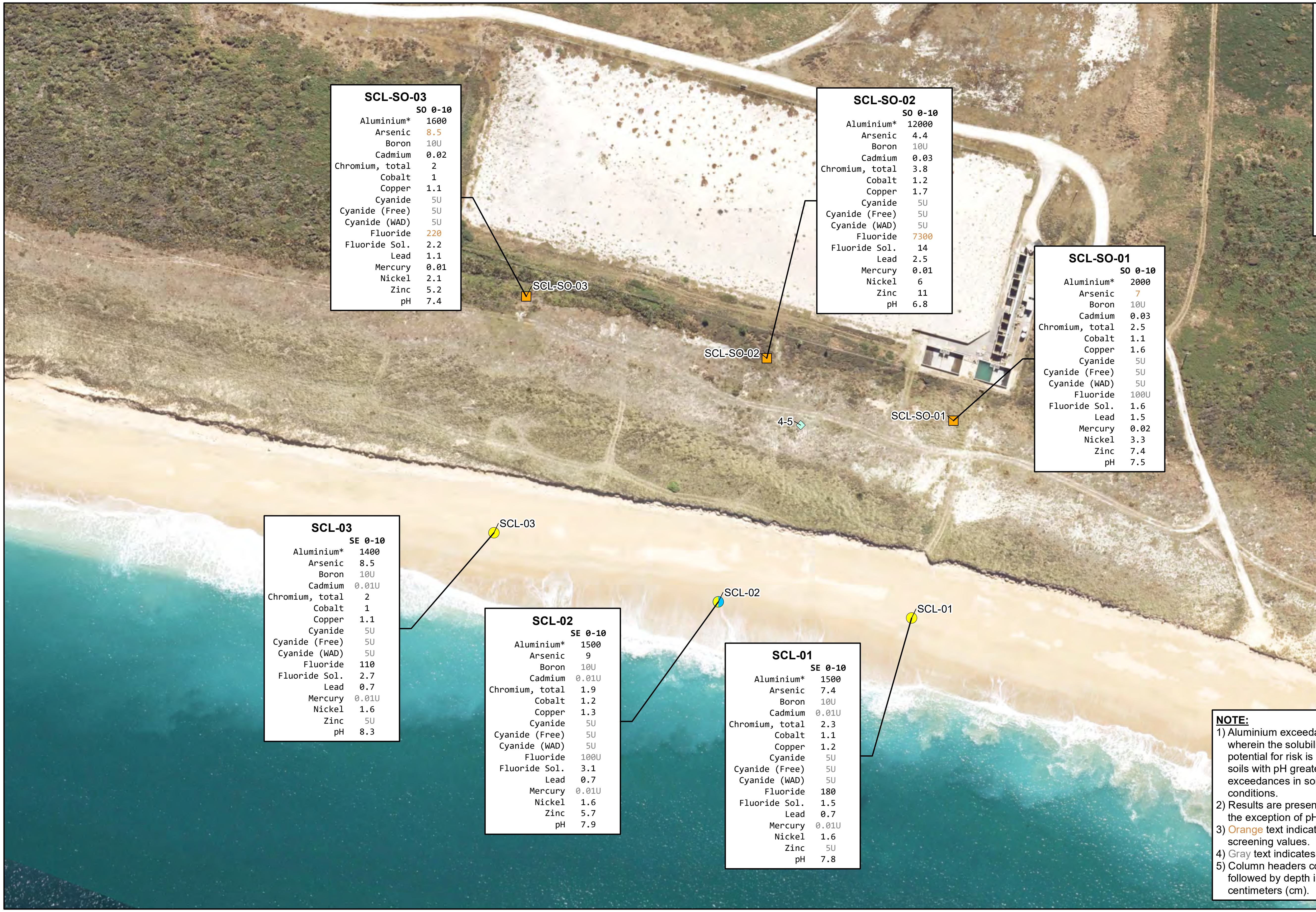

**SCL-SO-03**

| | SO 0-10 |
|---|---|
| Aluminium* | 1600 |
| Arsenic | 8.5 |
| Boron | 10U |
| Cadmium | 0.02 |
| Chromium, total | 2 |
| Cobalt | 1 |
| Copper | 1.1 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 220 |
| Fluoride Sol. | 2.2 |
| Lead | 1.1 |
| Mercury | 0.01 |
| Nickel | 2.1 |
| Zinc | 5.2 |
| pH | 7.4 |

**SCL-SO-02**

| | SO 0-10 |
|---|---|
| Aluminium* | 12000 |
| Arsenic | 4.4 |
| Boron | 10U |
| Cadmium | 0.03 |
| Chromium, total | 3.8 |
| Cobalt | 1.2 |
| Copper | 1.7 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 7300 |
| Fluoride Sol. | 14 |
| Lead | 2.5 |
| Mercury | 0.01 |
| Nickel | 6 |
| Zinc | 11 |
| pH | 6.8 |

**SCL-SO-01**

| | SO 0-10 |
|---|---|
| Aluminium* | 2000 |
| Arsenic | 7 |
| Boron | 10U |
| Cadmium | 0.03 |
| Chromium, total | 2.5 |
| Cobalt | 1.1 |
| Copper | 1.6 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 1.6 |
| Lead | 1.5 |
| Mercury | 0.02 |
| Nickel | 3.3 |
| Zinc | 7.4 |
| pH | 7.5 |

**SCL-03**

| | SE 0-10 |
|---|---|
| Aluminium* | 1400 |
| Arsenic | 8.5 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 2 |
| Cobalt | 1 |
| Copper | 1.1 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 110 |
| Fluoride Sol. | 2.7 |
| Lead | 0.7 |
| Mercury | 0.01U |
| Nickel | 1.6 |
| Zinc | 5U |
| pH | 8.3 |

**SCL-02**

| | SE 0-10 |
|---|---|
| Aluminium* | 1500 |
| Arsenic | 9 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 1.9 |
| Cobalt | 1.2 |
| Copper | 1.3 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 100U |
| Fluoride Sol. | 3.1 |
| Lead | 0.7 |
| Mercury | 0.01U |
| Nickel | 1.6 |
| Zinc | 5.7 |
| pH | 7.9 |

**SCL-01**

| | SE 0-10 |
|---|---|
| Aluminium* | 1500 |
| Arsenic | 7.4 |
| Boron | 10U |
| Cadmium | 0.01U |
| Chromium, total | 2.3 |
| Cobalt | 1.1 |
| Copper | 1.2 |
| Cyanide | 5U |
| Cyanide (Free) | 5U |
| Cyanide (WAD) | 5U |
| Fluoride | 180 |
| Fluoride Sol. | 1.5 |
| Lead | 0.7 |
| Mercury | 0.01U |
| Nickel | 1.6 |
| Zinc | 5U |
| pH | 7.8 |

**LEGEND**

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment

● Surface Water

● Surface Water & Pore Water

◆ Sub-surface Aqueous

◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

**NOTE:**

1) Aluminium exceedances are based on a narrative approach wherein the solubility of aluminium, and subsequently the potential for risk is pH dependent. Aluminium is soluble in soils with pH greater than 9 or pH less than 5.5. Therefore, exceedances in soil are noted if the soil pH meets these conditions.
2) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
3) Orange text indicates result detected above recommended screening values.
4) Gray text indicates non-detected result.
5) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).

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## SCL Pad Assessment Area
## Soil and Sediment Trace Element/Inorganic Results

0 10 20 40 60 80 Meters
1 cm = 15 meters [Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 18A

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,500 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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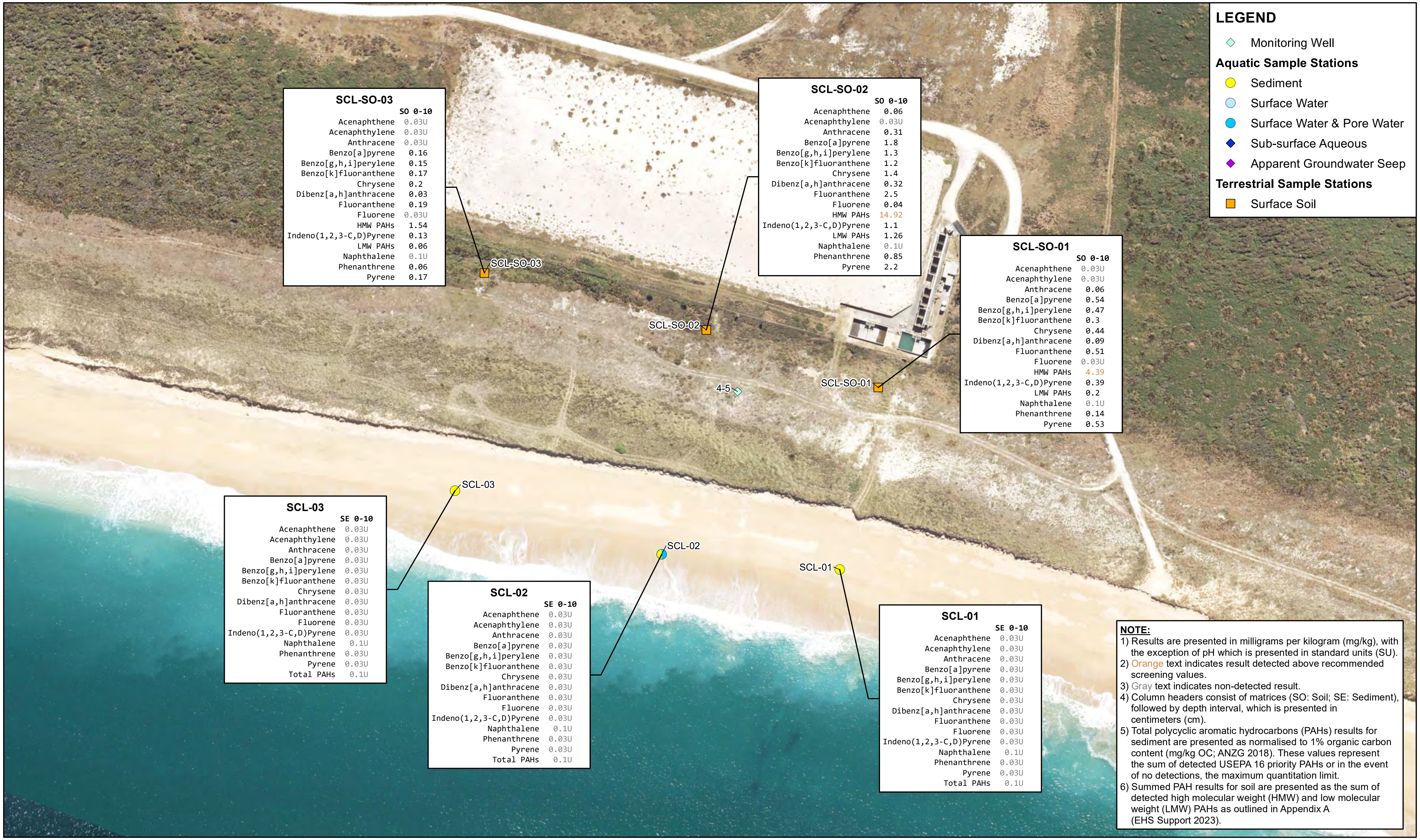

## LEGEND

◇ Monitoring Well

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**SCL-SO-03**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.16 |
| Benzo[g,h,i]perylene | 0.15 |
| Benzo[k]fluoranthene | 0.17 |
| Chrysene | 0.2 |
| Dibenz[a,h]anthracene | 0.03 |
| Fluoranthene | 0.19 |
| Fluorene | 0.03U |
| HMW PAHs | 1.54 |
| Indeno(1,2,3-C,D)Pyrene | 0.13 |
| LMW PAHs | 0.06 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.06 |
| Pyrene | 0.17 |

**SCL-SO-02**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.06 |
| Acenaphthylene | 0.03U |
| Anthracene | 0.31 |
| Benzo[a]pyrene | 1.8 |
| Benzo[g,h,i]perylene | 1.3 |
| Benzo[k]fluoranthene | 1.2 |
| Chrysene | 1.4 |
| Dibenz[a,h]anthracene | 0.32 |
| Fluoranthene | 2.5 |
| Fluorene | 0.04 |
| HMW PAHs | 14.92 |
| Indeno(1,2,3-C,D)Pyrene | 1.1 |
| LMW PAHs | 1.26 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.85 |
| Pyrene | 2.2 |

**SCL-SO-01**

| | SO 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.06 |
| Benzo[a]pyrene | 0.54 |
| Benzo[g,h,i]perylene | 0.47 |
| Benzo[k]fluoranthene | 0.3 |
| Chrysene | 0.44 |
| Dibenz[a,h]anthracene | 0.09 |
| Fluoranthene | 0.51 |
| Fluorene | 0.03U |
| HMW PAHs | 4.39 |
| Indeno(1,2,3-C,D)Pyrene | 0.39 |
| LMW PAHs | 0.2 |
| Naphthalene | 0.1U |
| Phenanthrene | 0.14 |
| Pyrene | 0.53 |

**SCL-03**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**SCL-02**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**SCL-01**

| | SE 0-10 |
|---|---|
| Acenaphthene | 0.03U |
| Acenaphthylene | 0.03U |
| Anthracene | 0.03U |
| Benzo[a]pyrene | 0.03U |
| Benzo[g,h,i]perylene | 0.03U |
| Benzo[k]fluoranthene | 0.03U |
| Chrysene | 0.03U |
| Dibenz[a,h]anthracene | 0.03U |
| Fluoranthene | 0.03U |
| Fluorene | 0.03U |
| Indeno(1,2,3-C,D)Pyrene | 0.03U |
| Naphthalene | 0.1U |
| Phenanthrene | 0.03U |
| Pyrene | 0.03U |
| Total PAHs | 0.1U |

**NOTE:**

1) Results are presented in milligrams per kilogram (mg/kg), with the exception of pH which is presented in standard units (SU).
2) Orange text indicates result detected above recommended screening values.
3) Gray text indicates non-detected result.
4) Column headers consist of matrices (SO: Soil; SE: Sediment), followed by depth interval, which is presented in centimeters (cm).
5) Total polycyclic aromatic hydrocarbons (PAHs) results for sediment are presented as normalised to 1% organic carbon content (mg/kg OC; ANZG 2018). These values represent the sum of detected USEPA 16 priority PAHs or in the event of no detections, the maximum quantitation limit.
6) Summed PAH results for soil are presented as the sum of detected high molecular weight (HMW) and low molecular weight (LMW) PAHs as outlined in Appendix A (EHS Support 2023).

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## SCL Pad Assessment Area
## Soil and Sediment Polycyclic Aromatic Hydrocarbon Results

0 10 20 40 60 80 Meters
1 cm = 15 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 18B

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,500 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

N

**LEGEND**

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment

● Surface Water

● Surface Water & Pore Water

◆ Sub-surface Aqueous

◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

**SCL-02**

| | WPO | WS |
|---|---|---|
| Aluminium | 0.05U | 0.07 |
| Arsenic | 0.002 | 0.004 |
| Barium | 0.02U | 0.02U |
| Beryllium | 0.001U | 0.001U |
| Boron | 8.3 | 8.2 |
| Cadmium | 0.0002U | 0.0002U |
| Chloride (As Cl) | 19000 | 19000 |
| Chromium, total | 0.001U | 0.001U |
| Cobalt | 0.001U | 0.001U |
| Copper | 0.001U | 0.001U |
| Cyanide | 0.005U | 0.005U |
| Cyanide (Free) | 0.005U | 0.005U |
| Fluoride | 0.87 | 0.87 |
| Iron | 0.05U | 0.13 |
| Lead | 0.001U | 0.001U |
| Manganese | 0.005U | 0.005U |
| Mercury | 0.0001U | 0.0001U |
| Nickel | 0.001 | 0.001U |
| Vanadium | 0.005U | 0.005U |
| Zinc | 0.005U | 0.008 |

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrices (WPO: Pore Water; WS: Surface Water), followed by water column interval (TWC: Top of Water Column; BWC: Bottom of Water Column) and/or sample taken post rainfall (FF).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, manganese, and mercury.

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## SCL Pad Assessment Area
## Surface Water and Pore Water Trace Element/Inorganic Results

0 10 20 40 60 80 Meters
1 cm = 15 meters [Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

**FIGURE 18C**

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
| **MAP PROJECTION:** | Transverse Mercator |
| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,500 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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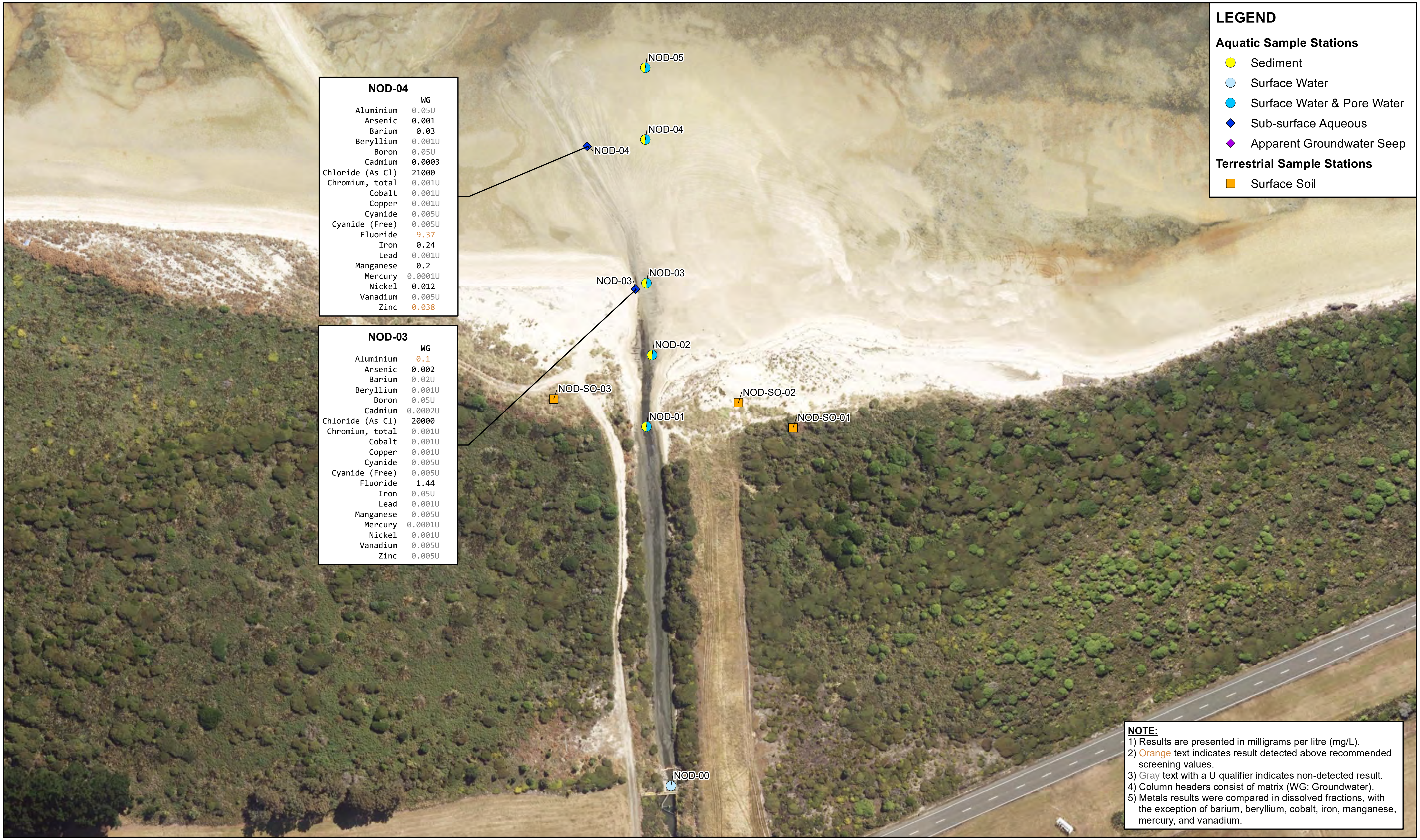

**NOD-04**

| | WG |
|---|---|
| Aluminium | 0.05U |
| Arsenic | 0.001 |
| Barium | 0.03 |
| Beryllium | 0.001U |
| Boron | 0.05U |
| Cadmium | 0.0003 |
| Chloride (As Cl) | 21000 |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.001U |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 9.37 |
| Iron | 0.24 |
| Lead | 0.001U |
| Manganese | 0.2 |
| Mercury | 0.0001U |
| Nickel | 0.012 |
| Vanadium | 0.005U |
| Zinc | 0.038 |

**NOD-03**

| | WG |
|---|---|
| Aluminium | 0.1 |
| Arsenic | 0.002 |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 0.05U |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 20000 |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.001U |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 1.44 |
| Iron | 0.05U |
| Lead | 0.001U |
| Manganese | 0.005U |
| Mercury | 0.0001U |
| Nickel | 0.001U |
| Vanadium | 0.005U |
| Zinc | 0.005U |

**LEGEND**

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil

**NOTE:**
1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrix (WG: Groundwater).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, cobalt, iron, manganese, mercury, and vanadium.

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## North Drain Assessment Area
## Sub-surface Aqueous Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 19

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:1,200 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO<br>© DIGITAL GLOBE 2018 |

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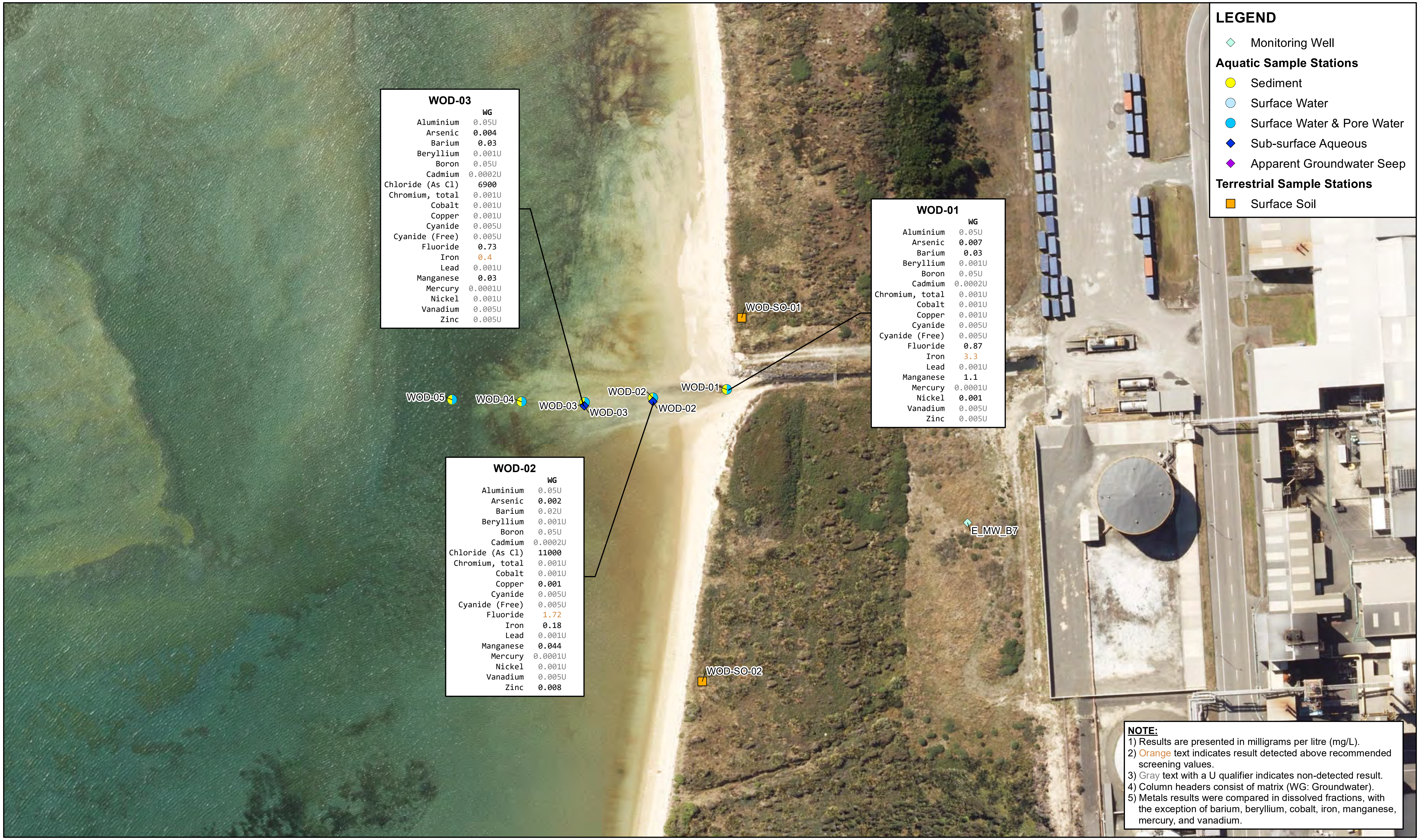

**WOD-03**

| | WG |
|---|---|
| Aluminium | 0.05U |
| Arsenic | 0.004 |
| Barium | 0.03 |
| Beryllium | 0.001U |
| Boron | 0.05U |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 6900 |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.001U |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 0.73 |
| Iron | 0.4 |
| Lead | 0.001U |
| Manganese | 0.03 |
| Mercury | 0.0001U |
| Nickel | 0.001U |
| Vanadium | 0.005U |
| Zinc | 0.005U |

**WOD-01**

| | WG |
|---|---|
| Aluminium | 0.05U |
| Arsenic | 0.007 |
| Barium | 0.03 |
| Beryllium | 0.001U |
| Boron | 0.05U |
| Cadmium | 0.0002U |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.001U |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 0.87 |
| Iron | 3.3 |
| Lead | 0.001U |
| Manganese | 1.1 |
| Mercury | 0.0001U |
| Nickel | 0.001 |
| Vanadium | 0.005U |
| Zinc | 0.005U |

**WOD-02**

| | WG |
|---|---|
| Aluminium | 0.05U |
| Arsenic | 0.002 |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 0.05U |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 11000 |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.001 |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 1.72 |
| Iron | 0.18 |
| Lead | 0.001U |
| Manganese | 0.044 |
| Mercury | 0.0001U |
| Nickel | 0.001U |
| Vanadium | 0.005U |
| Zinc | 0.008 |

## LEGEND

◇ Monitoring Well

**Aquatic Sample Stations**

● Sediment

● Surface Water

● Surface Water & Pore Water

◆ Sub-surface Aqueous

◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

■ Surface Soil

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrix (WG: Groundwater).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, cobalt, iron, manganese, mercury, and vanadium.

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# West Drain Assessment Area
# Sub-surface Aqueous Trace Element/Inorganic Results

0 5 10 20 30 40 Meters
1 cm = 12 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 20

| | |
|---|---|
| **CREATED BY:** | C. Saraniecki |
| **APPROVED BY:** | M. Gerjoi |
| **PROJECT REF. NO:** | AUS##XXXX-YYYY |
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| **GRID/DATUM:** | NZGD 2000 |
| **SCALE:** | 1:1,200 |
| **AERIAL IMAGE SOURCE:** | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

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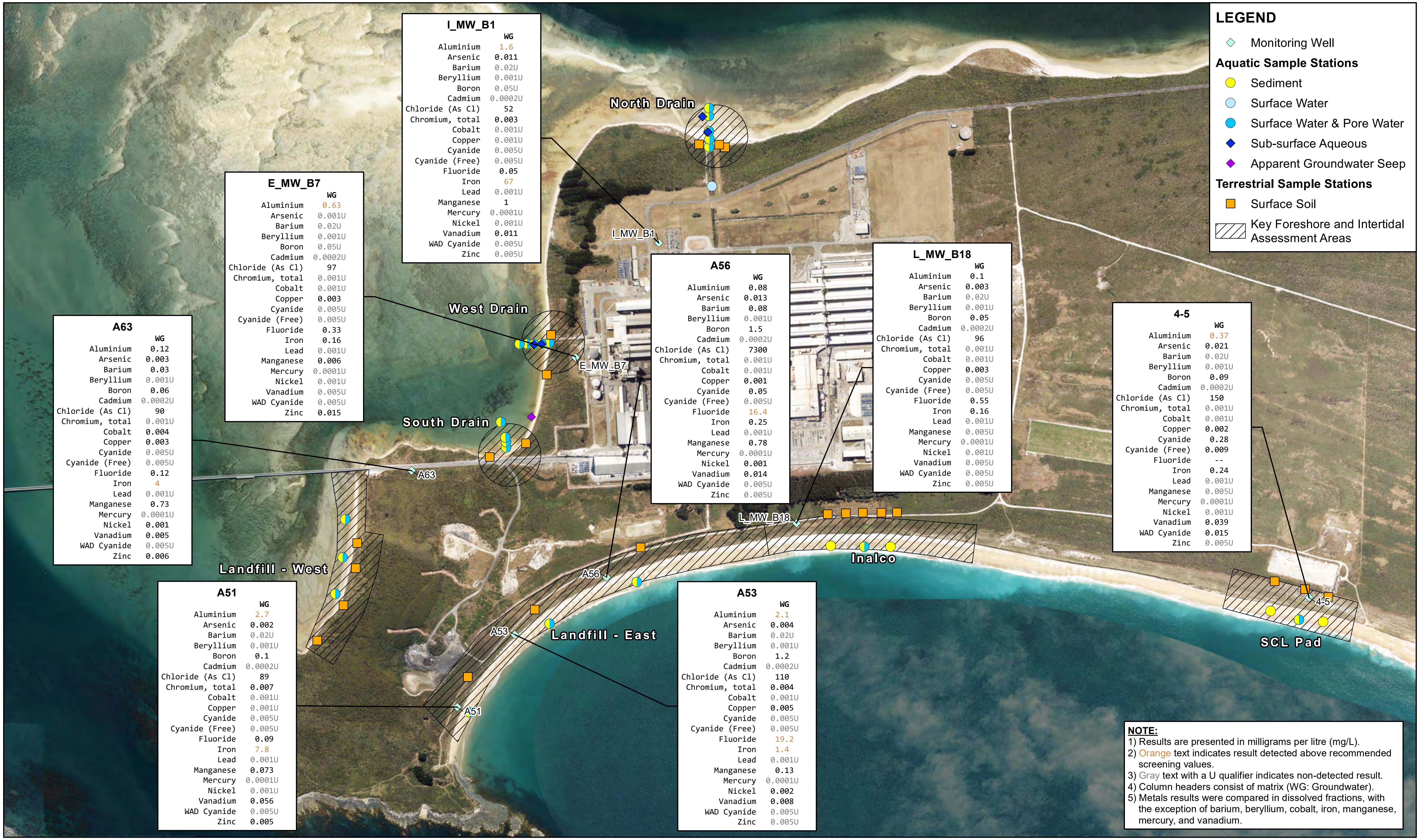

**LEGEND**

- ◇ Monitoring Well

**Aquatic Sample Stations**

- ● Sediment
- ● Surface Water
- ● Surface Water & Pore Water
- ◆ Sub-surface Aqueous
- ◆ Apparent Groundwater Seep

**Terrestrial Sample Stations**

- ■ Surface Soil
- ▨ Key Foreshore and Intertidal Assessment Areas

**I_MW_B1**

| | WG |
|---|---|
| Aluminium | 1.6 |
| Arsenic | 0.011 |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 0.05U |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 52 |
| Chromium, total | 0.003 |
| Cobalt | 0.001U |
| Copper | 0.001U |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 0.05 |
| Iron | 67 |
| Lead | 0.001U |
| Manganese | 1 |
| Mercury | 0.0001U |
| Nickel | 0.001U |
| Vanadium | 0.011 |
| WAD Cyanide | 0.005U |
| Zinc | 0.005U |

**E_MW_B7**

| | WG |
|---|---|
| Aluminium | 0.63 |
| Arsenic | 0.001U |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 0.05U |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 97 |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.003 |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 0.33 |
| Iron | 0.16 |
| Lead | 0.001U |
| Manganese | 0.006 |
| Mercury | 0.0001U |
| Nickel | 0.001U |
| Vanadium | 0.005U |
| WAD Cyanide | 0.005U |
| Zinc | 0.015 |

**A63**

| | WG |
|---|---|
| Aluminium | 0.12 |
| Arsenic | 0.003 |
| Barium | 0.03 |
| Beryllium | 0.001U |
| Boron | 0.06 |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 90 |
| Chromium, total | 0.001U |
| Cobalt | 0.004 |
| Copper | 0.003 |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 0.12 |
| Iron | 4 |
| Lead | 0.001U |
| Manganese | 0.73 |
| Mercury | 0.0001U |
| Nickel | 0.001 |
| Vanadium | 0.005 |
| WAD Cyanide | 0.005U |
| Zinc | 0.006 |

**A56**

| | WG |
|---|---|
| Aluminium | 0.08 |
| Arsenic | 0.013 |
| Barium | 0.08 |
| Beryllium | 0.001U |
| Boron | 1.5 |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 7300 |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.001 |
| Cyanide | 0.05 |
| Cyanide (Free) | 0.005U |
| Fluoride | 16.4 |
| Iron | 0.25 |
| Lead | 0.001U |
| Manganese | 0.78 |
| Mercury | 0.0001U |
| Nickel | 0.001 |
| Vanadium | 0.014 |
| WAD Cyanide | 0.005U |
| Zinc | 0.005U |

**L_MW_B18**

| | WG |
|---|---|
| Aluminium | 0.1 |
| Arsenic | 0.003 |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 0.05 |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 96 |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.003 |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 0.55 |
| Iron | 0.16 |
| Lead | 0.001U |
| Manganese | 0.005U |
| Mercury | 0.0001U |
| Nickel | 0.001U |
| Vanadium | 0.005U |
| WAD Cyanide | 0.005U |
| Zinc | 0.005U |

**4-5**

| | WG |
|---|---|
| Aluminium | 0.37 |
| Arsenic | 0.021 |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 0.09 |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 150 |
| Chromium, total | 0.001U |
| Cobalt | 0.001U |
| Copper | 0.002 |
| Cyanide | 0.28 |
| Cyanide (Free) | 0.009 |
| Fluoride | -- |
| Iron | 0.24 |
| Lead | 0.001U |
| Manganese | 0.005U |
| Mercury | 0.0001U |
| Nickel | 0.001U |
| Vanadium | 0.039 |
| WAD Cyanide | 0.015 |
| Zinc | 0.005U |

**A51**

| | WG |
|---|---|
| Aluminium | 2.7 |
| Arsenic | 0.002 |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 0.1 |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 89 |
| Chromium, total | 0.007 |
| Cobalt | 0.001U |
| Copper | 0.001U |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 0.09 |
| Iron | 7.8 |
| Lead | 0.001U |
| Manganese | 0.073 |
| Mercury | 0.0001U |
| Nickel | 0.001U |
| Vanadium | 0.056 |
| WAD Cyanide | 0.005U |
| Zinc | 0.005 |

**A53**

| | WG |
|---|---|
| Aluminium | 2.1 |
| Arsenic | 0.004 |
| Barium | 0.02U |
| Beryllium | 0.001U |
| Boron | 1.2 |
| Cadmium | 0.0002U |
| Chloride (As Cl) | 110 |
| Chromium, total | 0.004 |
| Cobalt | 0.001U |
| Copper | 0.005 |
| Cyanide | 0.005U |
| Cyanide (Free) | 0.005U |
| Fluoride | 19.2 |
| Iron | 1.4 |
| Lead | 0.001U |
| Manganese | 0.13 |
| Mercury | 0.0001U |
| Nickel | 0.002 |
| Vanadium | 0.008 |
| WAD Cyanide | 0.005U |
| Zinc | 0.005U |

**NOTE:**

1) Results are presented in milligrams per litre (mg/L).
2) Orange text indicates result detected above recommended screening values.
3) Gray text with a U qualifier indicates non-detected result.
4) Column headers consist of matrix (WG: Groundwater).
5) Metals results were compared in dissolved fractions, with the exception of barium, beryllium, cobalt, iron, manganese, mercury, and vanadium.

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# Site Assessment Area
# Groundwater Trace Element/Inorganic Results

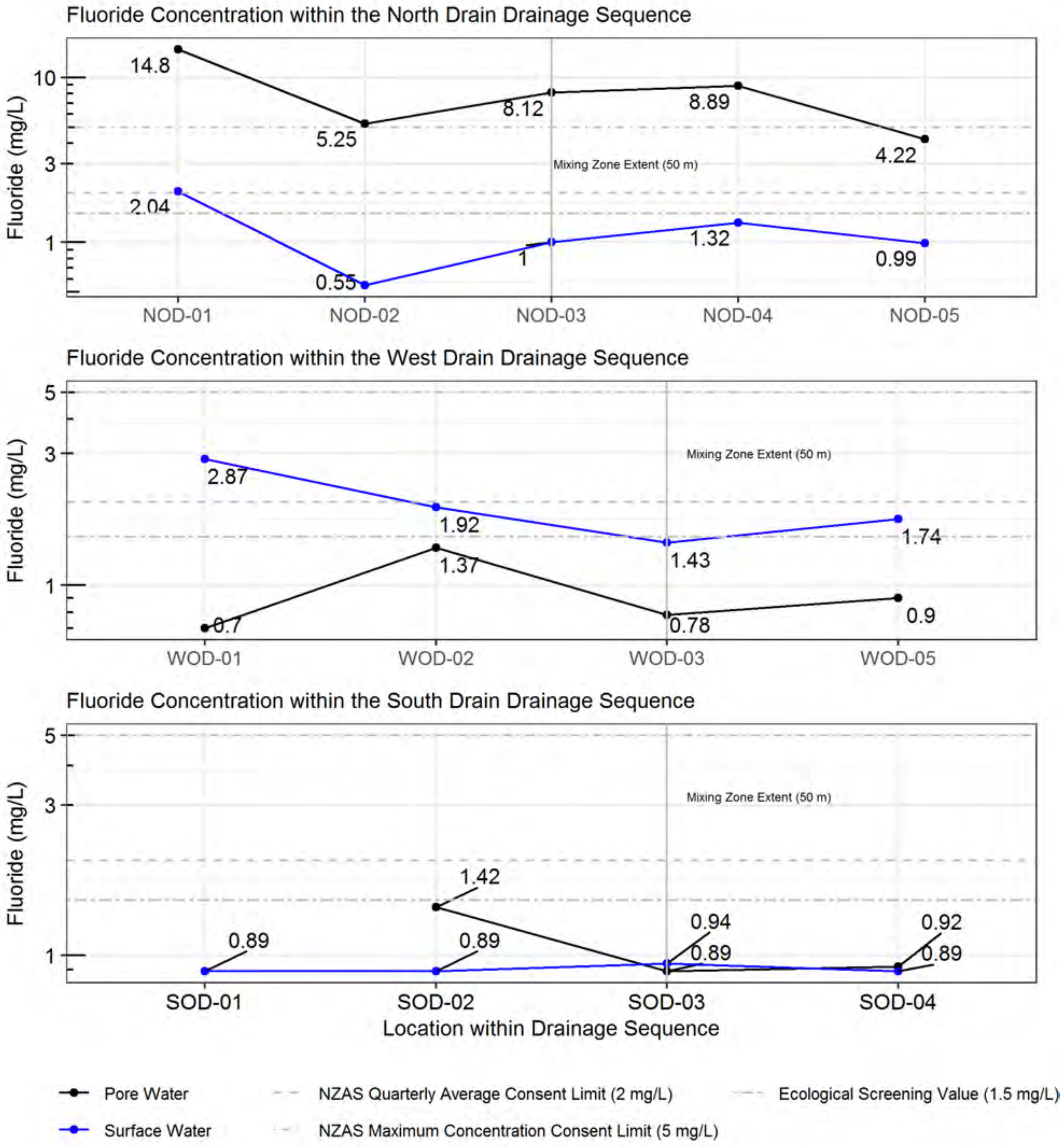
0 90 180 360 540 720 Meters
1 cm = 110 meters
[Page Size: A4]

**PROJECT AWARUA**
**ENVIRONMENT SOUTHLAND**

## FIGURE 21

| | |
|---|---|
| CREATED BY: | C. Saraniecki |
| APPROVED BY: | M. Gerjoi |
| PROJECT REF. NO: | AUS##XXXX-YYYY |
| MAP PROJECTION: | Transverse Mercator |
| GRID/DATUM: | NZGD 2000 |
| SCALE: | 1:11,000 |
| AERIAL IMAGE SOURCE: | GOOGLE EARTH PRO © DIGITAL GLOBE 2018 |

N

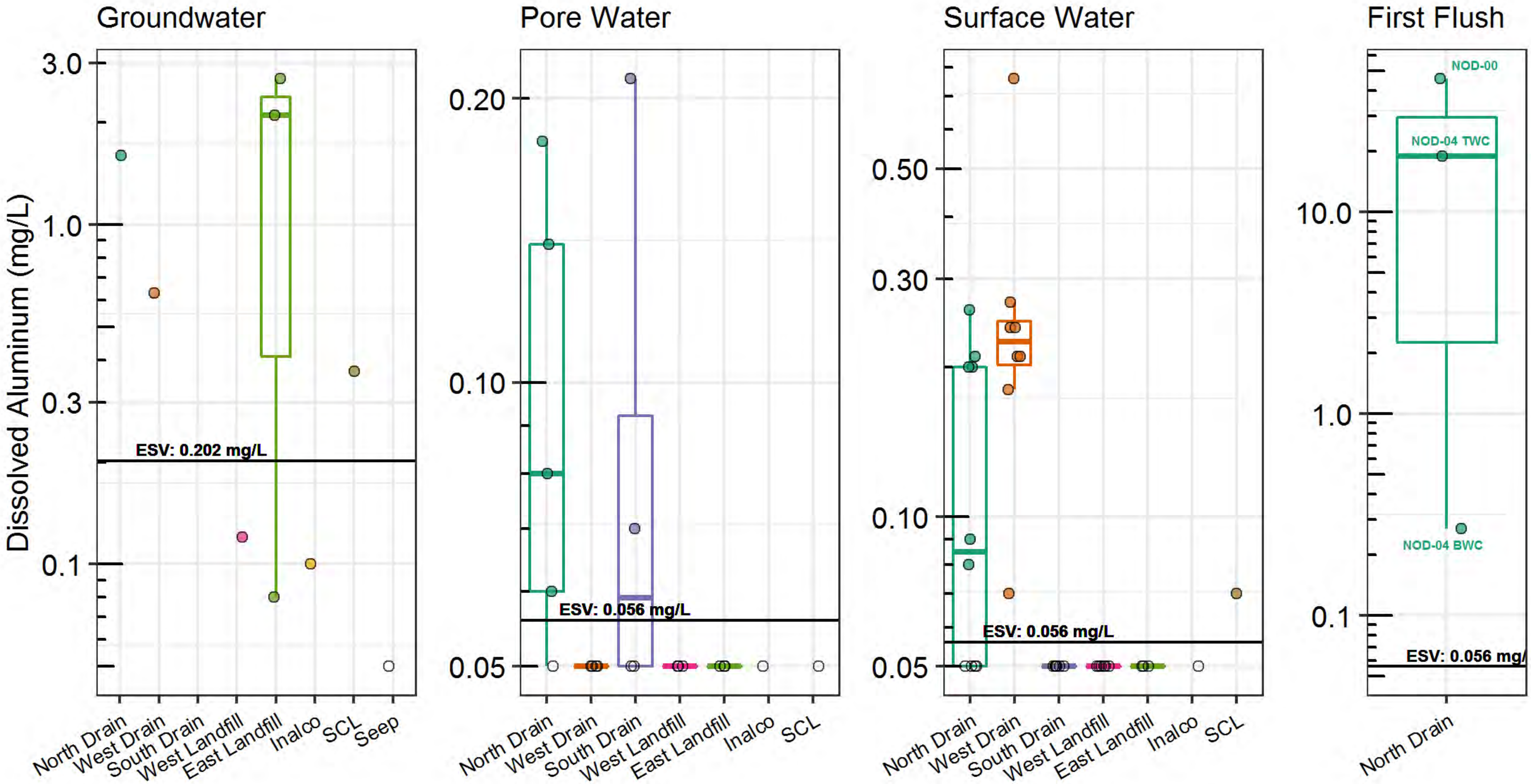

Fluoride Concentration within the North Drain Drainage Sequence

Fluoride Concentration within the West Drain Drainage Sequence

Fluoride Concentration within the South Drain Drainage Sequence

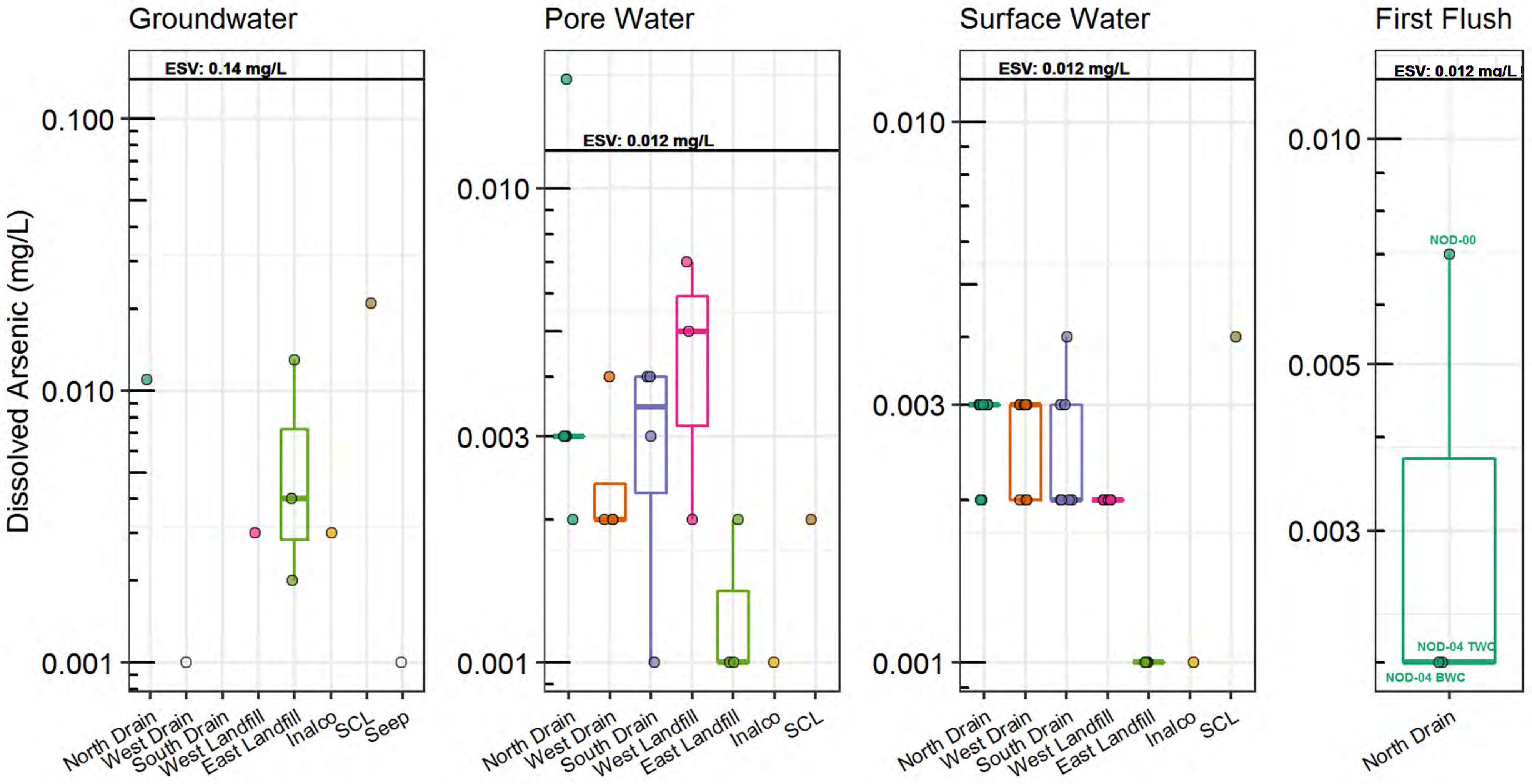
Surface water concentrations are the maximum value of the top and bottom of water column measurements

| | | | |
|---|---|---|---|
| EHS Support | **CMA Assessment Technical Report**<br>**ES Independent Monitoring Programme**<br>**Tiwai Point** | **Cross-Sectional View of NZAS Drain Sequence Fluoride Concentrations** | **FIGURE 22** |



Open circles indicate non-detect values
Horizontal line (if present) indicates matrix-specific ecological screening value
'Seep' indicates sample collected from apparent seep identified near South Drain

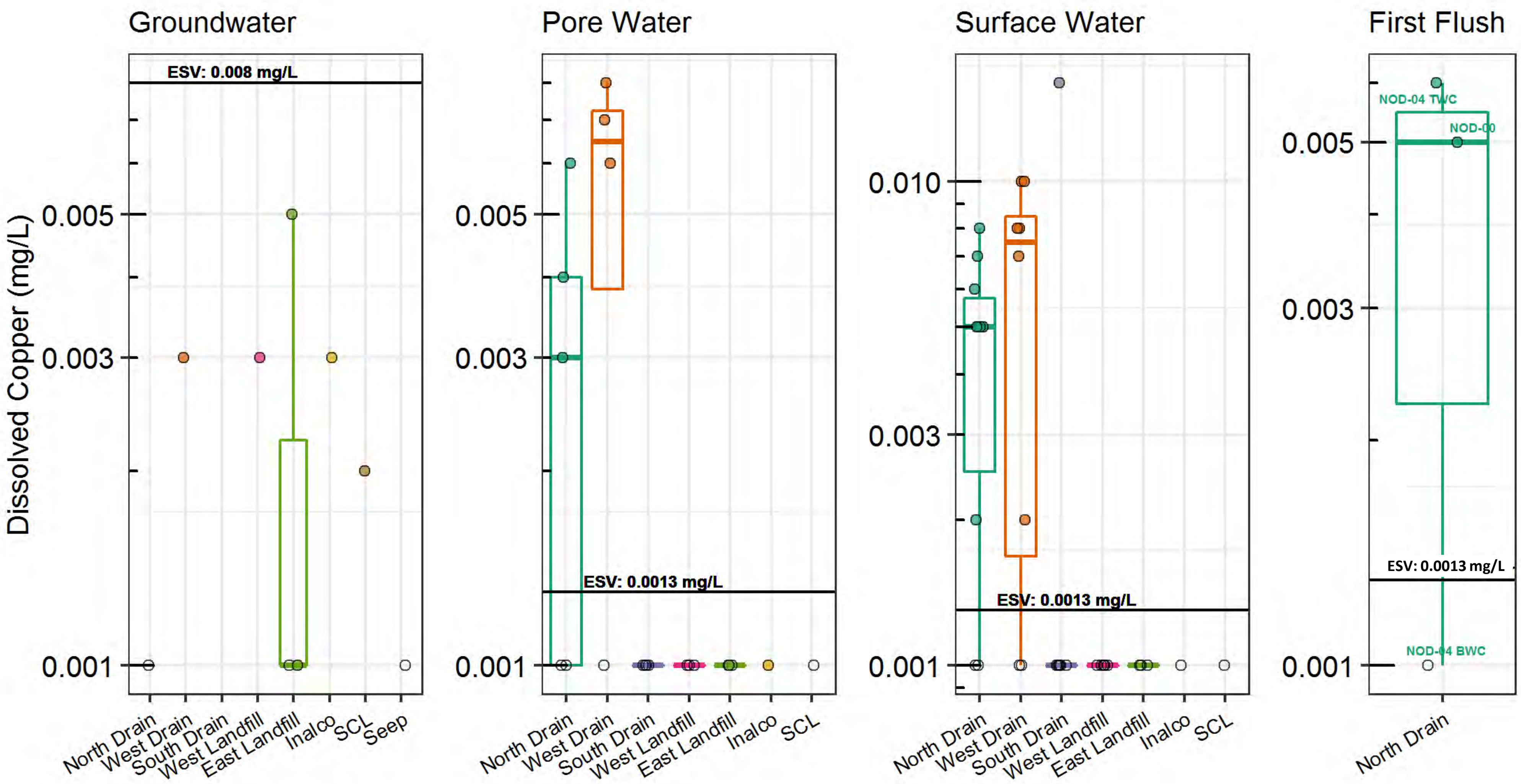
| | | | |
|---|---|---|---|
| EHS Support | **CMA Assessment Technical Report**<br>**ES Independent Monitoring Programme**<br>**Tiwai Point** | **Aluminium Aqueous Results Compared to Ecological Screening Values** | **FIGURE 23** |



Open circles indicate non-detect values
Horizontal line (if present) indicates matrix-specific ecological screening value
'Seep' indicates sample collected from apparent seep identified near South Drain

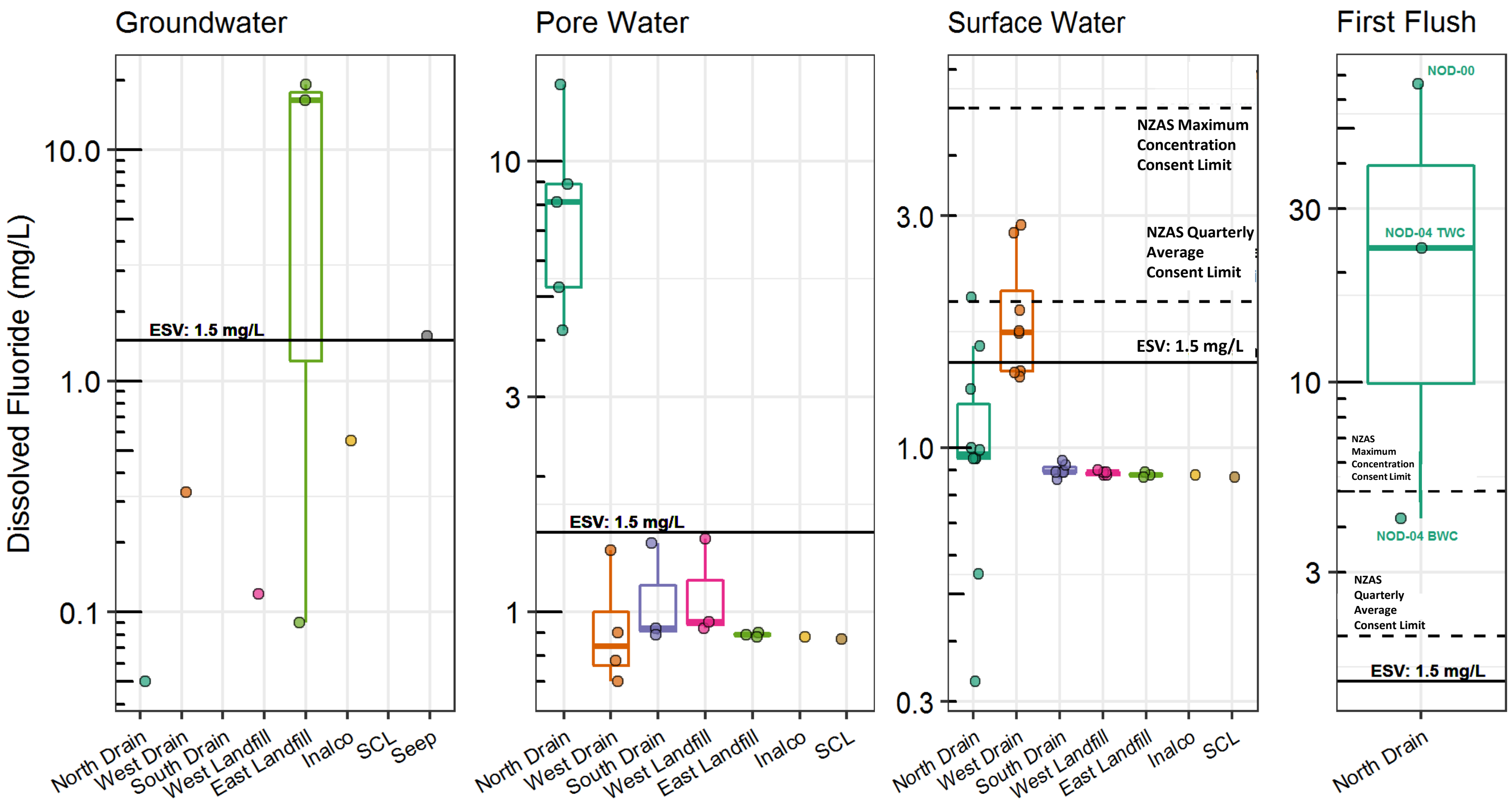
**Arsenic Aqueous Results Compared to Ecological Screening Values**

**FIGURE 24**



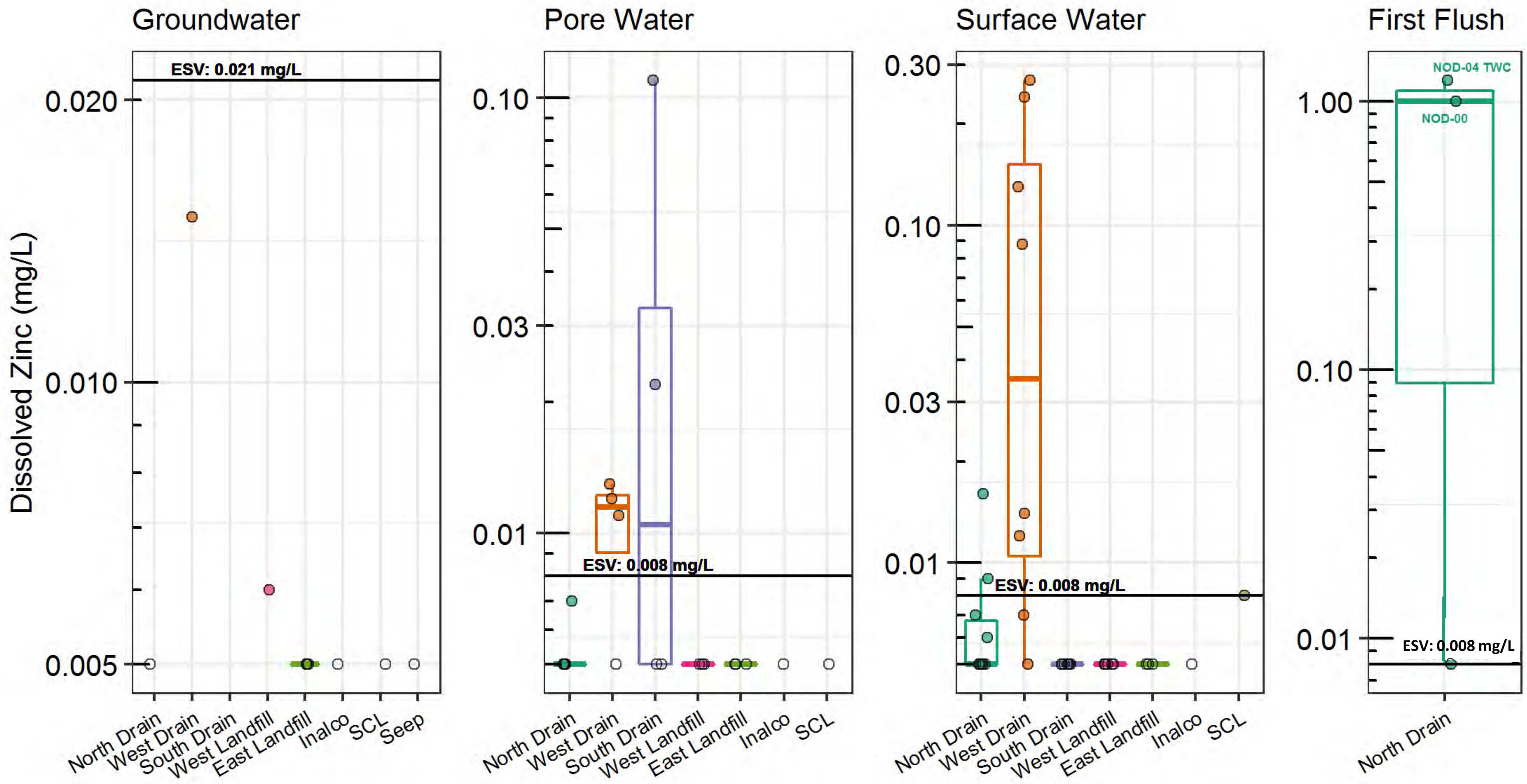
Open circles indicate non-detect values
Horizontal line (if present) indicates matrix-specific ecological screening value
'Seep' indicates sample collected from apparent seep identified near South Drain

| EHS Support | CMA Assessment Technical Report<br>ES Independent Monitoring Programme<br>Tiwai Point | Copper Aqueous Results Compared to Ecological Screening Values | FIGURE 25 |
|---|---|---|---|



Open circles indicate non-detect values
Horizontal line (if present) indicates matrix-specific ecological screening value
'Seep' indicates sample collected from apparent seep identified near South Drain

| EHS Support | CMA Assessment Technical Report<br>ES Independent Monitoring Programme<br>Tiwai Point | Fluoride Aqueous Results Compared to Ecological Screening Values | FIGURE 26 |
|---|---|---|---|



Open circles indicate non-detect values
Horizontal line (if present) indicates matrix-specific ecological screening value
'Seep' indicates sample collected from apparent seep identified near South Drain

| | | | |
|---|---|---|---|
| EHS Support | CMA Assessment Technical Report<br>ES Independent Monitoring Programme<br>Tiwai Point | **Zinc Aqueous Results Compared to Ecological Screening Values** | **FIGURE 27** |

# Appendix A Screening Value Derivation

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# MEMO

To: Environment Southland – Graeme McKenzie and Bruce Halligan

From: Simon Hunt

CC: Wynn Williams – Tim McGuigan

Date: 20 July 2023

**Re: Technical Memo – Surface Water, Pore Water, Groundwater, Sediment and Soil Environmental Screening Values**

---

## 1. Introduction and Background

EHS Support New Zealand Ltd (EHS Support) has been retained by Environment Southland (ES) to prepare ecological/environmental risk screening values to assist with the interpretation of data obtained during environmental investigation work undertaken within the coastal marine area (CMA) abutting the New Zealand Aluminium Smelters (NZAS) manufacturing facility (hereafter referred to as the Site) located at Tiwai Point.

EHS Support was initially requested by ES to provide an assessment and review of the data collected during two collaborative sampling events conducted by GHD New Zealand Limited (GHD) and EHS Support in February 2022. Both parties conducted sampling of groundwater, surface water and sediment at similar locations within the Site. The samples collected were analysed for constituents known to be associated with the aluminium smelting process (collectively referred to as Contaminants of Potential Environmental Concern (COPEC)) and screened against relevant and applicable thresholds with a focus on initial screening of marine sediment and surface water results against ecological risk screening criteria.

Since completing this initial benchmarking exercise, ES commissioned EHS Support to undertake an independent assessment of the CMA surrounding the Site in early 2023. This assessment resulted in a comprehensive assessment of soil, marine sediment, marine pore water, and marine surface water at the following key locations around the Site and at background locations. In addition, EHS Support collected co-incident groundwater samples from selected NZAS groundwater monitoring wells located adjacent to the CMA sampling areas.

- Downstream of the three stormwater drains (north, west, and south drains) that carry stormwater and process water from the smelter domain and discharge into the Bluff Harbour.
- Within Foveaux Strait and Bluff Harbour that abut and are downstream of the NZAS landfill.
- Within Foveaux Strait that abuts and is downstream of the Inalco Processing Area (within the smelter domain) and Spent Cell Lining (SCL) Pad.
- Background locations within Bluff Harbour and Foveaux Strait.

The objective of this technical memo is to present the screening criteria for the following media and to explain the rationale for the selection and derivation of the criteria.

- Ecological risk screening criteria for marine sediment, pore water, and surface water.
- Terrestrial soil ecological screening criteria for non-NZAS land abutting the Site.

This technical memo is subject to the limitations given in **Appendix A** – Limitations.

## 2. Analytical Suites and Contaminants of Potential Environmental Concern

The EHS Support Sampling and Analysis Plan (EHS Support, 2022) prepared for the CMA assessment identified the following contaminants of potential environmental concern (COPEC's; **Table 1**):

**TABLE 1 CONTAMINANTS OF POTENTIAL ENVIRONMENTAL CONCERN**

| Analysis | Constituents |
|---|---|
| **Marine Surface Water/Porewater** | |
| Metal(loid)s, total and dissolved | Al, As, B, Ba, Be, Cd, Cr, Co, Cu, Li, Mn, Ni, Pb, Se, Ti, V, Zn, Hg |
| Inorganics and General Chemistry | Cyanide (Free, Total, WAD) |
| | Fluoride (dissolved) |
| | Fluoride (total) |
| SVOCs | TCL Suite including PAHs |
| **Marine Sediment** | |
| Metal(loid)s | Al, As, B, Ba, Be, Cd, Cr, Co, Cu, Li, Mn, Ni, Pb, Se, Th, Ti, V, Zn, Hg |
| Inorganics and General Chemistry | Cyanide (Free, Total, WAD) |
| | Fluoride |
| SVOCs | TCL Suite including PAHs |

**Notes:**
SVOC = Semi-volatile organic compounds
TCL = Target compound list
WAD = Weak acid dissociable

## 3. Environmental Screening Values

To assess the environmental quality of the sediment, groundwater, marine surface water, and pore water samples collected during the CMA investigation the constituent concentrations have been compared to available environmental effects thresholds.

The term threshold is a general term that can include standards (a legally enforceable value), criteria (a standard in the Clean Water Act in the United States), and guidelines (a threshold which typically has no regulatory status). Although guidelines, such as those produced by legacy ANZECC (2000) (which have been replaced by ANZG, 2018), are included in Regional Plans/Water Plans issued by Regional Councils and therefore have regulatory status.

To simplify the presentation of the various types of environmental thresholds used in the CMA report, they are collectively referred to as Environmental Screening Values (ESVs). The ESVs selected for comparison to results from the CMA were derived after a review of international guideline values for the COPEC's identified in **Table 1**.

ESVs were chosen based on the availability of international guideline values for a specific COPEC. The sections below describe the process by which screening values were selected for the ES independent assessment.

The ANZECC guidelines have since been superseded by the ANZG Guidelines for Fresh and Marine Water Quality (ANZG) and so the EHS Support review references both the ANZECC trigger value (TV) and ANZG default guideline value (DGV) level of protection for 95% of marine species. Higher quality thresholds would need to be applied to marine waters that lie further out within Bluff Harbour and Foveaux Strait.

If no marine guideline value was available, the complimentary freshwater value was selected. Several constituents selected for this review do not have ANZECC TVs or ANZG DGVs. Guideline value selection for these constituents is based on the systematic approach identified in the following sections (which is consistent with the Ministry for the Environment (MfE) Contaminated Land Management Guidelines No.2 Hierarchy and Application in New Zealand of Environmental Guideline Values (MfE, 2011a).

It should be noted that given the site setting important ecological functions may be present within freshwater drainage systems and in areas where freshwater discharges over the saline wedge in the foreshore area. These have not been evaluated but will need to be considered as part of any future detailed site investigation to be completed at the site. For these systems (if and where present) freshwater criteria would be the most applicable.

The ANZG (2018) DGVs are derived using the species sensitivity distribution method. DGVs are derived to protect against harmful effects from long-term (that is chronic) exposure. The SSD method allows the calculation of DGVs for different levels of ecosystem protection (typically 80 % through 99 % protection). Each DGV is provided with a reliability rating from very high to low or unknown. It should be noted that currently ANZG is revising the DGVs for copper, iron, and nickel, chromium (3+), zinc (freshwater), and manganese (marine).

The international toxicant guidelines that have been utilised to substitute for absent ANZG DGVs have not been developed in the same way as the ANZG DGVs. The differences relate to the toxicity data used in the derivation, the exposure frequency and duration the guideline value are based upon as well as the phyla/species that the guidance is based upon. However, in the absence of specific ANZG DGVs, the guideline values identified during this assessment from international sources provide usable substitutes for providing environmental protection. **Table 2** presents the recommended guideline hierarchy for identifying guideline values to be used as screening values.

**Table 2 SOURCES FOR THE SELECTION SCREENING VALUE**

| Source | Type |
|---|---|
| Australia and New Zealand Guidelines for Fresh and Marine Water Quality | Trigger Values for Marine Water |
| ANZG Guidelines (ANZG) | Aquatic Ecosystems Default Guidelines Values (DGVs) for the Protection of Marine Life |
| Canadian Council of Ministers of the Environment (CCME) | Water Quality Guidelines for the Protection of Aquatic Life: Marine Short/Long Term |
| British Columbia Ministry of Environment and Climate Change Strategy (BC ENV) | Marine Long-term Chronic Water Quality Guideline |
| United States Environmental Protection Agency (USEPA) or State Promulgated Values | Promulgated Water Quality Guideline – Marine |

## 3.1 Groundwater

EHS Support has conducted a review of relevant and applicable guideline values and 80% ANZG for protection of marine water species (or other applicable guidance) has been chosen because the groundwater system reports to the marine environment. These are presented in **TABLE 3**.

## 3.2 Marine Surface Water

The marine surface water sample results are to be screened against the recommended DGVs presented in **TABLE 3**. The process by which guideline values were selected for a given constituent is as follows:

- If a Marine DGV protective of 80% or 95% of aquatic species from ANZG was available, it was retained as the groundwater or surface water/pore water screening value, respectively. Where available, Marine DGVs were used. Freshwater DGVs were used for constituents where no Marine DGV was available.
- Else, the Water Quality Guideline from CCME was selected. This typically relates to CCME Water Quality Guidelines (WQGs) for the Long-Term protection of aquatic life. Where available, marine surface water quality guidelines were used. Freshwater surface water quality guidelines were used for constituents where no marine surface water quality guideline was available.
- Else, the Water Quality Guideline from BC ENV was selected. This typically relates to BC ENV Water Quality Guidelines (WQGs) for the Long-Term Chronic protection of aquatic life. Where available, marine surface water quality guidelines were used. Freshwater surface water quality guidelines were used for constituents where no marine surface water quality guideline was available.
- Else, a promulgated value from the United States Environmental Protection Agency (USEPA) or State agency was selected. The most conservative promulgated USEPA or State agency was selected. Where available, marine surface water benchmarks were used. Freshwater surface water benchmarks were used for constituents where no marine surface water benchmark was available.

ANZG provides a low reliability DGV for aluminium under variable pH conditions. Given the lack of robust guidelines for aluminium, a reliable marine guideline value derived using an SSD approach by van Dam et al. (2018) is recommended as the screening value.

ANZG does not currently have a promulgated trigger value for boron in marine waters that could be adopted as ESV in pore water and surface water. The existing ANZG trigger values for boron in freshwater are less than previously published background concentrations for boron in marine waters. Therefore, an appropriate approach to assessing boron in the CMA investigation area surface water and pore water is to adopt a regionally representative background value of 5.1 mg/L (ANZECC & ARMCANZ, 2000). This value is appropriate for screening level assessments but since it is not a promulgated risk-based value, exceedances of this value do not necessarily indicate the presence of unacceptable risk. Given that boron is less toxic in marine environments than freshwater environments, the CMA investigation results for boron are not likely to represent unacceptable risk to aquatic receptors.

The British Columbia Ambient Water Quality Guideline protective of marine aquatic life was selected for fluoride. A discussion of the available fluoride guidelines is provided in the following sections.

**TABLE 3 RECOMMENDED SCREENING VALUES FOR GROUNDWATER AND MARINE SURFACE WATER**

| Analyte | Cas-RN | 80% DGV (µg/L) | Source | 95% DGV (µg/L) | Source |
|---|---|---|---|---|---|
| **TRACE ELEMENTS*** | | | | | |
| Aluminium[1] (Dissolved) | 7429-90-5 | 150[a]/202 | ANZECC/van Dam (2018) | 55 [a] /56 | ANZECC/van Dam (2018)) |
| Arsenic[2] (Dissolved) | 17428-41-0 | 48 | Golding et al. (2022) | 12 | Golding et al. (2022) |
| Barium (Total) | 7440-39-3 | 1000 | BC ENV | 1000 | BC ENV |
| Beryllium (Total) | 7440-41-7 | 100 | BC ENV | 100 | BC ENV |
| Boron (Dissolved) | 7440-42-8 | 5100 | ANZECC/ANZG | 5100 | ANZECC/ANZG |
| Cadmium (Dissolved) | 7440-43-9 | 36 | ANZECC/ANZG | 5.5 | ANZECC/ANZG |
| Chromium, total (Dissolved)[3] | 16065-83-1 | 91 | ANZECC/ANZG | 27 | ANZECC/ANZG |
| Cobalt (Total) | 7440-48-4 | 150 | ANZECC/ANZG | 1 | ANZECC/ANZG |
| Iron [b] (Total) | 7439-89-6 | 300 | CCME | 300 | CCME |
| Copper (Dissolved) | 7440-50-8 | 8 | ANZECC/ANZG | 1.3 | ANZECC/ANZG |
| Lead (Dissolved) | 7439-92-1 | 12 | ANZECC/ANZG | 4.4 | ANZECC/ANZG |
| Lithium [b] | 7439-93-2 | -- | -- | -- | -- |
| Manganese [b] (Total) | 7439-96-5 | 3600 | ANZECC/ANZG | 1900 | ANZECC/ANZG |
| Mercury (Total) | 7439-97-6 | 1.4 | ANZECC/ANZG | 0.1[c] | ANZECC/ANZG |
| Nickel (Dissolved) | 7440-02-0 | 560 | ANZECC/ANZG | 70 | ANZECC/ANZG |
| Titanium [b] | 7440-32-6 | -- | -- | -- | -- |
| Vanadium (Total) | 7440-62-2 | 280 | ANZECC/ANZG | 100 | ANZECC/ANZG |
| Zinc (Dissolved) | 7440-66-6 | 43/21 | ANZECC/ANZG | 15/8 | ANZECC/ANZG |
| **INORGANICS** | | | | | |
| Cyanide (Total) | 57-12-5 | 14 | ANZECC/ANZG | 4 | ANZECC/ANZG |

| Analyte | Cas-RN | 80% DGV (µg/L) | Source | 95% DGV (µg/L) | Source |
|---|---|---|---|---|---|
| Cyanide (Free) | FREE CN | 14 | ANZECC/ANZG | 4 | ANZECC/ANZG |
| Fluoride | 16984-48-8 | 1500 | BC ENV | 1500 | BC ENV |
| **PAHs** | | | | | |
| Acenaphthene | 83-32-9 | 5.8 | CCME | 5.8 | CCME |
| Acenaphthylene | 208-96-8 | 28 | USEPA Region 4 | 28 | USEPA Region 4 |
| Anthracene | 120-12-7 | 7 | ANZECC/ANZG | 0.4 | ANZECC/ANZG |
| Benzo(a)anthracene | 56-55-3 | 0.018 | CCME | 0.018 | CCME |
| Benzo(a)pyrene | 50-32-8 | 0.7 | ANZECC/ANZG | 0.2 | ANZECC/ANZG |
| Benzo(b)fluoranthene | 205-99-2 | 0.06 | USEPA Region 4 | 0.06 | USEPA Region 4 |
| Benzo(e)pyrene | 192-97-2 | 0.9 | USEPA Region 4 | 0.9 | USEPA Region 4 |
| Benzo(g,h,i)perylene | 191-24-2 | 0.012 | USEPA Region 4 | 0.012 | USEPA Region 4 |
| Benzo(k)fluoranthene | 207-08-9 | 0.06 | USEPA Region 4 | 0.06 | USEPA Region 4 |
| Chrysene | 218-01-9 | 0.1 | BC ENV | 0.1 | BC ENV |
| Dibenz(a,h)anthracene | 53-70-3 | 0.01 | USEPA Region 4 | 0.01 | USEPA Region 4 |
| Fluoranthene | 206-44-0 | 2 | ANZECC/ANZG | 1.4 | ANZECC/ANZG |
| Fluorene | 86-73-7 | 3 | CCME | 3 | CCME |
| Indeno(1,2,3-c,d)pyrene | 193-39-5 | 0.012 | USEPA Region 4 | 0.012 | USEPA Region 4 |
| Naphthalene | 91-20-3 | 120 | ANZECC/ANZG | 70 | ANZECC/ANZG |
| Perylene | 198-55-0 | 0.9 | USEPA Region 4 | 0.9 | USEPA Region 4 |
| Phenanthrene | 85-01-8 | 8 | ANZECC/ANZG | 2 | ANZECC/ANZG |
| Pyrene | 129-00-0 | 0.025 | CCME | 0.025 | CCME |

**Notes**:
a – ANZECC guidelines for aluminium is pH dependent. Values listed are dependent on pH > 6.5.
b – Limited promulgated metals guidelines exist for Li, Fe, Mn, Ti, which may be associated with the aluminium production process.
For international guidelines that do not use percent species detection level, the available screening guideline is listed for both the 80% and 95% species protection level.
* Trace elements should be compared to the relevant fraction to appropriately characterize ecological risk in the receiving environment.
Freshwater guidelines were substituted when no Marine guidelines was available.
The recommended total cyanide guidelines are based on aquatic toxicology data expressed as free cyanide.
The PAHs presented represent the 18 parent PAH compounds used by ANZG for the derivation of Total PAH Sediment DGV.
1 – van Dam et al. (2018); Screening value was derived from revised water quality guidelines presented in the literature based on SSD approach.
2 – The Australian and New Zealand Guidelines for Fresh and Marine Quality do not provide guidelines for total arsenic in marine waters. Therefore, the 80 % and 95% marine guideline values derived by Golding et al. (2022) for arsenic (V) was adopted due to the propensity of arsenic to exists as oxyanions of arsenate [As(V)].
3 – The Australian and New Zealand Guidelines for Fresh and Marine Quality do not provide guidelines for boron in marine waters. Therefore, the marine background value of 5100 µg/L was adopted from ANZECC (2000) as a reference value.
4 – The Australian and New Zealand Guidelines for Fresh and Marine Quality do not provide guidelines for total chromium in marine waters. Therefore, marine trigger value for chromium (III) was adopted as a conservative measure of ecological risk.
ANZG – ANZG Guidelines
BTAG – USEPA Region 3 Biological Technical Assistance Group
BC ENV – British Columbia Ministry of Environment and Climate Change Strategy
CCME – Canadian Council of Ministers of Environment
DGV – Default Guideline Value
PAH – Polycyclic Aromatic Hydrocarbons

## 3.3 Marine Sediment

Sediment samples are to be screened against the DGV and GV-High values that are presented in **Table 4**. The DGVs indicate the concentrations below which there is a low risk of unacceptable effects occurring and are protective of aquatic ecosystems. The GV-High value provides an indication of concentrations at which toxicity-related adverse effects would be expected. As such, GV-High values are used as an indicator of potential high-level toxicity problems, not as a guideline value.

**TABLE 4 RECOMMENDED SEDIMENT GUIDELINE VALUES**

| Analyte | Cas-RN | DGV Screening-Level (mg/kg) | Source | ANZG GV-High Screening-Level (mg/kg) |
|---|---|---|---|---|
| **TRACE ELEMENTS** | | | | |
| Aluminium[a] | 7429-90-5 | No Criteria | -- | -- |
| Antimony | 7440-36-0 | 2 | ANZG-DGV | 25 |
| Arsenic | 7440-38-2 | 20 | ANZG-DGV | 70 |
| Cadmium | 7440-43-9 | 1.5 | ANZG-DGV | 10 |
| Chromium | 7440-47-3 | 80 | ANZG-DGV | 370 |
| Cobalt | 7440-48-4 | 50 | BTAG | -- |
| Copper | 7440-50-8 | 65 | ANZG-DGV | 270 |
| Lead | 7439-92-1 | 50 | ANZG-DGV | 220 |
| Mercury | 7439-97-6 | 0.15 | ANZG-DGV | 1 |
| Nickel | 7440-02-0 | 21 | ANZG-DGV | 52 |
| Silver | 7440-22-4 | 1 | ANZG-DGV | 4 |
| Zinc | 7440-66-6 | 200 | ANZG-DGV | 410 |
| **INORGANICS** | | | | |
| Free Cyanide[b] | FREE CN | No Criteria | -- | -- |
| Cyanide[b] | 57-12-5 | No Criteria | -- | -- |
| WAD Cyanide[b] | WDCN | No Criteria | -- | -- |
| Fluoride | 16984-48-8 | 290 | Metcalfe-Smith et al. 2003 | -- |
| **PAHs*** | | | | |
| 2-methylnaphthalene | 91-57-6 | 0.0202 | CCME | -- |
| Acenaphthene | 83-32-9 | 0.00671 | CCME | -- |
| Acenaphthylene | 208-96-8 | 0.00587 | CCME | -- |
| Anthracene | 120-12-7 | 0.0469 | CCME | -- |
| Benzo[a]pyrene | 50-32-8 | 0.0888 | CCME | -- |

| Analyte | Cas-RN | DGV Screening-Level (mg/kg) | Source | ANZG GV-High Screening-Level (mg/kg) |
|---|---|---|---|---|
| Benzo[g,h,i]perylene | 191-24-2 | 0.17 | BTAG | -- |
| Benzo[k]fluoranthene | 207-08-9 | 0.24 | BTAG | -- |
| Chrysene | 218-01-9 | 0.108 | CCME | -- |
| Dibenz(a,h)anthracene | 53-70-3 | 0.00622 | CCME | -- |
| Fluoranthene | 206-44-0 | 0.113 | CCME | -- |
| Fluorene | 86-73-7 | 0.0212 | CCME | -- |
| Indeno(1,2,3-c,d)pyrene | 193-39-5 | 0.017 | BTAG | -- |
| Naphthalene | 91-20-3 | 0.0346 | CCME | -- |
| Phenanthrene | 85-01-8 | 0.0867 | BTAG | -- |
| Pyrene | 129-00-0 | 0.153 | CCME | -- |
| Total PAHs | PAHs total | 10 | ANZG-DGV | 50 |
| **TPH** | | | | |
| TPHs | -- | 280 | ANZG-DGV | 550 |
| **PCBs** | | | | |
| Total PCBs[1] | PCBs total | 0.034 | ANZG-DGV | 0.280 |
| **SVOCs** | | | | |
| 1,2-dichlorobenzene[1] | 95-50-1 | 0.989 | BTAG | -- |
| 1,3-dichlorobenzene[1] | 541-73-1 | 0.842 | BTAG | -- |
| 1,4-dichlorobenzene[1] | 106-46-7 | 0.46 | BTAG | -- |
| 2,4,5-trichlorophenol[1] | 95-95-4 | 0.819 | BTAG | -- |
| 2,4,6-trichlorophenol[1] | 88-06-2 | 2.65 | BTAG | -- |
| 2,4-dichlorophenol | 120-83-2 | 0.117 | BTAG | -- |
| 2,4-dimethylphenol | 105-67-9 | 0.029 | BTAG | -- |
| 2,4-Dinitrotoluene | 121-14-2 | 0.0416 | BTAG | -- |
| 2-chlorophenol[1] | 95-57-8 | 0.344 | BTAG | -- |
| 4-bromophenyl phenyl ether | 101-55-3 | 1.23 | BTAG | -- |
| 4-methylphenol | 106-44-5 | 0.67 | BTAG | -- |
| 4,4-DDE[1] | 72-55-9 | 0.0014 | ANZG-DGV | 0.007 |
| 3,4- & 4,4-DDD[1] | -- | 0.0035 | ANZG-DGV | 0.009 |
| a-BHC[1] | 319-84-6 | 1.36 | BTAG | -- |
| Aldrin | 309-00-2 | 0.002 | BTAG | -- |
| b-BHC | 319-85-7 | 0.005 | BTAG | -- |
| Bis(2-ethylhexyl) phthalate | 117-81-7 | 0.182 | BTAG | -- |
| Butyl benzyl phthalate[1] | 85-68-7 | 16.8 | BTAG | -- |
| Chlordane | 57-74-9 | 0.0045 | ANZG-DGV | 0.009 |
| d-BHC | 319-86-8 | 6.4 | BTAG | -- |

| Analyte | Cas-RN | DGV Screening-Level (mg/kg) | Source | ANZG GV-High Screening-Level (mg/kg) |
|---|---|---|---|---|
| Dibenzofuran[1] | 132-64-9 | 7.3 | BTAG | -- |
| Dieldrin | 60-57-1 | 0.0028 | ANZG-DGV | 0.007 |
| Di-n-butyl phthalate[1] | 84-74-2 | 1.16 | BTAG | -- |
| Endosulfan[1] | 115-29-7 | 0.000107 | BTAG | -- |
| Endosulfan sulphate[1] | 1031-07-8 | 0.000357 | BTAG | -- |
| Endrin | 72-20-8 | 0.0027 | ANZG-DGV | 0.06 |
| g-BHC (Lindane) | 58-89-9 | 0.00032 | CCME | -- |
| Heptachlor | 76-44-8 | 0.0006 | CCME | -- |
| Heptachlor epoxide | 1024-57-3 | 0.0006 | BTAG | -- |
| Hexachlorobenzene | 118-74-1 | 0.02 | BTAG | -- |
| Hexachlorocyclopentadiene[1] | 77-47-4 | 0.139 | BTAG | -- |
| Hexachloroethane[1] | 67-72-1 | 0.804 | BTAG | -- |
| Lindane | 58-89-9 | 0.0009 | ANZG-DGV | -- |
| Methoxychlor[1] | 72-43-5 | 0.0296 | BTAG | -- |
| n-Nitrosodiphenylamine[1] | 86-30-6 | 422 | BTAG | -- |
| Phenol | 108-95-2 | 0.42 | BTAG | -- |
| Total DDT[1] | -- | 0.0012 | ANZG-DGV | 0.005 |
| **VOCs** | | | | |
| 1,1,1-trichloroethane[1] | 71-55-6 | 0.856 | BTAG | -- |
| 1,1,2,2-tetrachloroethane[1] | 79-34-5 | 0.202 | BTAG | -- |
| 1,1,2-trichloroethane[1] | 79-00-5 | 0.57 | BTAG | -- |
| 1,1-dichloroethene[1] | 75-35-4 | 2.78 | BTAG | -- |
| 1,2,3-trichlorobenzene | 87-61-6 | 0.858 | BTAG | -- |
| 1,2,4-trichlorobenzene[1] | 120-82-1 | 0.473 | BTAG | -- |
| Benzene[1] | 71-43-2 | 0.137 | BTAG | -- |
| Bromoform[1] | 75-25-2 | 1.31 | BTAG | -- |
| Carbon disulfide | 75-15-0 | 0.000851 | BTAG | -- |
| Carbon tetrachloride[1] | 56-23-5 | 7.24 | BTAG | -- |
| Chlorobenzene[1] | 108-90-7 | 0.162 | BTAG | -- |
| Ethylbenzene[1] | 100-41-4 | 0.305 | BTAG | -- |
| Styrene[1] | 100-42-5 | 7.07 | BTAG | -- |
| Tetrachloroethene[1] | 127-18-4 | 0.19 | BTAG | -- |
| Toluene[1] | 108-88-3 | 1.09 | BTAG | -- |
| trans-1,2-dichloroethene | 156-60-5 | 1.05 | BTAG | -- |

**Notes**:
a – Sediment aluminium value is dependent on factors affecting aqueous mobility. The screening value will be determined upon evaluating these parameters.

b – A full suite of analysis is required in order to appropriately constrain the nature and extent of cyanide; therefore, no screening value was selected.
1 - Values are reported at the default level using 1% TOC and are subject to change based on site specific criteria.
* PAH screening against ANZG DGV requires 1% organic carbon normalization.
Ecological Screening Hierarchy was built using the following guidelines. The value for each constituent was selected from the first tier with value for that constituent. Within each tier, a conservative screening value was selected based on site factors including land use and/or marine/freshwater environment.
In the absence of promulgated risk-based criteria, an interim guideline value derived from the literature was selected for fluoride screening in sediment (Metcalfe-Smith et al. 2003). A robust assessment of risk may require site-specific derivation of fluoride criteria. The value selected represents a realistic value were for fluoride rather than selecting the most conservative CCME value.
● ANZG Sediment Default Guideline Values
● CCME Sediment Quality Guidelines for the Protection of Environmental Health - conservative value selected across all land uses given the ambiguous nature of future site plans.
● USEPA Region 3 BTAG Guidelines for Marine Sediment (USEPA 2006a,b)
ANZG – Australia and New Zealand Guidelines
BHC – beta-Hexachlorocyclohexane
BTAG – USEPA Region 3 Biological Technical Assistance Group
CCME – Canadian Council of Ministers of the Environment
DDD – Dichlorodiphenyldichloroethylene
DDE – Dichlorodiphenyldichloroethane
DDT – Dichlorodiphenyltrichloroethane
mg/kg – milligram per kilograms
PAH – Polycyclic Aromatic Hydrocarbons
PCB – Polychlorinated biphenyl

## 3.4 Soils

Soil screening values (for protection of the terrestrial environment) outside of the NZAS facility boundary are presented in **Table 5.**

The terrestrial ecological soil contaminant standards have been derived for sensitive and non-sensitive environmental areas. It will be necessary to apply the appropriate standards to each respective environmental setting based on the following definitions:

- Non-Sensitive Ecological Area comprises an area classified as moderate, low, or negligible ecological value using the methodology set out in the Roper-Lindsay et al. (2018) (EIANZ procedure).
- Sensitive Ecological Area comprises an area classified as very high or high ecological value using the methodology set out in Roper-Lindsay et al. (2018).

NZAS has prepared an ecological sensitivity map for the western area of Tiwai Peninsula using the EIANZ procedure. A copy of this map is reproduced in **Appendix B** – Sensitive and Non-Sensitive Area Map**.** The screening values presented comprise values derived/estimated using risk assessment procedures for ecological soil criteria, described in **Appendix C.**

**TABLE 5 BOUNDARY AREA ECOLOGICAL SCREENING VALUES**

| Analyte | Sensitive Ecological Soil Screening Values (mg/kg)[1] | Non-Sensitive Ecological Soil Screening Values (mg/kg)[1] |
|---|---|---|
| ***Inorganics*** | | |
| Aluminium[2] | Narrative | Narrative |
| Arsenic | 6 | 20 |
| Barium | - | - |
| Beryllium | - | - |
| Boron | 4 | 7 |
| Cadmium | 1.5 | 1.5 |
| Chromium Total | 100 | 190 |
| Cobalt | 61.7 | 105.3 |
| Copper | - | - |
| Cyanide (free) | - | - |
| Fluoride | 165 | 200[3] |
| Iron | - | - |
| Lead | 55 | 2180 |
| Manganese | - | - |
| Mercury | - | - |
| Nickel | 66.5 | 120.1 |
| Vanadium | - | - |
| Zinc | 110 | 130[3] |
| LMW PAHs[4] | 1.4 | 10 |
| HMW PAHs[4] | 3.7 | 8.5 |
| Total PAH[5] | - | - |
| Acenaphthene | - | - |
| Acenaphthylene | - | - |
| Anthracene | - | - |
| Benzo(a)anthracene | - | - |
| Benzo(a)pyrene | - | - |
| Benzo(b)fluoranthene | - | - |
| Benzo(e)pyrene | - | - |
| Benzo(g,h,i)perylene | - | - |
| Benzo(k)fluoranthene | - | - |
| Chrysene | - | - |
| Dibenz(a,h)anthracene | - | - |
| Fluoranthene | - | - |

| Analyte | Sensitive Ecological Soil Screening Values (mg/kg)[1] | Non-Sensitive Ecological Soil Screening Values (mg/kg)[1] |
|---|---|---|
| Fluorene | - | - |
| Indeno(1,2,3-c,d)pyrene | - | - |
| Naphthalene | - | - |
| Perylene | - | - |
| Phenanthrene | - | - |
| Pyrene | - | - |
| TPH F1 (C6-C10 carbon bands)[6] | 66 | 110 |
| TPH F2 (>C10-C16 carbon bands)[7] | 45 | 70 |
| TPH F3 (>C16-C34 carbon bands - coarse)[7,8] | 166 | 300 |
| TPH F4 (>C34 carbon bands - coarse)[7,9] | 380 | 1,700 |
| TPH (C7-C36 carbon bands) | - | - |
| Total PCBs | 1 | 1 |

Notes:

mg/kg = milligrams per kilogram dry weight
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
w/w = weight/weight
D = dissolved concentrations
T = total concentrations
TV = threshold value[14]

1.Ecological soil screening values (Eco-SGVs) have been derived for sensitive and non-sensitive environmental areas. It will be necessary to apply the appropriate screening values to each respective environmental setting. All Eco-SGVs will require background concentrations to be incorporated. For arsenic, cadmium, chromium, lead and zinc, the assumed background will need to be subtracted and the calculated site background added.

2. The narrative ecological soil screening value proposed for Tiwai Point identifies aluminium as a potential constituent of concern in areas with soil pH values less than 5.5, soil pH values greater than 9.0, or in specific areas where aluminium species with potentially greater solubility has been identified. The potential for adverse effects associated with ecological exposure to aluminium in soil should be further investigated to establish site-specific Eco-SGVs for areas of the site where these conditions exist. The systematic process of site-specific assessment of aluminium data in soils is as follows:

I. Calculate the geometric mean of field or laboratory measured soil pH within each ecological exposure area defined for the site. Consistent with NEPC (2013), the geometric mean can be a suitable metric to evaluate exposure if it is adequately representative of the area being evaluated. Localized areas of highly alkaline (pH > 9) or acidic soils (pH < 5.5) should be evaluated separately within exposure areas based on the size of the area of highly alkaline or acidic soil and the potential for adverse effects to terrestrial plant and soil invertebrate communities within those areas.
II. If the geometric mean of measured soil pH is within the range of 5.5 to 9.0, then aluminium will not be identified as a potential constituent of ecological concern that would require further investigation or remediation. In conjunction with the soil assessment, groundwater quality data from wells should be assessed to assess potential leaching to groundwater and presence of groundwater concentrations which could be deleterious to aquatic/benthic receptors within the receiving environment.

III. If the geometric mean of soil pH values for an ecological exposure area are outside this range (pH < 5.5 or pH > 9), a site-specific assessment of aluminium bioavailability and toxicity should be conducted consistent with NEPC (2013) and Heemsbergen et al. (2009):
   a. Further chemical investigation of site-specific aluminium bioavailability in soil using established chemical extraction methods appropriate for assessing the bioavailable fraction of aluminium (e.g., McLaughlin et al. 2000) and corresponding ecotoxicological endpoints to evaluate the bioavailable fraction[1].
   b. If the chemical investigation of site-specific aluminium bioavailability in soil within an ecological exposure area indicates the potential for adverse effects based on the bioavailable fraction of aluminum exceeding corresponding ecotoxicological endpoints, a direct toxicity assessment (DTA) should be conducted using soil from the exposure area in accordance with NEPC, (2013) and Heemsbergen et al. (2009). The following considerations should be incorporated into the design of the DTA:
      i. Standardised methods for soil toxicity testing developed by regulatory and international agencies, including American Society for Testing and Materials (ASTM), International Standards Organisation (ISO), OECD, Environment Canada (EC), and USEPA, should be used to support the DTA.
      ii. Test organisms should be directly exposed to soil collected from the site. The selection of appropriate test organisms should be informed by the conceptual site model and aligned with available standardized test methods. The number of test species and distribution of test species among taxonomic groups should be determined based on the minimum data requirements for deriving Eco-SGVs (Cavanagh and Munir, 2016).
      iii. Chronic exposure toxicity tests (greater than 2 weeks exposure duration) should be conducted to minimise the uncertainty in the application of an acute-to-chronic conversion factor.
      iv. Ecologically relevant test endpoints (e.g., growth and reproduction) and appropriate measures of effects (e.g., 30% effect concentration data) should be reported from soil toxicity tests to support Eco-SGV derivation (Cavanagh and Munir, 2016).
      v. Soil toxicity tests should meet the acceptability criteria provided in Heemsbergen et al. (2009), including satisfying the performance criteria established in each respective standardised soil toxicity test method.
      vi. Concentrations of constituents of potential ecological concern other than aluminium should be determined in representative aliquots of soil samples submitted for soil toxicity testing to characterize potential non-aluminium chemical stressors that may influence soil toxicity testing results. In addition, ancillary parameters, such as pH, organic carbon, and grain size distribution, should also be measured in representative aliquots of soil samples submitted for soil toxicity testing to aid in the interpretation of toxicity test results.

IV. Eco-SGVs for aluminium should be derived from site-specific toxicity endpoints based on the minimum data requirements (Cavanagh and Munir, 2016; NEPC, 2013; Heemsbergen et al., 2009):
   a. If there are toxicity endpoints for at least five species or soil processes for three taxonomic or nutrient groups, develop an SSD to establish species protection levels.
   b. If the minimum data requirements for the SSD cannot be met, apply the assessment factor (AF) approach.

4. The estimated non-sensitive ecological soil screening values for fluoride and zinc yielded concentrations of 237 mg/kg and 150 mg/kg respectively and are slightly higher than the Table 1 derived screening values for these determinants. To address this difference the lower concentrations have been applied to the non-sensitive ecological soil screening values.

5. Low molecular weight (LMW) PAHs include PAH compounds with fewer than four benzene rings; high molecular weight (HMW) PAHs include PAH compounds with four or greater benzene rings.

6. Total PAHs is the sum of the 18 USEPA priority PAHs.

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[1] The USEPA identified difficulties in the accuracy and precision of measuring soluble aluminum concentrations in pore water or soil extracts (USEPA, 2003). As a result, USEPA concluded that it was not possible at the time of the review to recommend the direct measurement of soluble aluminum as the method for predicting the toxicity of aluminum in soils. The difficulties associated with accurately and precisely measuring soluble aluminum in soil and identifying appropriate ecotoxicological endpoints for soluble aluminum would need to be reconciled to support a chemical investigation of aluminum bioavailability as a preliminary step prior to conducting a DTA.

7. Total Petroleum Hydrocarbons (TPH). Eco-SGVs for TPH were derived by Cavanagh and Munir (2016) for four TPH fractions based on carbon chains: F1: C6–C10, F2:>C10–C16, F3: >C16–C34 and F4: >C34. Eco-SGVs do not account for the effects of TPH ageing or organic carbon content on toxicity. F3 and F4 TPH toxicity data were available to derive Eco-SGVs for fine and coarse soils for these fractions. Given the predominance of coarse-grained soil at the Tiwai Point site, F3 and F4 TPH Eco-SGVs for coarse soils were selected over the Eco-SGCs developed by Cavanagh and Munir (2016). Cavanagh and Munir (2016) indicate that the Eco-SGVs for the F1, F2, and F4 fractions are relevant for fresh contamination only, while F3 Eco-SGVs are relevant to weathered hydrocarbon mixtures within that carbon chain range. At 20,000 mg/kg (MfE, 2011c) residual separate phase is expected to have formed in soil matrix and some aesthetic impact may be noted. There must be no measurable separate phase hydrocarbons in groundwater monitoring wells installed within the Boundary Area.

8. Cavanagh and Munir (2016) did not identify Eco-SGVs for the F3 TPH fraction in coarse soils for areas of ecological significance due to limited toxicity data for this fraction. This conclusion is consistent with ASC NEMP (2013) and CCME (2008), which did not derive F3 TPH (coarse) soil guideline values for ecologically significant areas due to limited toxicity data. In the absence of derived guideline values from these sources, an Eco-SGV of 166 mg/kg was derived based on SSDs developed for the F3 TPH in coarse soils.

9. Cavanagh and Munir (2016) did not identify Eco-SGVs for the F4 TPH fraction in coarse soils for areas of ecological significance due to limited toxicity data for this fraction. This conclusion was consistent with ASC NEMP (2013) and CCME (2006, 2008), which did not derive F4 TPH (coarse) soil guideline values for ecologically significant areas. In the absence of derived guideline values from these sources, the Eco-SGV of 380 mg/kg was derived based on SSDs for the F4 TPH fraction in coarse soils.

# Definitions and References

## Definitions

**Coarse Soil** – Means soil texture classification for sand as described in NZGS (2005) and referenced in Schedule B1 of ASC NEPM (NEPC, 2013).

**Fine Soil** – Means soil texture classification for sand as described in NZGS (2005) and referenced in Schedule B1 of ASC NEPM (NEPC, 2013). Fine with liquid limit less than 50% is applied for silt and fine with liquid limit greater than 50% is applied for clay.

**Non-Sensitive Ecological Areas** – Means an area classified as having moderate, low or negligible ecological value using the methodology set out in the Roper-Lindsay et al., (2018).

**Sensitive Ecological Areas** – Means an area classified as having high or very high ecological value using the methodology set out in the Roper-Lindsay et al., (2018).

**TPH Soil Management Limits** – Soil management limits address other adverse effects including separate-phase formation, fire and explosion hazards, effects on buried infrastructure and aesthetic considerations. Application of the management limits will require consideration of site-specific factors such as the depth of building basements and services and depth to groundwater, to determine the maximum depth to which the limits should apply. At a minimum, the soil management limits apply to the upper 4 m of the soil profile.

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# Appendix A – Limitations

This assessment work has been undertaken in accordance with the Umbrella Contract between ES and EHS Support, dated 2 August 2021.

EHS Support has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Environment Southland and only those third parties who have been authorised in writing by EHS Support to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

The methodology adopted and sources of information used by EHS Support are outlined in this report. EHS Support has made no independent verification of this information beyond the agreed scope of works and EHS Support assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to EHS Support was false.

This report was issued on 20 July 2023 and is based on the conditions encountered and information reviewed at the time of preparation. EHS Support disclaims responsibility for any changes that may have occurred after this time.

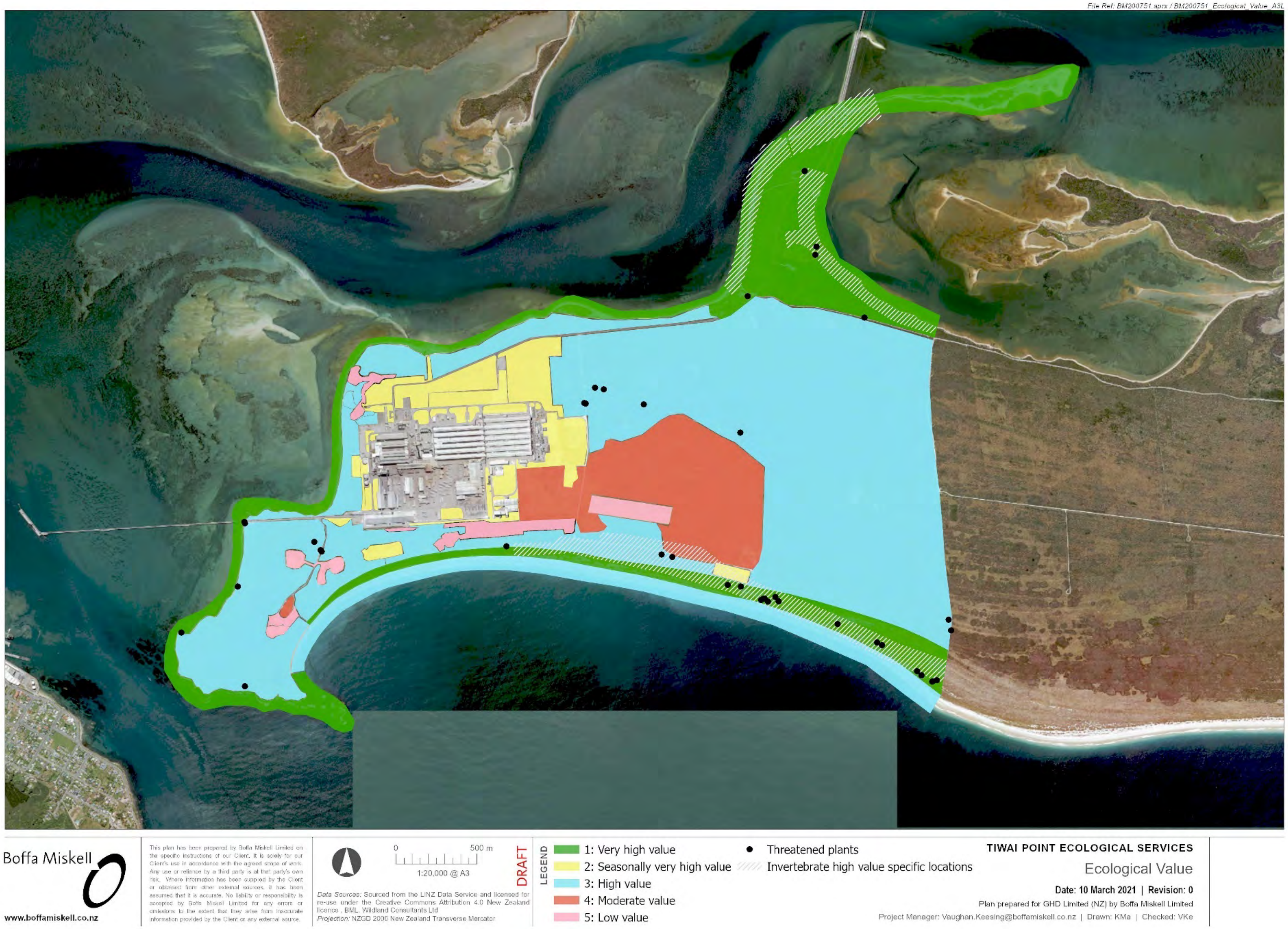
This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. EHS Support's conclusions are based upon the analytical data presented in this report and our experience. Future advances regarding the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact our conclusions and recommendations regarding their potential presence on this Site.

Where conditions encountered at the Site are subsequently found to differ significantly from those anticipated in this report, EHS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels, can change in a limited time; therefore, this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.

# Appendix B – Sensitive and Non-Sensitive Area Map



This plan has been prepared by Boffa Miskell Limited on the specific instructions of our Client. It is solely for our Client's use in accordance with the agreed scope of work. Any use or reliance by a third party is at that party's own risk. Where information has been supplied by the Client or obtained from other external sources, it has been assumed that it is accurate. No liability or responsibility is accepted by Boffa Miskell Limited for any errors or omissions to the extent that they arise from inaccurate information provided by the Client or any external source.

*Data Sources:* Sourced from the LINZ Data Service and licensed for re-use under the Creative Commons Attribution 4.0 New Zealand licence , BML, Wildland Consultants Ltd

*Projection:* NZGD 2000 New Zealand Transverse Mercator

**Figure 5-1 Ecological values for vegetation and habitats surrounding NZAS**

# Appendix C – Tiwai Point Aluminium Smelter. Technical Report – Ecological Soil Guideline Values

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# MEMO

To: Environment Southland – Graeme McKenzie and Bruce Halligan

From: Simon Hunt

CC: Wynn Williams Ltd – Tim McGuigan

Date: 22 February 2023

Re: Technical Memo – Ecological Soil Guideline Values. Tiwai Point Aluminium Smelter

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## Introduction

EHS Support New Zealand Ltd (“EHS Support”) has been retained by Environment Southland (ES) to develop Tier 1 ecological soil guideline values (Eco-SGVs) for the Tiwai Point Aluminium Smelter (“Tiwai Point”) in Awarua, New Zealand. The guideline values have been derived to be protective of terrestrial ecosystems at Tiwai Point.

The purpose of this memorandum is to provide supporting documentation for the derivation of the Tier 1 Eco-SGVs.

## Methodology – Ecological Soil Guideline Values

The following sections describe the approach for calculating Eco-SGVs for the protection of ecological receptors. Eco-SGVs were derived to be protective of ecological receptor populations based on ecological protection levels defined for land use categories identified from species sensitivity distribution (SSD) derived from effect concentrations for 30% of test organisms ($EC_{30}$) endpoints. Eco-SGVs were derived to be protective based on the toxicity datasets reviewed and analysed for the identified constituents of concern; however, the derived Eco-SGVs may be over-protective in the context of site-specific conditions that affect the bioavailability and toxicity of constituents of concern. In addition to the site-specific conditions that affect the bioavailability and toxicity of constituents of concern, site-specific background concentrations should be incorporated into the derivation of remedial goals (refer **Attachment A**). Therefore, the Eco-SGVs identified in Table 4 will require to be adjusted when suitable and approved soil background concentrations are available (i.e., Eco-SGV= ABC + ACL).

### Constituents of Concern

Constituents identified for Eco-SGV derivation are those known to be associated with the aluminium smelting process, and include the following:

| PAHs | Inorganics | | |
|---|---|---|---|
| - Low molecular weight (LMW) PAHs<br>- High molecular weight (HMW) PAHs | - Aluminium<br>- Arsenic<br>- Boron<br>- Cadmium | - Chromium (III)<br>- Cobalt<br>- Copper<br>- Fluoride | - Lead<br>- Nickel<br>- Zinc |

The list of constituents identified for the derivation of Eco-SGVs is a subset of the list of constituents identified above for the derivation of human health direct contact Tier 1 screening values. As warranted, Eco-SGVs for additional constituents may be derived using the following approach .

## Approach

Eco-SGVs were derived consistent with the approach presented in the *Updating the Ecological Soil Guideline Values (Eco-SGVs*; Cavanagh, 2019), supplemented with international guidance documents on the derivation of ecological soil guidelines (Heemsbergen et al., 2009; Organisation for Economic Cooperation and Development [OECD], 2017; Oorts, 2020; USEPA, 2005).

As supported by available toxicity data, Eco-SGVs were calculated for the following land use categories and corresponding ecological protection levels:

- Areas of ecological significance (99% protection level)
- Non-food production land (95% protection level)
- Agricultural land (95% protection level for plants; 80% protection level for microbes/invertebrates)
- Residential/recreational (80% protection level)
- Commercial/industrial (60% protection level)

Consistent with Cavanagh (2019), the approach for addressing secondary poisoning and transfer through the food web includes increasing the ecological protection level by 5%.

**Table 1** provides a summary of the approaches used to derive Eco-SGVs. Eco-SGVs were selected or derived in the following hierarchy:

1. Eco-SGVs derived for New Zealand in Cavanagh (2019) were selected.
2. Hazardous concentrations (HCx) were calculated using the Threshold Calculator for Metals in Soil v3.0 (TCM v3.0; Oorts, 2020) for the ecological protection levels identified above.
3. Eco-SGVs were derived in this report consistent with the approach presented in Cavanagh (2019).

**Table 1 Summary of the Approach for Calculating Eco-SGVs**

| Analyte | CAS No. | Eco-SGVs (Cavanagh, 2019; Cavanagh and Munir, 2016) | Threshold Calculator for Metals (Oorts, 2020) | Derived by EHS Support (This Report) |
|---|---|---|---|---|
| ***PAHs*** | | | | |
| LMW PAHs | NA | | | ● |
| HMW PAHs | NA | | | ● |
| ***Total Petroleum Hydrocarbons (TPH)*** | | | | |
| F1 | NA | ● | | |
| F2 | NA | ● | | |

| Analyte | CAS No. | Eco-SGVs (Cavanagh, 2019; Cavanagh and Munir, 2016) | Threshold Calculator for Metals (Oorts, 2020) | Derived by EHS Support (This Report) |
|---|---|---|---|---|
| F3 (coarse) | NA | ● | | ●[1] |
| F4 (coarse) | NA | ● | | ●[1] |
| ***Inorganics*** | | | | |
| Aluminium | 7429-90-5 | | | ●[2] |
| Arsenic | 7440-38-2 | ● | | |
| Boron | 7440-42-8 | ● | | |
| Cadmium | 7440-43-9 | ● | | |
| Chromium | 16065-83-1 | ● | | |
| Cobalt | 7440-48-4 | | ● | |
| Copper | 7440-50-8 | ● | | |
| Fluoride | 7782-41-4 | | | ● |
| Lead | 7439-92-1 | ● | | |
| Nickel | 7440-02-0 | | ● | |
| Zinc | 7440-66-6 | ● | | |

Note:
HMW = high molecular weight
LMW = low molecular weight
NA = not applicable
PAHs = polycyclic aromatic hydrocarbons
Eco-SGVs = ecological soil guideline values

1, Values for the Sensitive Ecological Soil Contaminant Standard (99th percent protection) were derived in this report; values for other land uses were derived in Cavanagh and Munir (2016).

2, Narrative guideline discussed in the *Aluminium* section below.

A discussion of each approach is provided in the following sections.

## Eco-SGVs (Cavanagh, 2019; Cavanagh and Munir, 2016)

Cavanagh (2019) and Cavanagh and Munir (2016) derived Eco-SGVs for arsenic, boron, cadmium, chromium, copper, lead, zinc, and total petroleum hydrocarbons (TPH) for various land use categories:

- Areas of ecological significance
- Non-food production land
- Agricultural use
- Residential/recreational area
- Commercial/industrial

Consistent with guidance, Eco-SGVs were derived for inorganic constituents based on $EC_{30}$ endpoints using an SSD approach for levels of ecological protection identified for each land use category. For copper and zinc, Eco-SGVs calculated by Cavanagh (2019) for exposure to metals in aged soils with soil properties considered sensitive to metals exposure were selected to represent historical releases and site conditions in soil. Sensitive soils were selected based on the *Detailed Site*

*Investigation Report* (GHD, 2021) that indicated basic soil suite results with minimum (all zones) and average (all zones except Zone A and Zone L) cation exchange capacity (CEC) less than the 13 centimoles/kilogram (cmol/kg) or milliequivalent/100 grams (meq/100 g), as established as one of the key factors for sensitive soils (Cavanagh, 2019) (other factor data for local soils is not available).

Eco-SGVs for TPH were derived by Cavanagh and Munir (2016) for four TPH fractions based on carbon chains: F1: C6–C10, F2:>C10–C16, F3: >C16–C34 and F4: >C34. Derived Eco-SGVs do not account for the effects of TPH ageing or organic carbon content on toxicity. However, F3 and F4 TPH toxicity data were available to derive Eco-SGVs for fine and coarse soils for these fractions. Given the predominance of coarse-grained soil at the Tiwai Point site, F3 and F4 TPH Eco-SGVs for coarse soils were selected. Cavanagh and Munir (2016) indicate that the Eco-SGVs for the F1, F2, and F4 fractions are relevant for fresh contamination only, while F3 Eco-SGVs are relevant to weathered hydrocarbon mixtures within that carbon chain range. Given the limited data used to develop Eco-SGVs, Cavanagh and Munir (2016) indicate that Eco-SGVs for TPHs are most appropriate for use as screening criteria. Therefore, additional site-specific assessment may be needed to adjust Eco-SGVs for TPHs to establish final remedial goals.

### Threshold Calculator for Metals (Oorts, 2020)

In the absence of Eco-SGVs for cobalt and nickel from Cavanagh (2019), available toxicity data in the TCMv3.0 was used to derive soil threshold values. TCMv3.0 is a publicly available calculator that uses datasets developed for the European Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) dossiers and supplemental datasets to derive soil threshold concentrations consistent with OECD (2016).

Eco-SGVs were calculated for cobalt and nickel using TCMv3.0 based on sensitive soil characteristics identified by Cavanagh (2019). Total recoverable concentrations of each metal (including background) were estimated based on estimated thresholds normalised to specific site soil conditions for the land use categories and associated ecological protection levels identified by Cavanagh (2019), as indicated above (**Attachment A-1**). In the absence of specific effect concentrations (e.g., $EC_{30}$), no observed effect concentration (NOEC), maximum allowable toxicant concentration (MATC) and lowest observed effects concentration (LOEC) endpoints were included, provided that the resulting effect concentrations did not exceed and effect boundary of $EC_{10}$, $EC_{25}$, or $EC_{40}$ for NOEC, MATC or LOEC values, respectively.

### Derived by EHS Support (This Report)

Eco-SGVs were derived for LMW PAHs, HMW PAHs, F3 and F4 TPHs for sensitive ecological areas, fluoride and aluminium because SGVs were not available for these constituents from Cavanagh and Munir (2016), Cavanagh (2019) or TCM v3.0. The approach for calculating Eco-SGVs for LMW PAHs, HMW PAHs and fluoride followed the approach for developing an SSD that is presented by Cavanagh (2019). Direct contact exposure endpoints for the protection of plants, soil invertebrates, or soil microbial communities were compiled from accepted datasets and supplemented by additional literature studies. As warranted, toxicity endpoints were standardized to LOEC or $EC_{30}$ endpoints based on the guidance provided by Cavanagh (2019). LOEC or $EC_{30}$ direct exposure endpoints were input into Burrlioz 2.0 software[1] to generate the direct exposure soil SSDs for LMW PAHs, HMW

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[1] The Burrlioz 2.0 software fits a statistical distribution to an empirical cumulative frequency distribution of the direct exposure toxicity endpoints. For datasets containing less than 8 toxicity endpoints, a log-logistic distribution is used to

PAHs and fluoride, consistent with Cavanagh (2019) and the derivation of soil and water quality guidelines (WQG) in Australia and New Zealand (Heemsbergen et al., 2009; Warne et al., 2018, respectively). Additional details on the data supporting the SSD generation for LMW PAHs, HMW PAHs and fluoride are provided as follows.

A numerical Eco-SGV was not developed for aluminium given the geochemical parameters that control the bioavailability and toxicity of aluminium in soil. Therefore, a narrative soil screening value for aluminium was developed consistent with USEPA (2003) (refer to section below). The following sections describe the underlying datasets to derive Eco-SGVs for LMW PAHs, HMW PAHs and fluoride, as well as the rationale for the narrative guideline for aluminium.

### *PAHs*

Direct contact toxicity endpoints for LMW PAHs and HMW PAHs were established using toxicity studies accepted by the USEPA for the derivation of ecological soil screening levels (Eco-SSLs; USEPA, 2003). LMW PAHs represent PAH compounds with fewer than four benzene rings; HMW PAHs represent PAH compounds with four or more benzene rings. Endpoint values in the Eco-SSL dataset represent exposure to total concentrations of each molecular weight category soil (e.g., added contaminant concentration plus background). Reported endpoints for LMW PAHs and HMW PAHs were standardized to LOEC or $EC_{30}$ endpoints based on the guidance provided by Cavanagh (2019) and compiled for species-endpoint for input into the Burrlioz 2.0 software for SSD generation. Direct contact endpoint values used to generate LMW PAH and HMW PAH SSDs are provided in **Attachment A-2.** Outputs from the Burrlioz SSD generation for LMW PAHs and HMW PAHs, including ecological protection levels designated for each land use category are provided in **Attachment A-3**.

Cavanagh and Munir (2016) derived Eco-SGVs for individual PAH compounds within the LMW (fluoranthene) and HMW (benzo[a]pyrene) groups. **Table 2** presents a comparison of the Eco-SGVs derived in this report for LMW and HMW to Eco-SGVs derived by Cavanagh and Munir (2016) for fluoranthene and benzo[a]pyrene. The comparisons indicate that the Eco-SGVs derived in this document based on US EPA Eco-SSL datasets were generally lower (within a factor of 3) across

**Table 2 Comparisons of Eco-SGVs Derived for Individual PAH Compounds in Cavanagh and Munir (2016).**

| COC | Areas of Ecological Significance (99%) | Non-Food Production Land (95%) | Agricultural Land (95% plants, 80% microbes/ invertebrates) | Residential/ Recreational Area (80%) | Commercial/ Industrial (60%) |
|---|---|---|---|---|---|
| **Low Molecular Weight (LMW) Polycyclic Aromatic Hydrocarbons (mg/kg)** | | | | | |
| LMW PAHs<br>(EHS Support – This Report) | 1.4 | 10 | 10 | 55 | 130 |
| Fluoranthene<br>(Cavanagh and Munir, 2016) | 7.6 | 27 | 27 | 89 | 190 |
| **High Molecular Weight (LMW) Polycyclic Aromatic Hydrocarbons (mg/kg)** | | | | | |
| HMW PAHs<br>(EHS Support – This Report) | 3.7 | 8.5 | 8.5 | 19 | 31 |

---

generate the cumulative frequency distribution; for datasets containing 8 or more toxicity endpoints, a Burr Type III distribution is used.

| COC | Areas of Ecological Significance (99%) | Non-Food Production Land (95%) | Agricultural Land (95% plants, 80% microbes/ invertebrates) | Residential/ Recreational Area (80%) | Commercial/ Industrial (60%) |
|---|---|---|---|---|---|
| Benzo[a]pyrene (Cavanagh and Munir, 2016) | 2.8 | 9.4 | 9.4 | 28 | 54 |

ecological protection levels for LMW and HMW PAHs, with greater alignment between Eco-SGVs derived for HMW PAHs (in this report) and benzo[a]pyrene (Cavanagh and Munir, 2016). Both the Eco-SGVs developed by Cavanagh and Munir (2016) and this review do not include a background concentration. Background is assumed to be zero for all organic compounds.

### *F3 and F4 Total Petroleum Hydrocarbons – Sensitive Ecological Areas*

Eco-SGVs were derived for F3 and F4 TPH fractions the protection of ecologically sensitive areas (99th percent protection levels) that were not derived in Cavanagh and Munir (2016). These values were derived using toxicological endpoints for coarse soils (>50% of soil particles have a diameter >75 µm) to represent typical soil conditions at Tiwai Point. SSDs were used to derive Eco-SGVs based on the approach described in Cavanagh and Munir (2016) and Cavanagh (2019).

Direct contact endpoints for the protection of terrestrial plants and soil invertebrates were derived using data compiled in CCME (2008) and supplemental data collected following the development of the CCME CWS. Supplemental direct contact toxicity data F3 fraction was obtained from a review by Gainer et al. (2019) that presented toxicity data for 19 species based on bulk soil petroleum hydrocarbon concentrations (mg/kg dw), including toxicity data compiled in CCME (2008). Direct contact effects concentrations for 25 percent of test organisms ($EC_{25}$) were compiled for the four TRH fractions from studies evaluating petroleum hydrocarbon effects in coarse-grained test soils. A single $EC_{25}$ value was calculated to represent each species in the SSD based on the geometric mean of species and endpoint combinations, consistent with the rules for data manipulation prescribed in Warne et al. (2018)[2]. The specific approach for deriving direct contact $EC_{25}$ values for use in the SSDs is described for each for the F3 and F4 fractions include:

- **F3 Fraction:** Data from coarse soil exposure studies presented in Gainer et al. (2019) were compiled for 37 growth, reproduction, or mortality $EC_{25}$ endpoints for six terrestrial plant and seven soil invertebrate species based on exposure to F3 TRH. Behavioural endpoints, specifically avoidance by soil invertebrates, were not included in the endpoint compilation. The minimum geometric mean for each species-endpoint combination was selected as the $EC_{25}$ to represent direct contact exposure to the species in the SSD.
- **F4 Fraction:** Data from CCME (2008) were compiled for 16 growth, reproduction, or mortality $EC_{25}$ endpoints for three terrestrial plant and two soil invertebrate species based on exposure to F4 TRH. The minimum geometric mean for each species-endpoint combination was selected as the $EC_{25}$ to represent exposure to the species in the SSD.

SSDs were developed based on the direct contact $EC_{25}$ endpoints for the F3 and F4 TPH fractions. The output from the Burrlioz SSD generation for the 99th protection level (sensitive ecological areas) for F3 and F4 TPH fractions is provided in **Attachment C-3**.

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[2] Consistent with Warne et al. (2018), the geometric mean of each species-endpoint combination was calculated and the minimum geometric mean for each species-endpoint combination was selected as the $EC_{25}$ to represent the species in the SSD.

### *Fluoride*

Direct contact toxicity endpoints for fluoride were compiled primarily based on the toxicity review presented for the derivation of the preliminary Eco-SGV for fluoride by Cavanagh and Munir (2016), with the addition of supplemental endpoints from acceptable literature studies. Original source documents were reviewed for studies compiled for fluoride by Cavanagh and Munir (2016), except for Telesinski et al. (2012) and Rathore and Agrawal (1989). Because the original source documents could not be reviewed and confirmed, endpoints from Telesinski et al. (2012) and Rathore and Agrawal (1989) were excluded from the SSD.

In addition to the endpoints compiled from Cavanagh and Munir (2016), supplemental endpoints from Zouari et al. (2014) and Van Wensem and Adema (1991) were added to the fluoride dataset. An $EC_{30}$ for olive tree (*Olea sp.*) growth was identified in Zouari et al. (2014) at a dose of 100mM NaF, which corresponds to a total soil fluoride concentration of 1,770 mg/kg. Van Wensem and Adema (1991) evaluated soil microbial processes in poplar litter and identified effects on soil processes at total fluoride concentrations ranging from 338 to 3,610 mg/kg. While this study was initially censored by Cavanagh and Munir (2016) for Eco-SGV derivation because the exposure medium was not soil, it is included in the derivation of Eco-SGVs in this report due to the importance of microbial processes in the litter horizon of soil.

Reported endpoints were consistently expressed as total fluoride concentrations in soil for SSD generation. Soil exposures that included an added concentration of soluble fluoride, typically in the form of sodium fluoride (NaF), were estimated as total fluoride based on the stoichiometric relationship of sodium to fluorine in NaF (1.21:1). Total fluoride in the exposure concentration was estimated by adding the added fluoride concentration to a baseline fluoride concentration. If the baseline fluoride concentration in the test soil was reported in the study, the reported baseline concentration was summed with the added concentration in the exposure treatment to estimate total fluoride. If the baseline fluoride concentration in the test soil was not reported in the study, the added concentration in the exposure treatment was summed with an estimated background fluoride concentration of 204 mg/kg reported by Cavanagh and Munir (2016) to estimate the total fluoride concentration in the exposure treatment. Total fluoride endpoints were standardised to LOEC or $EC_{30}$ endpoints based on guidance provided by Cavanagh (2019). Standardised endpoints compiled for species-endpoint combinations were input into the Burrlioz 2.0 software to generate the direct contact SSD for total fluoride. Direct contact endpoint values used to generate the fluoride SSD are provided in **Attachment A-2**. The output from the Burrlioz SSD generation for fluoride, including ecological protection levels designated for each land use category is provided in **Attachment A-3**.

### *Aluminium*

As previously stated, numerical Eco-SGVs were not developed for aluminium given that geochemical parameters control the bioavailability and toxicity of aluminium in upland soils. In the development of Eco-SSLs, USEPA (US EPA, 2003) recognised that aluminium toxicity is associated with soluble aluminium concentrations in soil and, as a result, that total aluminium concentrations are not considered to be a suitable or reliable predictor of potential aluminium toxicity or bioaccumulation in soil. Therefore, USEPA deemed comparisons to total aluminium concentrations in soil to soluble aluminium-based toxicity endpoints as inappropriate for the derivation of an Eco-SSL for aluminium.

The bioavailability and toxicity of aluminium in soil is attributed to the presence of toxic aluminium ions that are controlled by geochemical conditions in the soil, primarily pH. **Figure 1** presents a solubility diagram of the most significant species of aluminium in an aqueous solution as a function of pH. As indicated in the solubility diagram, trivalent aluminium ($Al^{3+}$), is the most abundant aluminium species in low pH (less than 5). At pH between 5 and 6, $AlOH^{2+}$ and $Al(OH)_2^+$ are the dominant aluminium species, while $Al(OH)_3$ (gibbsite) is the dominant species at circumneutral pH between 6 and 7. In alkaline solutions (pH > 7), $Al(OH)_4^-$ (aluminate) is the dominant aluminium species present in solution (**Figure 1**).

Aluminium toxicity in soil is primarily attributed primarily to the presence of $Al^{3+}$ that predominates in low pH soils (< 5). $AlOH^{2+}$ and $Al(OH)^{2+}$, species that are predominant at pH between 5 and 6, are less toxic to plants relative to $Al^{3+}$ and $Al(OH)_{3,}$ which is predominant between pH 6 and 7, is considered non-toxic and relatively insoluble (Bojórquez-Quintal et al, 2017).  Aluminium toxicity in plants has been reported in highly alkaline soils at pH > 9, which has been attributed to increased $Al(OH)_4^-$ concentrations (Brautigan et al., 2012).

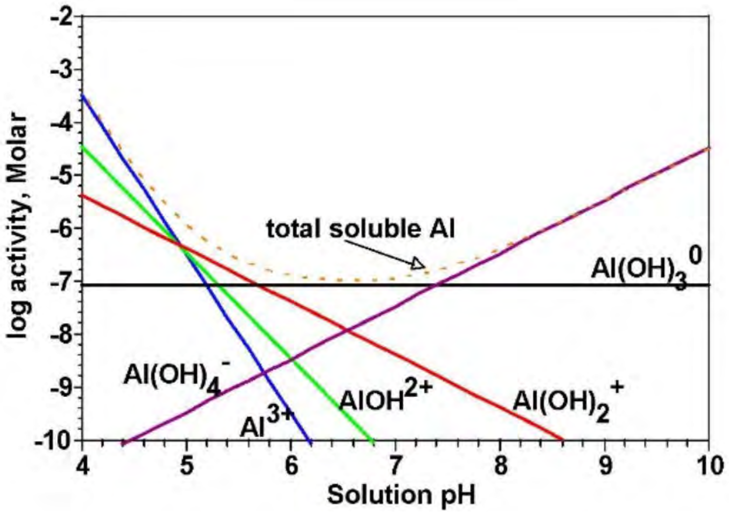

**Figure 1. Solubility diagram of the most significant species of aluminium in an aqueous solution of $AlCl_3$ (as presented in US EPA, 2003).**

Given that total aluminium concentrations are not considered to be a suitable or reliable predictor of potential aluminium toxicity in soil, US EPA developed an alternative approach to assess ecological risk associated with soil aluminium concentrations based on potential for aluminium ions, particularly $Al^{3+}$, to be present in soil pore water. Given that $Al^{3+}$ is not measured in natural soils with a pH of 5.0 or above, USEPA indicated that aluminium is only a constituent of concern in soils with a pH of less than 5.5 (USEPA, 2003). In addition to low soil pH conditions where $Al^{3+}$ predominates, additional assessment of ecological exposure to aluminium should be conducted in highly alkaline soils (pH > 9) where $Al(OH)_4^-$ toxicity to plants has been documented (Brautigan et al., 2012). Therefore, the narrative soil screening value proposed for Tiwai Point identifies aluminium as a potential constituent of concern in areas of the site with soil pH values less than 5.5, soil pH values greater than 9.0, or in specific areas where aluminium species with potentially greater solubility has been identified. The potential for adverse effects associated with ecological exposure to aluminium in soil should be further investigated to establish site-specific Eco-SGVs for areas of the site where these conditions exist.

## Summary

**Table 3** provides a summary of Eco-SGVs selected or derived for Tiwai Point. Where applicable, assumptions regarding the contribution of background concentrations to the calculated Eco-SGV (based on lowest median background concentrations) are presented. As previously stated, Eco-SGVs were derived to be protective of ecological receptor populations based on ecological protection levels defined for land use categories, but do not account for site-specific background conditions or site-specific conditions that influence the bioavailability or toxicity of constituents of concern. Therefore, the Eco-SGVs summarised in **Table 3** should be applied as preliminary remediation goals that may be further refined based on site-specific information (background and site-specific effects information) that may be used to support final soil remediation goals for Tiwai Point.

**Table 3 Summary of the Eco-SGVs Selected or Derived for Tiwai Point**

| COC | Assumed Contribution of Background in Eco-SGV Calculation[1] | Areas of Ecological Significance (99%) | Non-Food Production Land (95%) | Agricultural Land (95% plants, 80% microbes/ invertebrates) | Residential/ Recreational Area (80%) | Commercial /Industrial (60%) |
|---|---|---|---|---|---|---|
| **Polycyclic Aromatic Hydrocarbons (mg/kg)** | | | | | | |
| LMW PAHs | NI | 1.4 | 10 | 10 | 55 | 130 |
| HMW PAHs | NI | 3.7 | 8.5 | 8.5 | 19 | 31 |
| **Total Petroleum Hydrocarbons (mg/kg)** | | | | | | |
| F1 | NI | 66 | 110 | 110 | 130 | 170 |
| F2 | NI | 45 | 70 | 70 | 110 | 140 |
| F3 (coarse) | NI | 166 | 300 | 300 | 300 | 1700 |
| F4 (coarse) | NI | 380 | 1700 | 1700 | 1700 | 3300 |
| **Inorganics (mg/kg)** | | | | | | |
| Aluminium | Not Applicable | Narrative | Narrative | Narrative | Narrative | Narrative |
| Arsenic | 2.2 | 6 | 20 | 20 | 60 | 150 |
| Boron | NI | 4 | 7 | 6 | 15 | 15 |
| Cadmium | 0.05 | 1.5 | 1.5 | 1.5 | 12 | 33 |
| Chromium (III) | 9 | 100 | 190 | 300 | 390 | 650 |
| Cobalt | NI | 61.7 | 105.3 | 90.4 | 192.4 | 309.2 |
| Copper | 7 | 45 | 85 | 150 | 180 | 320 |
| Fluoride | NI | 165 | 237 | 237 | 398 | 638 |
| Lead | 7 | 55 | 280 | 530 | 9007 | 25,007 |
| Nickel | NI | 66.5 | 120.1 | 85.9 | 223.5 | 394.5 |
| Zinc | 24 | 110 | 150 | 130 | 260 | 430 |

1, NI = Background concentration not included in Eco-SGV calculation. Background concentrations represent lowest median background concentrations reported in Cavanagh (2019) or Cavanagh and Munir (2016).

Low molecular weight (LMW) PAHs include PAH compounds with fewer than four benzene rings; high molecular weight (HMW) PAHs include PAH compounds with four or greater benzene rings.

See discussion of narrative guidelines for aluminium in the preceding section.

COC = constituent of concern

mg/kg = milligrams per kilogram

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## Limitations

This assessment work has been undertaken in accordance with the Umbrella Contract between ES and EHS Support, dated 2 August 2021.

EHS Support has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Environment Southland and only those third parties who have been authorised in writing by EHS Support to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

The methodology adopted and sources of information used by EHS Support are outlined in this report. EHS Support has made no independent verification of this information beyond the agreed scope of works and EHS Support assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to EHS Support was false.

This report was issued on 22 February 2023 and is based on the conditions encountered and information reviewed at the time of preparation. EHS Support disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. EHS Support's conclusions are based upon the analytical data presented in this report and our experience. Future advances regarding the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact our conclusions and recommendations regarding their potential presence on this Site.

Where conditions encountered at the Site are subsequently found to differ significantly from those anticipated in this report, EHS must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels, can change in a limited time; therefore, this document and the information contained herein should only be regarded as valid at the time of the investigation unless otherwise explicitly stated in this report.

# Attachment A - Derivation of Eco-SGVs

# Attachment A1

# Threshold calculator for metals in soil v3.0

A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
cobalt

**Select trophic levels to be protected**
plants + invertebrates + micro-organisms

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
1

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

upper effect boundary NOEC 10

upper effect boundary MATC 25

upper effect boundary LOEC 40

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

**The necessary input parameters for derivation of site specific soil quality**
**effective CEC (cmolc/kg dwt)**

**Enter soil pH (0.01 M $CaCl_2$ method)**
4.5

**Enter organic carbon content (%)**
3.1

**Enter clay content (particle-size fraction < 2 µm, %)**
17

**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay
The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Metal: **cobalt**

Trophic levels: **plants + invertebrates + micro-organisms**

Threshold based on: **HC1 of EC30 values (mg/kg dry weight)**

**Generic (no normalization, all data)**
Total approach (natural background included)
**HC1 of EC30 values (mg/kg dry weight)** 6.2
5% - 95% confidence interval
**3.9 - 9.2**

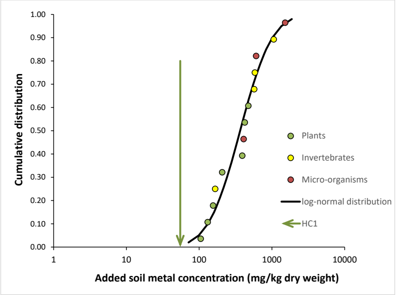
**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

**Normalized to specific soil conditions (species mean)**
Total approach (natural background included)
**HC1 of EC30 values (mg/kg dry weight)** 61.7
5% - 95% confidence interval
**24.6 - 107.4**

**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

### SSD graph (based on species mean values)

**SSD for EC30 data for cobalt normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for cobalt (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Agropyron dasystachyum | yield (root) | 424 |
| Brassica napus | yield (shoot) | 155 |
| Hordeum vulgare | yield (shoot) | 474 |
| Lycopersicon esculentum | yield (shoot) | 207 |
| Medicago sativa | yield (shoot length) | 131 |
| Raphanus sativus | yield (root length) | 391 |
| Trifolium pratense | yield (root length) | 105 |
| | | |
| Eisenia andrei | reproduction (juvenile dry mass) | 166 |
| Eisenia fetida | reproduction (cocoon production) | 571 |
| Enchytraeus albidus | reproduction (number of juveniles) | 583 |
| | | |
| Folsomia candida | reproduction (number of juveniles) | 1059 |
| native soil dwelling microorganisms | potential nitrification rate | 409 |
| native soil dwelling microorganisms | glucose induced respiration | 606 |
| native soil dwelling microorganisms | maize residue mineralization | 1521 |

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**Threshold calculator for metals in soil v3.0**

**A global tool for terrestrial risk assessment**

**INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS**

Reset input

**Select metal**

cobalt

**Select trophic levels to be protected**

plants + invertebrates + micro-organisms

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)

30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)

5

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**

yes

upper effect boundary NOEC: 10

upper effect boundary MATC: 25

upper effect boundary LOEC: 40

**Total or added approach**

total (natural background included)

**Jurisdiction**

open (global)

**Enter total metal concentration (mg/kg)**

**Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)**

The necessary input parameters for derivation of site specific soil quality effective CEC (cmolc/kg dwt)

**Enter soil pH (0.01 M $CaCl_2$ method)**

4.5

**Enter organic carbon content (%)**

3.1

**Enter clay content (particle-size fraction < 2 µm, %)**

17

**Enter effective CEC ($cmol_c$/kg)**

15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay

The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

**OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS**

Metal: **cobalt**

Trophic levels: **plants + invertebrates + micro-organisms**

Threshold based on: **HC5 of EC30 values (mg/kg dry weight)**

**Generic (no normalization, all data)**

Total approach (natural background included)

**HC5 of EC30 values (mg/kg dry weight)** 18.1

5% - 95% confidence interval
**12.7 - 24.6**

**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

**Normalized to specific soil conditions (species mean)**

Total approach (natural background included)

**HC5 of EC30 values (mg/kg dry weight)** 105.3

5% - 95% confidence interval
**51.7 - 164.8**

**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

**SSD graph (based on species mean values)**

**SSD for EC30 data for cobalt normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**

**Species mean values (mg/kg dry soil) for cobalt (added concentrations)**

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Agropyron dasystachyum | yield (root) | 424 |
| Brassica napus | yield (shoot) | 155 |
| Hordeum vulgare | yield (shoot) | 474 |
| Lycopersicon esculentum | yield (shoot) | 207 |
| Medicago sativa | yield (shoot length) | 131 |
| Raphanus sativus | yield (root length) | 391 |
| Trifolium pratense | yield (root length) | 105 |
| | | |
| Eisenia andrei | reproduction (juvenile dry mass) | 166 |
| Eisenia fetida | reproduction (cocoon production) | 571 |
| Enchytraeus albidus | reproduction (number of juveniles) | 583 |
| | | |
| Folsomia candida | reproduction (number of juveniles) | 1059 |
| native soil dwelling microorganisms | potential nitrification rate | 409 |
| native soil dwelling microorganisms | glucose induced respiration | 606 |
| native soil dwelling microorganisms | maize residue mineralization | 1521 |

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# Threshold calculator for metals in soil v3.0

A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
cobalt

**Select trophic levels to be protected**
plants

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
5

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

upper effect boundary NOEC 10
upper effect boundary MATC 25
upper effect boundary LOEC 40

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

**The necessary input parameters for derivation of site specific soil quality**
**effective CEC (cmolc/kg dwt)**

**Enter soil pH (0.01 M $CaCl_2$ method)**
4.5

**Enter organic carbon content (%)**
3.1

**Enter clay content (particle-size fraction < 2 µm, %)**
17

**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay
The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Metal: **cobalt**
Trophic levels: **plants**
Threshold based on: **HC5 of EC30 values (mg/kg dry weight)**

**Generic (no normalization, all data)**
Total approach (natural background included)
**HC5 of EC30 values (mg/kg dry weight)** 12.9
5% - 95% confidence interval
**8.3 - 18.6**

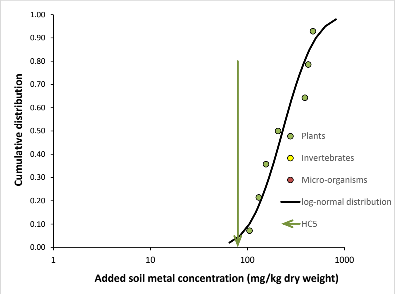
**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

**Normalized to specific soil conditions (species mean)**
Total approach (natural background included)
**HC5 of EC30 values (mg/kg dry weight)** 90.4
5% - 95% confidence interval
**34.4 - 144.7**

**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

### SSD graph (based on species mean values)

**SSD for EC30 data for cobalt normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for cobalt (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Agropyron dasystachyum | yield (root) | 424 |
| Brassica napus | yield (shoot) | 155 |
| Hordeum vulgare | yield (shoot) | 474 |
| Lycopersicon esculentum | yield (shoot) | 207 |
| Medicago sativa | yield (shoot length) | 131 |
| Raphanus sativus | yield (root length) | 391 |
| Trifolium pratense | yield (root length) | 105 |
| | | |
| Eisenia andrei | reproduction (juvenile dry mass) | |
| Eisenia fetida | reproduction (cocoon production) | |
| Enchytraeus albidus | reproduction (number of juveniles) | |
| | | |
| Folsomia candida | reproduction (number of juveniles) | |
| native soil dwelling microorganisms | potential nitrification rate | |
| native soil dwelling microorganisms | glucose induced respiration | |
| native soil dwelling microorganisms | maize residue mineralization | |

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# Threshold calculator for metals in soil v3.0

A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
cobalt

**Select trophic levels to be protected**
invertebrates + micro-organisms

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
20

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

upper effect boundary NOEC 10

upper effect boundary MATC 25

upper effect boundary LOEC 40

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

**The necessary input parameters for derivation of site specific soil quality effective CEC (cmolc/kg dwt)**

**Enter soil pH (0.01 M $CaCl_2$ method)**
4.5

**Enter organic carbon content (%)**
3.1

**Enter clay content (particle-size fraction < 2 µm, %)**
17

**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay
The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Metal: **cobalt**

Trophic levels: **invertebrates + micro-organisms**

Threshold based on: **HC20 of EC30 values (mg/kg dry weight)**

**Generic (no normalization, all data)**
Total approach (natural background included)
**HC20 of EC30 values (mg/kg dry weight)** 146.7
5% - 95% confidence interval
**97.5 - 207.9**

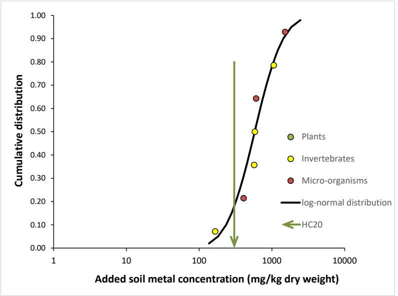
**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

**Normalized to specific soil conditions (species mean)**
Total approach (natural background included)
**HC20 of EC30 values (mg/kg dry weight)** 311.0
5% - 95% confidence interval
**139 - 498.6**

**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

### SSD graph (based on species mean values)

**SSD for EC30 data for cobalt normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for cobalt (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Agropyron dasystachyum | yield (root) | |
| Brassica napus | yield (shoot) | |
| Hordeum vulgare | yield (shoot) | |
| Lycopersicon esculentum | yield (shoot) | |
| Medicago sativa | yield (shoot length) | |
| Raphanus sativus | yield (root length) | |
| Trifolium pratense | yield (root length) | |
| Eisenia andrei | reproduction (juvenile dry mass) | 166 |
| Eisenia fetida | reproduction (cocoon production) | 571 |
| Enchytraeus albidus | reproduction (number of juveniles) | 583 |
| Folsomia candida | reproduction (number of juveniles) | 1059 |
| native soil dwelling microorganisms | potential nitrification rate | 409 |
| native soil dwelling microorganisms | glucose induced respiration | 606 |
| native soil dwelling microorganisms | maize residue mineralization | 1521 |

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A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
cobalt

**Select trophic levels to be protected**
plants + invertebrates + micro-organisms

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
20

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

upper effect boundary NOEC 10

upper effect boundary MATC 25

upper effect boundary LOEC 40

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

**The necessary input parameters for derivation of site specific soil quality effective CEC (cmolc/kg dwt)**

**Enter soil pH (0.01 M $CaCl_2$ method)**
4.5

**Enter organic carbon content (%)**
3.1

**Enter clay content (particle-size fraction < 2 µm, %)**
17

**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay

The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Metal: **cobalt**

Trophic levels: **plants + invertebrates + micro-organisms**

Threshold based on: **HC20 of EC30 values (mg/kg dry weight)**

**Generic (no normalization, all data)**
Total approach (natural background included)
**HC20 of EC30 values (mg/kg dry weight)** 60.7
5% - 95% confidence interval
**45.9 - 78.1**

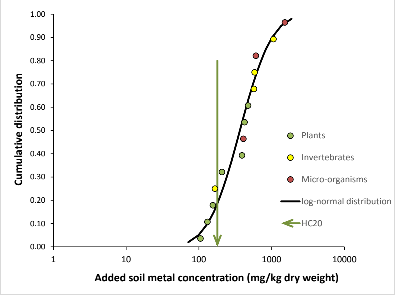
**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

**Normalized to specific soil conditions (species mean)**
Total approach (natural background included)
**HC20 of EC30 values (mg/kg dry weight)** 192.4
5% - 95% confidence interval
**115.2 - 277.2**

**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

### SSD graph (based on species mean values)

**SSD for EC30 data for cobalt normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for cobalt (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Agropyron dasystachyum | yield (root) | 424 |
| Brassica napus | yield (shoot) | 155 |
| Hordeum vulgare | yield (shoot) | 474 |
| Lycopersicon esculentum | yield (shoot) | 207 |
| Medicago sativa | yield (shoot length) | 131 |
| Raphanus sativus | yield (root length) | 391 |
| Trifolium pratense | yield (root length) | 105 |
| | | |
| Eisenia andrei | reproduction (juvenile dry mass) | 166 |
| Eisenia fetida | reproduction (cocoon production) | 571 |
| Enchytraeus albidus | reproduction (number of juveniles) | 583 |
| | | |
| Folsomia candida | reproduction (number of juveniles) | 1059 |
| native soil dwelling microorganisms | potential nitrification rate | 409 |
| native soil dwelling microorganisms | glucose induced respiration | 606 |
| native soil dwelling microorganisms | maize residue mineralization | 1521 |

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A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
cobalt

**Select trophic levels to be protected**
plants + invertebrates + micro-organisms

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
40

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

upper effect boundary NOEC: 10
upper effect boundary MATC: 25
upper effect boundary LOEC: 40

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

**The necessary input parameters for derivation of site specific soil quality**
**effective CEC (cmolc/kg dwt)**

**Enter soil pH (0.01 M $CaCl_2$ method)**
4.5

**Enter organic carbon content (%)**
3.1

**Enter clay content (particle-size fraction < 2 µm, %)**
17

**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay
The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

| | |
|---|---|
| Metal: | **cobalt** |
| Trophic levels: | **plants + invertebrates + micro-organisms** |
| Threshold based on: | **HC40 of EC30 values (mg/kg dry weight)** |

**Generic (no normalization, all data)**

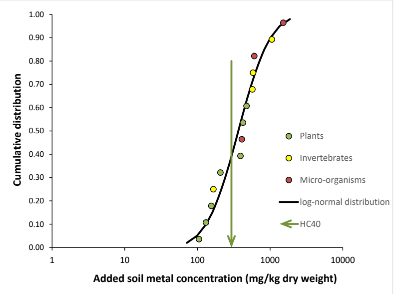
| | | |
|---|---|---|
| Total approach (natural background included) | | 5% - 95% confidence interval |
| **HC40 of EC30 values (mg/kg dry weight)** | **157.9** | **125.2 - 197.4** |
| **Potentially Affected Fraction (PAF, %)** | **total metal concentration = 0** | |

**Normalized to specific soil conditions (species mean)**

| | | |
|---|---|---|
| Total approach (natural background included) | | 5% - 95% confidence interval |
| **HC40 of EC30 values (mg/kg dry weight)** | **309.2** | **206.6 - 441.6** |
| **Potentially Affected Fraction (PAF, %)** | **total metal concentration = 0** | |

### SSD graph (based on species mean values)

**SSD for EC30 data for cobalt normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for cobalt (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Agropyron dasystachyum | yield (root) | 424 |
| Brassica napus | yield (shoot) | 155 |
| Hordeum vulgare | yield (shoot) | 474 |
| Lycopersicon esculentum | yield (shoot) | 207 |
| Medicago sativa | yield (shoot length) | 131 |
| Raphanus sativus | yield (root length) | 391 |
| Trifolium pratense | yield (root length) | 105 |
| | | |
| Eisenia andrei | reproduction (juvenile dry mass) | 166 |
| Eisenia fetida | reproduction (cocoon production) | 571 |
| Enchytraeus albidus | reproduction (number of juveniles) | 583 |
| | | |
| Folsomia candida | reproduction (number of juveniles) | 1059 |
| native soil dwelling microorganisms | potential nitrification rate | 409 |
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| native soil dwelling microorganisms | maize residue mineralization | 1521 |

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# Threshold calculator for metals in soil v3.0

A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
nickel

**Select trophic levels to be protected**
plants + invertebrates + micro-organisms

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
1

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

upper effect boundary NOEC 10

upper effect boundary MATC 25

upper effect boundary LOEC 40

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

**The necessary input parameters for derivation of site specific soil quality effective CEC (cmolc/kg dwt)**

**Enter soil pH (0.01 M $CaCl_2$ method)**
4.5

**Enter organic carbon content (%)**
3.1

**Enter clay content (particle-size fraction < 2 µm, %)**
17

**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay

The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Metal: **nickel**

Trophic levels: **plants + invertebrates + micro-organisms**

Threshold based on: **HC1 of EC30 values (mg/kg dry weight)**

**Generic (no normalization, all data)**

Total approach (natural background included)

**HC1 of EC30 values (mg/kg dry weight)** 17.7

5% - 95% confidence interval
**13 - 23.2**

**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

**Normalized to specific soil conditions (species mean)**

Total approach (natural background included)

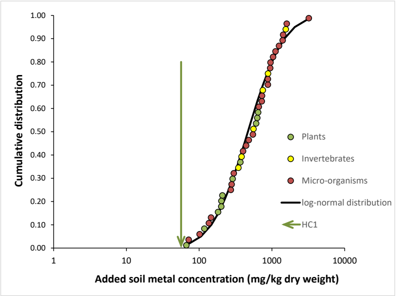
**HC1 of EC30 values (mg/kg dry weight)** 66.5

5% - 95% confidence interval
**39.8 - 97.6**

**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

### SSD graph (based on species mean values)

**SSD for EC30 data for nickel normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for nickel (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Allium cepa | yield | 368 |
| Avena sativa | yield (grain) | 182 |
| Hordeum vulgare | yield (root length) | 606 |
| Lactuca sativa | yield (leaves) | 209 |
| Lolium perenne | yield (shoot) | 67 |
| Lycopersicon esculentum | yield (shoot) | 289 |
| Medicago sativa | yield (tops) | 118 |
| Raphanus sativus | yield | 202 |
| Spinacia oleracea | yield (shoot) | 201 |
| Trigonella poenum graceum | yield | 629 |
| Zea mays | yield | 647 |
| Eisenia fetida | reproduction (cocoon production) | 558 |
| Eisenia veneta | reproduction (cocoon production) | 383 |
| Enchytraeus albidus | reproduction (number of juveniles) | 346 |
| Lumbricus rubellus | mortality | 1550 |
| Folsomia candida | reproduction (number of juveniles) | 884 |
| Folsomia fimetaria | reproduction (number of juveniles) | 750 |
| Aspergillus clavatus | hyphal growth | 72 |
| Aspergillus flavipes | hyphal growth | 725 |
| Aspergillus flavus | hyphal growth | 957 |
| Aspergillus niger | hyphal growth | 880 |
| Bacillus cereus | colony count | 1599 |
| Gliocladium sp. | hyphal growth | 947 |
| Nocardia rhodochrous | colony count | 1037 |
| Penicillium vermiculatum | hyphal growth | 442 |
| Proteus vulgaris | colony count | 1406 |
| Rhizopus stolonifer | hyphal growth | 660 |
| Rhodotorula rubra | colony count | 1428 |
| Serratia marcescens | colony count | 548 |
| Trichoderma viride | hyphal growth | 1121 |
| native soil dwelling microorganisms | potential nitrification rate | 280 |
| native soil dwelling microorganisms | glucose induced respiration | 481 |
| native soil dwelling microorganisms | maize residue mineralization | 1251 |
| native soil dwelling microorganisms | basal respiration | 731 |
| native soil dwelling microorganisms | glutamic acid induced respiration | 401 |
| native soil dwelling microorganisms | ATP content | 146 |
| native soil dwelling microorganisms | urease | 880 |
| native soil dwelling microorganisms | phosphatase | 136 |
| native soil dwelling microorganisms | arylsulphatase | 3217 |
| native soil dwelling microorganisms | dehydrogenase | 101 |
| native soil dwelling microorganisms | saccharase | 299 |
| native soil dwelling microorganisms | protease | 273 |

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# Threshold calculator for metals in soil v3.0

A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
nickel

**Select trophic levels to be protected**
plants + invertebrates + micro-organisms

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
5

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

| | |
|---|---|
| upper effect boundary NOEC | 10 |
| upper effect boundary MATC | 25 |
| upper effect boundary LOEC | 40 |

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

**Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)**
The necessary input parameters for derivation of site specific soil quality effective CEC (cmolc/kg dwt)

**Enter soil pH (0.01 M $CaCl_2$ method)**
4.5

**Enter organic carbon content (%)**
3.1

**Enter clay content (particle-size fraction < 2 µm, %)**
17

**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay

The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

| | |
|---|---|
| Metal: | **nickel** |
| Trophic levels: | **plants + invertebrates + micro-organisms** |
| Threshold based on: | **HC5 of EC30 values (mg/kg dry weight)** |

**Generic (no normalization, all data)**

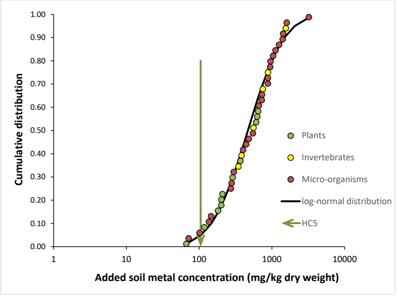
| | | |
|---|---|---|
| Total approach (natural background included) | | 5% - 95% confidence interval |
| **HC5 of EC30 values (mg/kg dry weight)** | **42.8** | **33.5 - 53.2** |
| **Potentially Affected Fraction (PAF, %)** | **total metal concentration = 0** | |

**Normalized to specific soil conditions (species mean)**

| | | |
|---|---|---|
| Total approach (natural background included) | | 5% - 95% confidence interval |
| **HC5 of EC30 values (mg/kg dry weight)** | **120.1** | **81.3 - 162.6** |
| **Potentially Affected Fraction (PAF, %)** | **total metal concentration = 0** | |

### SSD graph (based on species mean values)

**SSD for EC30 data for nickel normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for nickel (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Allium cepa | yield | 368 |
| Avena sativa | yield (grain) | 182 |
| Hordeum vulgare | yield (root length) | 606 |
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| Lolium perenne | yield (shoot) | 67 |
| Lycopersicon esculentum | yield (shoot) | 289 |
| Medicago sativa | yield (tops) | 118 |
| Raphanus sativus | yield | 202 |
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| Trigonella poenum graceum | yield | 629 |
| Zea mays | yield | 647 |
| Eisenia fetida | reproduction (cocoon production) | 558 |
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| Lumbricus rubellus | mortality | 1550 |
| Folsomia candida | reproduction (number of juveniles) | 884 |
| Folsomia fimetaria | reproduction (number of juveniles) | 750 |
| Aspergillus clavatus | hyphal growth | 72 |
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| Aspergillus flavus | hyphal growth | 957 |
| Aspergillus niger | hyphal growth | 880 |
| Bacillus cereus | colony count | 1599 |
| Gliocladium sp. | hyphal growth | 947 |
| Nocardia rhodochrous | colony count | 1037 |
| Penicillium vermiculatum | hyphal growth | 442 |
| Proteus vulgaris | colony count | 1406 |
| Rhizopus stolonifer | hyphal growth | 660 |
| Rhodotorula rubra | colony count | 1428 |
| Serratia marcescens | colony count | 548 |
| Trichoderma viride | hyphal growth | 1121 |
| native soil dwelling microorganisms | potential nitrification rate | 280 |
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| native soil dwelling microorganisms | ATP content | 146 |
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| native soil dwelling microorganisms | dehydrogenase | 101 |
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# Threshold calculator for metals in soil v3.0

A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
nickel

**Select trophic levels to be protected**
plants

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
5

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

| | |
|---|---|
| upper effect boundary NOEC | 10 |
| upper effect boundary MATC | 25 |
| upper effect boundary LOEC | 40 |

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

**The necessary input parameters for derivation of site specific soil quality effective CEC (cmolc/kg dwt)**

**Enter soil pH (0.01 M $CaCl_2$ method)**
4.5

**Enter organic carbon content (%)**
3.1

**Enter clay content (particle-size fraction < 2 µm, %)**
17

**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay
The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

| | |
|---|---|
| Metal: | **nickel** |
| Trophic levels: | **plants** |
| Threshold based on: | **HC5 of EC30 values (mg/kg dry weight)** |

**Generic (no normalization, all data)**

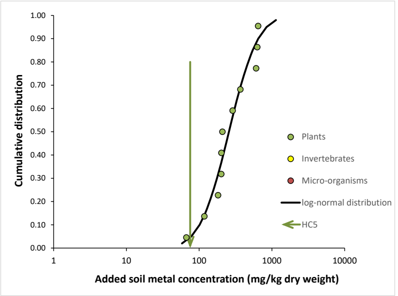
| | | |
|---|---|---|
| Total approach (natural background included)<br>**HC5 of EC30 values (mg/kg dry weight)** | 32.2 | 5% - 95% confidence interval<br>**22.4 - 43.7** |
| **Potentially Affected Fraction (PAF, %)** | total metal concentration = 0 | |

**Normalized to specific soil conditions (species mean)**

| | | |
|---|---|---|
| Total approach (natural background included)<br>**HC5 of EC30 values (mg/kg dry weight)** | 85.9 | 5% - 95% confidence interval<br>**39.5 - 135.3** |
| **Potentially Affected Fraction (PAF, %)** | total metal concentration = 0 | |

### SSD graph (based on species mean values)

**SSD for EC30 data for nickel normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for nickel (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Allium cepa | yield | 368 |
| Avena sativa | yield (grain) | 182 |
| Hordeum vulgare | yield (root length) | 606 |
| Lactuca sativa | yield (leaves) | 209 |
| Lolium perenne | yield (shoot) | 67 |
| Lycopersicon esculentum | yield (shoot) | 289 |
| Medicago sativa | yield (tops) | 118 |
| Raphanus sativus | yield | 202 |
| Spinacia oleracea | yield (shoot) | 201 |
| Trigonella poenum graceum | yield | 629 |
| Zea mays | yield | 647 |
| Eisenia fetida | reproduction (cocoon production) | |
| Eisenia veneta | reproduction (cocoon production) | |
| Enchytraeus albidus | reproduction (number of juveniles) | |
| Lumbricus rubellus | mortality | |
| Folsomia candida | reproduction (number of juveniles) | |
| Folsomia fimetaria | reproduction (number of juveniles) | |
| Aspergillus clavatus | hyphal growth | |
| Aspergillus flavipes | hyphal growth | |
| Aspergillus flavus | hyphal growth | |
| Aspergillus niger | hyphal growth | |
| Bacillus cereus | colony count | |
| Gliocladium sp. | hyphal growth | |
| Nocardia rhodochrous | colony count | |
| Penicillium vermiculatum | hyphal growth | |
| Proteus vulgaris | colony count | |
| Rhizopus stolonifer | hyphal growth | |
| Rhodotorula rubra | colony count | |
| Serratia marcescens | colony count | |
| Trichoderma viride | hyphal growth | |
| native soil dwelling microorganisms | potential nitrification rate | |
| native soil dwelling microorganisms | glucose induced respiration | |
| native soil dwelling microorganisms | maize residue mineralization | |
| native soil dwelling microorganisms | basal respiration | |
| native soil dwelling microorganisms | glutamic acid induced respiration | |
| native soil dwelling microorganisms | ATP content | |
| native soil dwelling microorganisms | urease | |
| native soil dwelling microorganisms | phosphatase | |
| native soil dwelling microorganisms | arylsulphatase | |
| native soil dwelling microorganisms | dehydrogenase | |
| native soil dwelling microorganisms | saccharase | |
| native soil dwelling microorganisms | protease | |

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# Threshold calculator for metals in soil v3.0

A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
nickel

**Select trophic levels to be protected**
invertebrates + micro-organisms

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
20

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

| | |
|---|---|
| upper effect boundary NOEC | 10 |
| upper effect boundary MATC | 25 |
| upper effect boundary LOEC | 40 |

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

**The necessary input parameters for derivation of site specific soil quality**
**effective CEC (cmolc/kg dwt)**

**Enter soil pH (0.01 M $CaCl_2$ method)**
4.5

**Enter organic carbon content (%)**
3.1

**Enter clay content (particle-size fraction < 2 µm, %)**
17

**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay
The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

| | |
|---|---|
| Metal: | **nickel** |
| Trophic levels: | **invertebrates + micro-organisms** |
| Threshold based on: | **HC20 of EC30 values (mg/kg dry weight)** |

**Generic (no normalization, all data)**

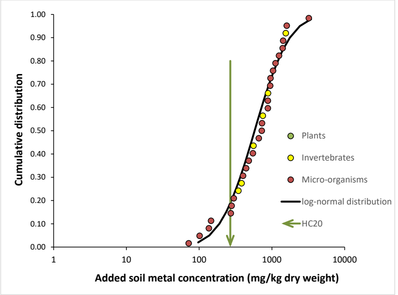
| | | |
|---|---|---|
| Total approach (natural background included) | | 5% - 95% confidence interval |
| **HC20 of EC30 values (mg/kg dry weight)** | **159.1** | **124.3 - 198.5** |
| **Potentially Affected Fraction (PAF, %)** | **total metal concentration = 0** | |

**Normalized to specific soil conditions (species mean)**

| | | |
|---|---|---|
| Total approach (natural background included) | | 5% - 95% confidence interval |
| **HC20 of EC30 values (mg/kg dry weight)** | **295.5** | **211.1 - 387.2** |
| **Potentially Affected Fraction (PAF, %)** | **total metal concentration = 0** | |

### SSD graph (based on species mean values)

**SSD for EC30 data for nickel normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for nickel (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Allium cepa | yield | |
| Avena sativa | yield (grain) | |
| Hordeum vulgare | yield (root length) | |
| Lactuca sativa | yield (leaves) | |
| Lolium perenne | yield (shoot) | |
| Lycopersicon esculentum | yield (shoot) | |
| Medicago sativa | yield (tops) | |
| Raphanus sativus | yield | |
| Spinacia oleracea | yield (shoot) | |
| Trigonella poenum graceum | yield | |
| Zea mays | yield | |
| Eisenia fetida | reproduction (cocoon production) | 558 |
| Eisenia veneta | reproduction (cocoon production) | 383 |
| Enchytraeus albidus | reproduction (number of juveniles) | 346 |
| Lumbricus rubellus | mortality | 1550 |
| Folsomia candida | reproduction (number of juveniles) | 884 |
| Folsomia fimetaria | reproduction (number of juveniles) | 750 |
| Aspergillus clavatus | hyphal growth | 72 |
| Aspergillus flavipes | hyphal growth | 725 |
| Aspergillus flavus | hyphal growth | 957 |
| Aspergillus niger | hyphal growth | 880 |
| Bacillus cereus | colony count | 1599 |
| Gliocladium sp. | hyphal growth | 947 |
| Nocardia rhodochrous | colony count | 1037 |
| Penicillium vermiculatum | hyphal growth | 442 |
| Proteus vulgaris | colony count | 1406 |
| Rhizopus stolonifer | hyphal growth | 660 |
| Rhodotorula rubra | colony count | 1428 |
| Serratia marcescens | colony count | 548 |
| Trichoderma viride | hyphal growth | 1121 |
| native soil dwelling microorganisms | potential nitrification rate | 280 |
| native soil dwelling microorganisms | glucose induced respiration | 481 |
| native soil dwelling microorganisms | maize residue mineralization | 1251 |
| native soil dwelling microorganisms | basal respiration | 731 |
| native soil dwelling microorganisms | glutamic acid induced respiration | 401 |
| native soil dwelling microorganisms | ATP content | 146 |
| native soil dwelling microorganisms | urease | 880 |
| native soil dwelling microorganisms | phosphatase | 136 |
| native soil dwelling microorganisms | arylsulphatase | 3217 |
| native soil dwelling microorganisms | dehydrogenase | 101 |
| native soil dwelling microorganisms | saccharase | 299 |
| native soil dwelling microorganisms | protease | 273 |

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# Threshold calculator for metals in soil v3.0

A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
**nickel**

**Select trophic levels to be protected**
**plants + invertebrates + micro-organisms**

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
**30**

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
**20**

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
**yes**

upper effect boundary NOEC **10**
upper effect boundary MATC **25**
upper effect boundary LOEC **40**

**Total or added approach**
**total (natural background included)**

**Jurisdiction**
**open (global)**

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

**The necessary input parameters for derivation of site specific soil quality**
**effective CEC (cmolc/kg dwt)**

**Enter soil pH (0.01 M $CaCl_2$ method)**
**4.5**

**Enter organic carbon content (%)**
**3.1**

**Enter clay content (particle-size fraction < 2 µm, %)**
**17**

**Enter effective CEC ($cmol_c$/kg)**
**15**
If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay
The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

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## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Metal: **nickel**

Trophic levels: **plants + invertebrates + micro-organisms**

Threshold based on: **HC20 of EC30 values (mg/kg dry weight)**

**Generic (no normalization, all data)**
Total approach (natural background included)
**HC20 of EC30 values (mg/kg dry weight)** **115.8**
5% - 95% confidence interval
**96.2 - 137.4**

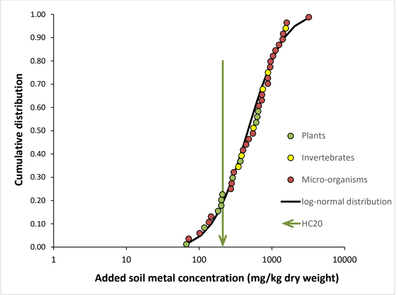
**Potentially Affected Fraction (PAF, %)** **total metal concentration = 0**

**Normalized to specific soil conditions (species mean)**
Total approach (natural background included)
**HC20 of EC30 values (mg/kg dry weight)** **233.5**
5% - 95% confidence interval
**172.9 - 299.1**

**Potentially Affected Fraction (PAF, %)** **total metal concentration = 0**

### SSD graph (based on species mean values)

**SSD for EC30 data for nickel normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for nickel (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Allium cepa | yield | 368 |
| Avena sativa | yield (grain) | 182 |
| Hordeum vulgare | yield (root length) | 606 |
| Lactuca sativa | yield (leaves) | 209 |
| Lolium perenne | yield (shoot) | 67 |
| Lycopersicon esculentum | yield (shoot) | 289 |
| Medicago sativa | yield (tops) | 118 |
| Raphanus sativus | yield | 202 |
| Spinacia oleracea | yield (shoot) | 201 |
| Trigonella poenum graceum | yield | 629 |
| Zea mays | yield | 647 |
| Eisenia fetida | reproduction (cocoon production) | 558 |
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A global tool for terrestrial risk assessment

## INPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Reset input

**Select metal**
nickel

**Select trophic levels to be protected**
plants + invertebrates + micro-organisms

**Enter effect level (x in ECx)**
(x in ECx; value between 1 and 50)
30

**Enter the probability level (p in HCp)**
(potentially affected fraction (PAF, in %) in the species sensitivity distribution; value between 1 and 99)
40

**Use NOEC, MATC and LOEC values in case no reliable ECx value can be derived**
yes

upper effect boundary NOEC 10
upper effect boundary MATC 25
upper effect boundary LOEC 40

**Total or added approach**
total (natural background included)

**Jurisdiction**
open (global)

**Enter total metal concentration (mg/kg)**

### Site specific information (for Co, Cu, Mo, Ni, Pb and Zn)

The necessary input parameters for derivation of site specific soil quality effective CEC (cmolc/kg dwt)

**Enter soil pH (0.01 M $CaCl_2$ method)**
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**Enter clay content (particle-size fraction < 2 µm, %)**
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**Enter effective CEC ($cmol_c$/kg)**
15

If no value for eCEC is inserted, it will be predicted from pH, %organic C and %clay
The predicted eCEC based on pH, clay and organic C is 13.8 cmolc/kg

**Enter background metal content (mg/kg)**

only required for added approach and bioavailability corrections for Zn

## OUTPUT FOR DIRECT TOXICITY TO SOIL ORGANISMS

Metal: **nickel**

Trophic levels: **plants + invertebrates + micro-organisms**

Threshold based on: **HC40 of EC30 values (mg/kg dry weight)**

**Generic (no normalization, all data)**
Total approach (natural background included)
**HC40 of EC30 values (mg/kg dry weight)** 254.4
5% - 95% confidence interval
**217.1 - 296.8**

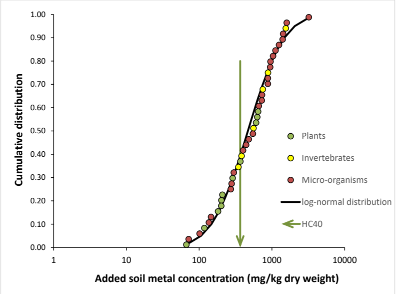
**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

**Normalized to specific soil conditions (species mean)**
Total approach (natural background included)
**HC40 of EC30 values (mg/kg dry weight)** 394.9
5% - 95% confidence interval
**309.4 - 495.8**

**Potentially Affected Fraction (PAF, %)** total metal concentration = 0

### SSD graph (based on species mean values)

**SSD for EC30 data for nickel normalized to pH 4.5, 3.1 % organic carbon, 17 % clay and effective CEC 15 cmolc/kg**



### Species mean values (mg/kg dry soil) for nickel (added concentrations)

corrected for aging and normalized to specific soil conditions

| Species | Endpoint | Species mean EC30 |
|---|---|---|
| Allium cepa | yield | 368 |
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| Lactuca sativa | yield (leaves) | 209 |
| Lolium perenne | yield (shoot) | 67 |
| Lycopersicon esculentum | yield (shoot) | 289 |
| Medicago sativa | yield (tops) | 118 |
| Raphanus sativus | yield | 202 |
| Spinacia oleracea | yield (shoot) | 201 |
| Trigonella poenum graceum | yield | 629 |
| Zea mays | yield | 647 |
| Eisenia fetida | reproduction (cocoon production) | 558 |
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| Enchytraeus albidus | reproduction (number of juveniles) | 346 |
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| Aspergillus clavatus | hyphal growth | 72 |
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| Aspergillus flavus | hyphal growth | 957 |
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| Proteus vulgaris | colony count | 1406 |
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| Rhodotorula rubra | colony count | 1428 |
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| Trichoderma viride | hyphal growth | 1121 |
| native soil dwelling microorganisms | potential nitrification rate | 280 |
| native soil dwelling microorganisms | glucose induced respiration | 481 |
| native soil dwelling microorganisms | maize residue mineralization | 1251 |
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| native soil dwelling microorganisms | ATP content | 146 |
| native soil dwelling microorganisms | urease | 880 |
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# Attachment A2

# Attachment A-2
## Direct Contact Chronic Toxicity Data Used in Species Sensitivity Distributions
## Eco-SGV Derivation
## Tiwai Point, Awarua, New Zealand

| COPEC | Reference | Test Organism | | Receptor Type | Endpoint | Source Toxicity Parameter | Reported/ Estimated | SSD Chronic Toxicity Value* (mg/kg dw soil) |
|---|---|---|---|---|---|---|---|---|
| Fluoride | Singh et al. 2001 | Wheat | *Triticum aestivum* | Plant | Total yield | LOEC | Reported | 249 |
| Fluoride | Ropelewska et al. 2016 | Soil Microbes | | Soil Process | Biomass | LOEC | Reported | 4204 |
| Fluoride | Van Wensem and Adema 1991 | Ammonium Mineralization | | Soil Process | Mineralization | LOEC | Reported | 338 |
| Fluoride | Jha et al. 2009 | Onion | *Allium sp.* | Plant | Growth | LOEC | Reported | 491 |
| Fluoride | Jha et al. 2008 | Spinach | *Spinacia olerace* | Plant | Shoot yield | LOEC | Reported | 582 |
| Fluoride | Van Wensem and Adema 1991 | Nitrate Mineralization | | Soil Process | Mineralization | LOEC | Reported | 1132 |
| Fluoride | Zouari et al. 2014 | Olive | *Olea sp.* | Plant | Growth | $EC_{30}$ | Reported | 1770 |
| Fluoride | Van Wensem and Adema 1991 | Phosphorus Mineralization | | Soil Process | Mineralization | LOEC | Reported | 3610 |
| LMW PAHs | Sverdrup et al. 2001 | Springtail | *Folsomia fimetaria L.* | Invertebrate | Reproduction | $EC_{10}$ | Estimated[2] | 20 |
| LMW PAHs | Sverdrup et al. 2002a | Potworm | *Enchytraeus crypticus* | Invertebrate | Reproduction | $EC_{10}$ | Estimated[2] | 37.5 |
| LMW PAHs | Sverdrup et al. 2002c | Earthworm | *Eisenia veneta* | Invertebrate | Growth | $EC_{10}$ | Estimated[2] | 62.5 |
| LMW PAHs | Mitchell et al., 1988 | Cucumber | *Cucumus sativus* | Plant | Growth | $EC_{50}$ | Estimated | 216 |
| LMW PAHs | Mitchell et al., 1988 | Heath banksia | *Banksia ericifolia* | Plant | Growth | $EC_{50}$ | Estimated | 300 |
| LMW PAHs | Mitchell et al., 1988 | Oats | *Avena sativa* | Plant | Growth | $EC_{50}$ | Estimated | 9 |
| LMW PAHs | Mitchell et al., 1988 | She-oak | *Casuarina distyla* | Plant | Growth | $EC_{50}$ | Estimated | 300 |
| LMW PAHs | Mitchell et al., 1988 | Soybean | *Glycine max* | Plant | Growth | $EC_{50}$ | Estimated | 300 |
| LMW PAHs | Mitchell et al., 1988 | Yellow bloodwood | *Eucalyptus eximia* | Plant | Growth | $EC_{50}$ | Estimated | 300 |
| HMW PAHs | Herbert et al. 2004 | Springtail | *Folsomia candida* | Invertebrate | Reproduction | MATC | Estimated[1] | 12.5 |
| HMW PAHs | Sverdrup et al. 2001 | Springtail | *Folsomia fimetaria L.* | Invertebrate | Reproduction | $EC_{10}$ | Estimated[2] | 25 |
| HMW PAHs | Sverdrup et al. 2002a | Potworm | *Enchytraeus crypticus* | Invertebrate | Reproduction | $EC_{10}$ | Estimated[2] | 27.5 |
| HMW PAHs | Sverdrup et al. 2002c | Earthworm | *Eisenia veneta* | Invertebrate | Growth | $EC_{10}$ | Estimated[2] | 95 |
| HMW PAHs | Brown et al. 2004 | Earthworm | *Lumbricus rubellus* | Invertebrate | Reproduction | MATC | Estimated[1] | 100 |

**Notes:**

*, Source Toxicity Parameter indicates the original toxicity test reported or used in the estimation of the of the SSD Chronic Toxicity Value

**, Values based on $EC_{20}$, $EC_{25}$, $EC_{30}$ or LOECs

COPEC, Constituent of Potential Ecological Concern

SSD, Species Sensitivity Distribution

LMW PAHs, Low Molecular Weight Polycyclic Aromatic Hydrocarbons

HMW PAHs, High Molecular Weight Polycyclic Aromatic Hydrocarbons

LOEC, Lowest Observed Effects Concentration

ECx, Effects Concentration at X Percentile

NOEC, No Observed Effects Concentration

MATC, Maximum Acceptable Toxicant Concentration, Geometric Mean of LOEC and NOEC

**Source Notes:**

1 , Estimated LOEC was calculated by dividing MATC by 2 and multiplying by 2.5
2, Estimated LOEC was calculated by multiplying NOEC by 2.5
NC, Not Calculated; CCME Values did not have sufficient information to conduct quality assessment; however, these values form the basis of the NEPM Guidance and were deemed suitable
a, LOECs based on dose concentration reported above each of the NOECs presented in Table 4.
b, Study incorrectly reports an LC50 based on fluoride concentration in onion shoots; therefore, a LOEC was adopted at the concentration associated with a reduction in biomass yield, which is approximately 60-70 mg F/kg shoot dw (See Fig 6). This shoot concentration corresponds to a total soil fluoride concentration of 492 mg/kg.
c, An EC30 was identified at a dose of 100mM NaF, which corresponded to a total soil fluoride concentration of 1770 mg/kg dw.
d, Decreased leaf, stem and root mass at 8 mg/kg but no statistical tests are provided to prove that this is a statistically significant difference compared to the control.
e, Statistically significant difference in CO2 respiration rate and oxygen consumption rate over control
f, Study reports a decrease in biomass starting at a concentration of 20 mg/kg.
g, Study reports a decrease in biomass starting at a concentration of 200 mg/kg.
h, Eco-SSL (USEPA, April 2007); Quality score based on USEPA Eco-SSL Methodology, which is comparable to ANZG (2018).
i, EC20 values; 326 mg/kg TiSiO4
j, Highest concentration tested; No effects; The same value is reported as a LOEC in avoidance testing with this species, however (1000 mg/kg TiSiO4).
k, Highest concentration tested; No effects (1000 mg/kg TiSiO4)
l, Highest concentration tested; No effects (1000 mg/kg TiO2)
m, Highest concentration tested; No effects (10,000 mg/kg TiO2 + 660 mg/kg Ti background in artificial soil)
n, Table E.2; Minimum concentration of endpoints
o, Table E.2; Geometric mean of growth tests
p, Minimum concentration of endpoints
q, Geometric mean of growth tests
r, Table F.16; Geometric mean of growth tests
s, Eco-SSL (USEPA, June 2007); Quality score based on USEPA Eco-SSL Methodology, which is comparable to ANZG (2018)

**References:**

Bakhat, H. F., Rasul, K., Farooq, A. B. U., Zia, Z., Natasha, Fahad, S., … Hammad, H. M. (2019). Growth and physiological response of spinach to various lithium concentrations in soil. Environmental Science and Pollution Research.

Bouguerra, S., Gavina, A., Ksibi, M., da Graça Rasteiro, M., Rocha-Santos, T., & Pereira, R. (2016). Ecotoxicity of titanium silicon oxide (TiSiO4) nanomaterial for terrestrial plants and soil invertebrate species. Ecotoxicology and Environmental Safety, 129, 291–301.

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# Attachment A3

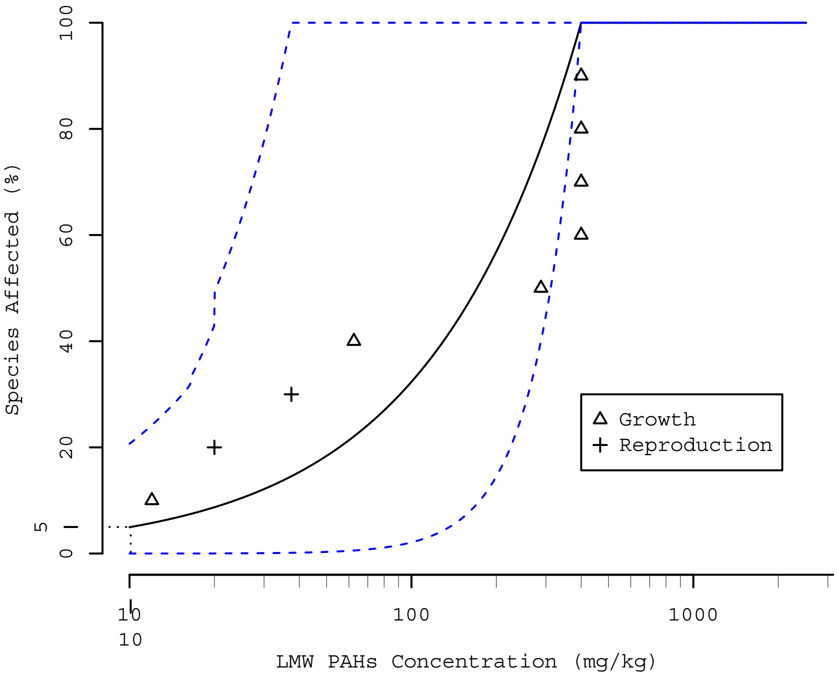
# Burrlioz 2.0 report

Toxicant: Low Molecular Weight Polycyclic Aromatic Hydrocarbons
Input file: C:\Users\Mayble.Abraham\OneDrive - EHS Support LLC\Documents\Mayble's files\
Time read: Tue Dec 06 14:45:57 2022
Units: milligrams per kilogram (mg/kg)
Model: inverse.pareto

Protection level information

| Protect. level | Guideline Value | lower 95% CI | upper 95% CI |
|---|---|---|---|
| 99% | 1.4 | 0.076 | 65 |
| 95% | 10 | 1.5 | 122 |
| 90% | 24 | 4.3 | 161 |
| 80% | 55 | 10 | 211 |
| 60% | 130 | 19 | 265 |

notes:



Data:

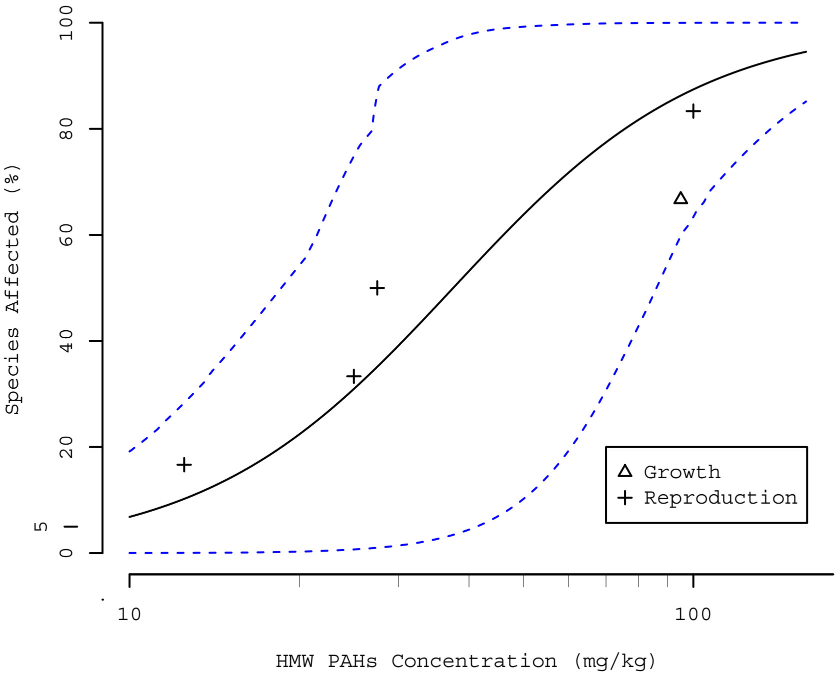
| W PAH (mg/kg) | Test Organism | Receptor Type | Endpoint | LMW Category |
|---|---|---|---|---|
| 12 | Oats | Plant | Growth | LMW PAHs |
| 20 | Springtail | Invertebrate | Reproduction | LMW PAHs |
| 37.5 | Potworm | Invertebrate | Reproduction | LMW PAHs |
| 62.5 | Earthworm | Invertebrate | Growth | LMW PAHs |
| 288 | Cucumber | Plant | Growth | LMW PAHs |
| 400 | Heath banksia | Plant | Growth | LMW PAHs |
| 400 | She-oak | Plant | Growth | LMW PAHs |
| 400 | Soybean | Plant | Growth | LMW PAHs |
| 400 | Yellow bloodwood | Plant | Growth | LMW PAHs |

# **Burrlioz 2.0 report**

```
Toxicant: High Molecular Weight Polycyclic Aromatic Hydrocarbons
Input file: C:\Users\Mayble.Abraham\OneDrive - EHS Support LLC\Documents\Mayble's files\
Time read: Tue Dec 06 14:42:59 2022
Units: milligrams per kilogram (mg/kg)
Model: log logistic

Protection level information
Protect. level      Guideline Value     lower 95% CI        upper 95% CI
99%                 3.7                 2.1                 27
95%                 8.5                 5.1                 41
90%                 12                  7.1                 50
80%                 19                  10                  60
60%                 31                  16                  79

notes:
```



Data:

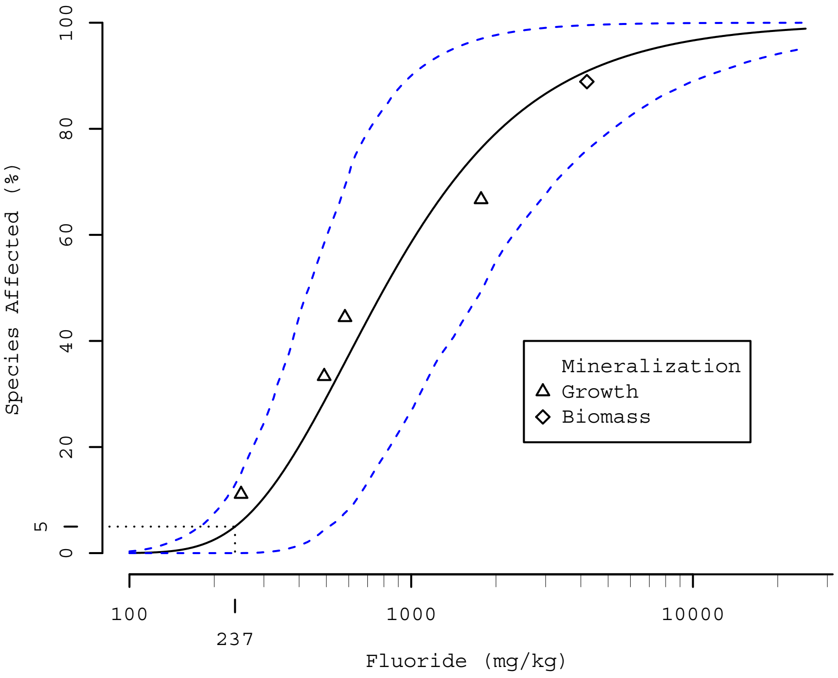
| ¿tPAH (mg/kg) | Test Organism | Receptor Type | Endpoint | HMW Category |
|---|---|---|---|---|
| 95 | Earthworm | Invertebrate | Growth | HMW PAHs |
| 12.5 | Springtail | Invertebrate | Reproduction | HMW PAHs |
| 25 | Springtail | Invertebrate | Reproduction | HMW PAHs |
| 27.5 | Potworm | Invertebrate | Reproduction | HMW PAHs |
| 100 | Earthworm | Invertebrate | Reproduction | HMW PAHs |

# Burrlioz 2.0 report

```
Toxicant: Fluoride
Input file: C:\Users\Mayble.Abraham\OneDrive - EHS Support LLC\Documents\Mayble's files\
Time read: Mon Dec 12 10:43:47 2022
Units: milligrams per kilogram (mg/kg)
Model: inverse.weibull

Protection level information
Protect. level      Guideline Value     lower 95% CI        upper 95% CI
99%                 165                 117                 413
95%                 237                 174                 543
90%                 295                 216                 643
80%                 398                 274                 844
60%                 638                 378                 1239

notes:
```



Data:

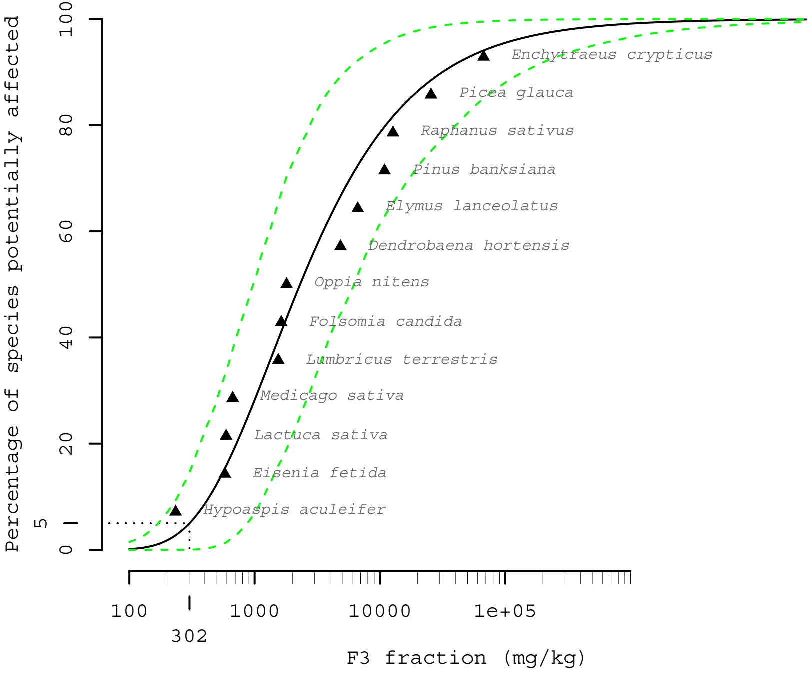
```
 EC30 (mg/kg)             Test Organism Receptor Type        Category
          338     Ammonium Mineralization  Soil Process  Mineralization
          491                       Onion         Plant          Growth
         1132      Nitrate Mineralization  Soil Process  Mineralization
         1770                       Olive         Plant          Growth
         3610   Phosphorus Mineralization  Soil Process  Mineralization
          582                     Spinach         Plant          Growth
          249                       Wheat         Plant          Growth
         4204               Soil Microbes  Soil Process         Biomass
```

# Burrlioz 2.0 report

```
Toxicant:
Input file: R:\Misc\Burrlioz Runs\20230222\F3_SSD_input.csv
Time read: Wed Feb 22 21:30:14 2023
Units: milligrams per kilogram (mg/kg)
Model: inverse.weibull

Protection level information
Protect. level       Guideline Value      lower 95% CI         upper 95% CI
99%                  166                  92                   535
95%                  302                  174                  865
90%                  435                  254                  1218
80%                  716                  402                  1944


notes:
```



Data:

| oxicity_value | species |
|---:|---:|
| 234 | Hypoaspis aculeifer |
| 578 | Eisenia fetida |
| 592 | Lactuca sativa |
| 668 | Medicago sativa |
| 1545 | Lumbricus terrestris |
| 1631 | Folsomia candida |
| 1799 | Oppia nitens |
| 4846 | Dendrobaena hortensis |
| 6653 | Elymus lanceolatus |
| 10881 | Pinus banksiana |
| 12713 | Raphanus sativus |
| 25552 | Picea glauca |
| 67184 | Enchytraeus crypticus |

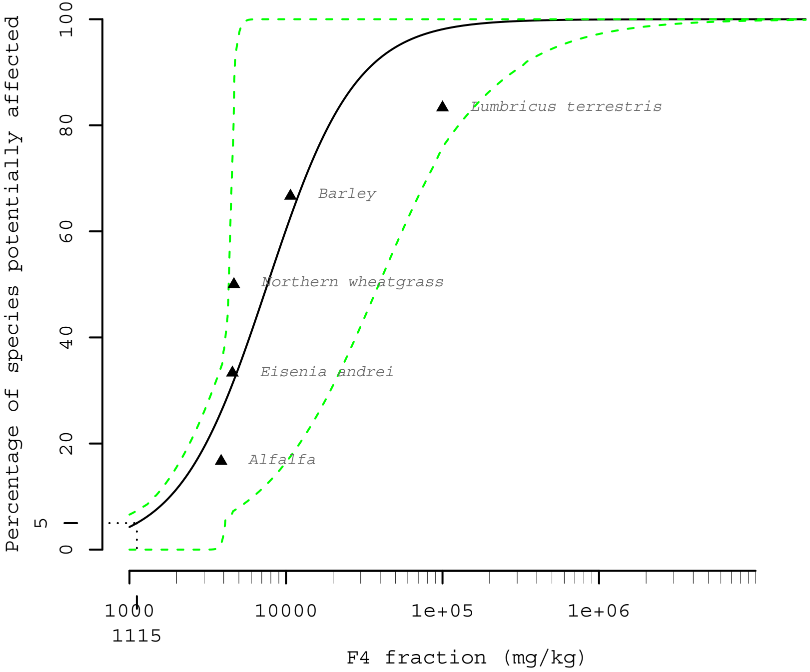
# Burrlioz 2.0 report

Toxicant:
Input file: R:\Misc\Burrlioz Runs\20230222\F4_SSD_input.csv
Time read: Wed Feb 22 21:25:11 2023
Units: milligrams per kilogram (mg/kg)
Model: log logistic

Protection level information

| Protect. level | Guideline Value | lower 95% CI | upper 95% CI |
|---|---|---|---|
| 99% | 380 | 147 | 3834 |
| 95% | 1115 | 740 | 4073 |
| 90% | 1815 | 1445 | 5927 |
| 80% | 3081 | 2421 | 11853 |

notes:



Data:

```
oxicity_value                species

         3851                Alfalfa
         4545         Eisenia andrei
         4648    Northern wheatgrass
        10683                 Barley
       1e+05   Lumbricus terrestris
```

# Appendix B Historical Aerials

| | | | |
|---|---|---|---|
| EHS Support | CMA Assessment Technical Report<br>Appendix B<br>Tiwai Point | View of Tiwai Point Before Construction of the Environment Southland Facility on March 15, 1951 (Processed January 13, 2019) | FIGURE B1 |

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| | | | |
|---|---|---|---|
| EHS Support | CMA Assessment Technical Report<br>Appendix B<br>Tiwai Point | View of Tiwai Point After Construction of the Environment Southland Facility on November 28, 1998 (Processed March 28, 2018) | FIGURE B2 |

**View of Tiwai Point After Construction of the Environment Southland Facility on November 2, 1978 (Processed May 9, 2020)**

**FIGURE B3**

| | | | |
|---|---|---|---|
| EHS Support | CMA Assessment Technical Report<br>Appendix B<br>Tiwai Point | View of Tiwai Point After Construction of the Environment Southland Facility on October 17, 1985 (Processed May 9, 2020) | **FIGURE B4** |

# Appendix C Photo Log

## PHOTOGRAPHIC LOG – TIWAI POINT COASTAL MARINE AREA ASSESSMENT

<table>
<tr><th colspan="2">Client Name:<br>ENVIRONMENT SOUTHLAND</th><th>Site Location: Tiwai Point CMA Assessment</th><th>Project No.<br>J000445</th></tr>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>1.</i></b></td><td colspan="2" rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:<br>West</td></tr>
<tr><td colspan="2">Description:<br>Photograph looking west along BFS background sampling location / beach towards Tiwai Point.</td></tr>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>2.</i></b></td><td colspan="2" rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:</td></tr>
<tr><td colspan="2">Description:<br>Photograph of porewater sampling, BFS sampling location.</td></tr>
</table>

| | | |
|---|---|---|
| ***Photo No.*** | ***3.*** |  |
| Direction Photo Taken:<br>West | | |
| Description:<br>Rear dune area (soil sampling location) BFS location. | | |
| ***Photo No.*** | ***4.*** |  |
| Direction Photo Taken:<br>West | | |
| Description:<br>BAB background sampling location (tidal flats). | | |

| **Photo No.** | **5.** |  |
|---|---|---|
| Direction Photo Taken:<br>Southeast | | |
| Description:<br>SCL SE/PW sampling location (beach). | | |
| **Photo No.** | **6.** |  |
| Direction Photo Taken:<br>Northwest towards Smelter location (stack visible) | | |
| Description:<br>SCL area groundwater monitoring wells and soil sampling location. | | |

| | | |
|---|---|---|
| ***Photo No.*** | ***7.*** |  |
| Direction Photo Taken: | | |
| Description:<br>SCL location soil sample. | | |
| ***Photo No.*** | ***8.*** |  |
| Direction Photo Taken:<br>West | | |
| Description:<br>ICL (foreground left) and ELF (centre rear) beach sampling locations. | | |

| | | |
|---|---|---|
| ***Photo No.*** | ***9.*** |  |
| Direction Photo Taken: | | |
| Sediment sample typical of Foveaux Strait sample siters (SCL, ICA, ELF). | | |
| ***Photo No.*** | ***10.*** |  |
| Direction Photo Taken:<br>North | | |
| Description:<br>WLF sampling site (beach centre rear) bedrock south end of beach in foreground. Facility wharf to rear. | | |

<table>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>11.</i></b></td><td rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:<br>South</td></tr>
<tr><td colspan="2">Description:<br>Towards south drain discharge point from SOD 50 m sample location. Site conveyor to rear.</td></tr>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>12.</i></b></td><td rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:<br>South</td></tr>
<tr><td colspan="2">Description:<br>SOD porewater sampling.</td></tr>
</table>

<table>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>13.</i></b></td><td rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:<br>North</td></tr>
<tr><td colspan="2">Description:<br>Groundwater seep between south and west drains.</td></tr>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>14.</i></b></td><td rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:<br>East</td></tr>
<tr><td colspan="2">Description:<br>West Drain discharge point (January 2023).<br>.</td></tr>
</table>

| ***Photo No.*** | ***15.*** |  |
|---|---|---|
| Direction Photo Taken:<br>East | | |
| Description:<br>West Drain (January 2023). | | |

| ***Photo No.*** | ***16.*** |  |
|---|---|---|
| Direction Photo Taken:<br>Southeast | | |
| Description:<br>WOD PW sampling – location bottom right. | | |

| **Photo No.** | **17.** |  |
|---|---|---|
| Direction Photo Taken: | | |
| Description:<br>West drain during period of rain. | | |
| **Photo No.** | **18.** |  |
| Direction Photo Taken:<br>South | | |
| Description:<br>West drain discharge. | | |

| **Photo No.** | ***19.*** |  |
|---|---|---|
| Direction Photo Taken: | | |
| Description:<br>Visible staining, West drain sediment. | | |

| **Photo No.** | ***20.*** |  |
|---|---|---|
| Direction Photo Taken: | | |
| Description:<br>Exposed bank north of West drain indicating sediment bedding and iron staining. | | |

| **_Photo No._** | **_21._** |  |
|---|---|---|
| Direction Photo Taken:<br>South | | |
| Description:<br>North Drain discharge location (January/February 2023). | | |
| **_Photo No._** | **_22._** |  |
| Direction Photo Taken:<br>North | | |
| Description:<br>North drain (NOD) PW and WS sampling. | | |

<table>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>23.</i></b></td><td rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:</td></tr>
<tr><td colspan="2">Description:<br>PW sampling. Evidence of marine life (crabs).</td></tr>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>24.</i></b></td><td rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:<br>South</td></tr>
<tr><td colspan="2">Description:<br>North drain Sediment (SE) sampling.</td></tr>
</table>

| | | |
|---|---|---|
| ***Photo No.*** | ***25.*** |  |
| Direction Photo Taken: South | | |
| Description:<br>North drain, sediment staining fin foreground. | | |
| ***Photo No.*** | ***26.*** |  |
| Direction Photo Taken:<br>North | | |
| Description:<br>North drain first flush event (2 February 2023). | | |

<table>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>27.</i></b></td><td rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:<br>Northwest</td></tr>
<tr><td colspan="2">Description:<br>North drain first flush event freshwater lens.</td></tr>
<tr><td><b><i>Photo No.</i></b></td><td><b><i>28.</i></b></td><td rowspan="3"></td></tr>
<tr><td colspan="2">Direction Photo Taken:<br>North</td></tr>
<tr><td colspan="2">Description:<br>North drain first flush event freshwater lens.</td></tr>
</table>

| | | |
|---|---|---|
| ***Photo No.*** | ***29.*** |  |
| Direction Photo Taken: | | |
| Description:<br>North drain first fluish event sediment deposition. | | |
| ***Photo No.*** | ***30.*** |  |
| Direction Photo Taken:<br>South | | |
| Description:<br>North drain first fluish event sediment deposition. | | |

| | | |
|---|---|---|
| ***Photo No.*** | ***31.*** |  |
| Direction Photo Taken:<br>East | | |
| Description:<br>West drain May 2023 post drain clean. | | |

| | | |
|---|---|---|
| ***Photo No.*** | ***32.*** |  |
| Direction Photo Taken:<br>East | | |
| Description:<br>West Drain May 2023 post drain clean. | | |

| **_Photo No._** | **_33._** |  |
|---|---|---|
| Direction Photo Taken:<br>South | | |
| Description:<br>North drain May 2023 post drain clean. | | |

| **_Photo No._** | **_34._** |  |
|---|---|---|
| Direction Photo Taken:<br>North | | |
| Description:<br>North drain May 2023. | | |

| | | |
|---|---|---|
| ***Photo No.*** | ***35.*** |  |
| Direction Photo Taken:<br>North | | |
| Description:<br>North drain May 2023 showing disturbance to low water mark. | | |
| ***Photo No.*** | ***36.*** |  |
| Direction Photo Taken:<br>Northeast | | |
| Description:<br>North drain May 2023, photo taken at low tide. | | |

| | | |
|---|---|---|
| ***Photo No.*** | ***37.*** |  |
| Direction Photo Taken: Northeast | | |
| Description:<br>AMS Redi-Driver preparing to collect sediment sample in the South Drain. | | |
| ***Photo No.*** | ***38.*** |  |
| Direction Photo Taken: North | | |
| Description:<br>Water quality parameter sample collected for North Drain pore water. | | |

# Appendix E Groundwater Forms and Datalogger Data

**Tiwai Point CMA - Groundwater and Electrical Conductivity Depths and Measurements**

| Monitoring Well ID | | A63 |
|---|---|---|
| Date | | 19/01/2023 |
| Water Level (m btow) | | 1.462 |
| Top of PVC Casing (m) | | 0.491 |
| Top of well (m) | | 0.749 |
| Total Depth (m btow) | | 6.179 |
| Depth (mbtow) | Depth (mbgl) | Electrical Conductivity (µs/cm) |
| 1.5 | 0.751 | 631 |
| 2 | 1.251 | 633 |
| 2.5 | 1.751 | 630 |
| 3 | 2.251 | 623 |
| 3.5 | 2.751 | 619 |
| 4 | 3.251 | 627 |
| 4.5 | 3.751 | 649 |
| 5 | 4.251 | 643 |
| 5.5 | 4.751 | 671 |
| 6 | 5.251 | 687 |

| Monitoring Well ID | | A51 |
|---|---|---|
| Date | | 19/01/2023 |
| Water Level (m btow) | | 3.9 |
| Top of PVC Casing (m) | | 0.205 |
| Top of well (m) | | 0.31 |
| Total Depth (m btow) | | 6.07 |
| Depth (mbtoc) | Depth (mbgl) | Electrical Conductivity (µs/cm) |
| 4 | 3.690 | 689 |
| 4.5 | 4.190 | 700 |
| 5 | 4.690 | 690 |
| 5.5 | 5.190 | 703 |
| 6 | 5.690 | 1172 |

| Monitoring Well ID | | A53 |
|---|---|---|
| Date | | 19/01/2023 |
| Water Level (m btow) | | 4.17 |
| Top of PVC Casing (m) | | -0.089 |
| Top of well (m) | | 0.325 |
| Total Depth (m btow) | | 6.44 |
| Depth (mbtoc) | Depth (mbgl) | Electrical Conductivity (µs/cm) |
| 4.17 | 3.845 | 1616 |
| 4.5 | 4.175 | 1661 |
| 5 | 4.675 | 1638 |
| 5.5 | 5.175 | 1667 |
| 6 | 5.675 | 1717 |
| 6.44 | 6.115 | 1849 |

| Monitoring Well ID | | A56 |
|---|---|---|
| Date | | 19/01/2023 |
| Water Level (m btow) | | 4.16 |
| Top of PVC Casing (m) | | 0.01 |
| Top of well (m) | | 0.335 |
| Total Depth (m btow) | | 6.14 |
| Depth (mbtoc) | Depth (mbgl) | Electrical Conductivity (µs/cm) |
| 4.16 | 3.825 | 19966 |
| 4.5 | 4.165 | 19833 |
| 5 | 4.665 | 17021 |
| 5.5 | 5.165 | 19380 |
| 6 | 5.665 | 19616 |
| 6.14 | 5.805 | 19626 |

| Monitoring Well ID | | L_MW_B18 |
|---|---|---|
| Date | | 20/01/2023 |
| Water Level (m btoc) | | 5.659 |
| Top of PVC Casing (m) | | 0.659 |
| Top of well (m) | | 0.6015 |
| Total Depth (m btoc) | | 7.45 |
| Depth (mbtoc) | Depth (mbgl) | Electrical Conductivity (µs/cm) |
| 5.66 | 5.001 | 624 |
| 6 | 5.341 | 632 |
| 6.5 | 5.841 | 625 |
| 7 | 6.341 | 624 |
| 7.45 | 6.791 | 622 |

| Monitoring Well ID | | 4 - 5 |
|---|---|---|
| Date | | 19/01/2023 |
| Water Level (m btoc) | | 4.17 |
| Top of PVC Casing (m) | | 0.425 |
| Top of well (m) | | - |
| Total Depth (m btow) | | 7.4 |
| Depth (mbtow) | Depth (mbgl) | Electrical Conductivity (µs/cm) |
| 4.17 | 3.745 | 733 |
| 4.5 | 4.075 | 721 |
| 5 | 4.575 | 735 |
| 5.5 | 5.075 | 753 |
| 6 | 5.575 | 769 |
| 6.5 | 6.075 | 692 |
| 7 | 6.575 | 785 |
| 7.4 | 6.975 | 323 |

| Monitoring Well ID | | E_MW_B7 |
|---|---|---|
| Date | | 19/01/2023 |
| Water Level (m btow) | | 3.36 |
| Top of PVC Casing (m) | | 0.63 |
| Top of well (m) | | 0.685 |
| Total Depth (m btow) | | 4.57 |
| Depth (mbtow) | Depth (mbgl) | Electrical Conductivity (µs/cm) |
| 3.36 | 2.675 | 377 |
| 4 | 3.315 | 422 |
| 4.5 | 3.815 | 473 |
| 4.57 | 3.885 | 471 |

| Monitoring Well ID | | I_MW_B1 |
|---|---|---|
| Date | | 20/01/2023 |
| Water Level (m btow) | | 3.709 |
| Top of PVC Casing (m) | | -0.035 |
| Top of well (m) | | - |
| Total Depth (m btow) | | 4.82 |
| Depth (mbtoc) | Depth (mbgl) | Electrical Conductivity (µs/cm) |
| 3.71 | 3.745 | 369 |
| 4 | 4.035 | 384 |
| 4.5 | 4.535 | 435 |
| 4.82 | 4.855 | 441 |

Notes:

Electrical conductivity measured using a Heron Conductivity, Temperature & Water Level Meter

m btoc = meters below top of PVC casing.

m btow = meters below top of well head.

## Tiwai Point CMA - Groundwater Monitoring Well Electrical Conductivity Profile

| Monitoring Well ID | A63 | E_MW_B7 | L_MW_B18 | I_MW_B1 | 4 - 5 | A51 | A53 | A56 |
|---|---|---|---|---|---|---|---|---|
| Top of PVC Casing Elevation (m) | 0.491 | 0.630 | 0.659 | -0.035 | 0.425 | 0.205 | -0.089 | 0.01 |
| Static Water Level (m btoc) | 1.204 | 3.305 | 5.659 | 3.709 | 4.170 | 3.795 | 3.756 | 3.835 |
| Static Water Level (m bgl) | 0.713 | 2.675 | 5.00 | 3.74 | 3.745 | 3.59 | 3.845 | 3.825 |
| Measurement Depth (m bgl) | Electrical Conductivity (µs/cm) | | | | | | | |
| 0.-0.5 | | | | | | | | |
| 0.5-1.0 | 631 | | | | | | | |
| 1-1.5 | 633 | | | | | | | |
| 1.5-2.0 | 630 | | | | | | | |
| 2.0-2.5 | 623 | | | | | | | |
| 2.5-3.0 | 619 | 377 | | | | | | |
| 3.0-3.5 | 627 | 422 | | | | | | |
| 3.5-4.0 | 649 | 473 | | 369 | 733 | 689 | 1616 | 19966 |
| 4.0-4.5 | 643 | | | 384 | 721 | 700 | 1661 | 19833 |
| 4.5-5.0 | 671 | | 624[A] | 435 | 735 | 690 | 1638 | 17021 |
| 5.0-5.5 | 687 | | 632 | 441[B] | 753 | 703 | 1667 | 19380 |
| 5.5-6.0 | | | 625 | | 769 | 1172 | 1717 | 19616 |
| 6.0-6.5 | | | 624 | | 692 | | 1849[C] | 19626[D] |
| 6.5-6.9 | | | 622 | | 785 | | | |
| 6.9-7.0 | | | | | 323 | | | |

| | |
|---|---|
| 1172 | Electrical conductivity greater than 1000 µs/cm |
| 1667 | Electrical conductivity greater than 1500 µs/cm |
| 17021 | Electrical conductivity greater than 10,000 µs/cm |

m bgl = meters below ground level.

m btoc = meters below top of PVC well casing.

A = EC was measured at the static water level at 5.01 m bgl

B = EC was measured at the bottom of well at 4.855m bgl

C = EC was measured at the bottom of well at 6.115 m bgl

D = EC was measured at the bottom of well at 5.805 m bgl

**Tiwai Point CMA - Groundwater Quality Parameters**

| Montoring Well ID | Date | pH | ORP (mv) | Temperature (°C) | SPC (µs/cm) | Dissolved Oxygen % |
|---|---|---|---|---|---|---|
| A63 | 19/01/2023 | 6.38 | 28.8 | 15.6 | 6.33 | 2.7 |
| E_MW_B7 | 19/01/2023 | 5.74 | 223.7 | 14.5 | 434.4 | 36.9 |
| L_MW_B18 | 20/01/2023 | 7.60 | 92.9 | 12.3 | 607 | 8.2 |
| I_MW_B1 | 20/01/2023 | 5.95 | 26.8 | 14.7 | 395.8 | 2.7 |
| 4 - 5 | 19/01/2023 | 9.35 | -62.8 | 14.8 | 834 | 3.6 |
| A51 | 19/01/2023 | 6.5 | -41.4 | 12.2 | 675 | 2.9 |
| A53 | 19/01/2023 | 7.1 | 199.5 | 13.6 | 1621 | 2.5 |
| A56 | 19/01/2023 | 7.61 | 137 | 13.1 | 21858 | 2.7 |

Notes:

Tabulated water quality parameters are taken from the final stabilised water quality readings prior to ground water sample collection.

**Tiwai Point CMA Investigation - Groundwater Well Measurements**

| Monitoring Well ID | A63 | E_MW_B7 | L_MW_B18 | 4 - 5* | A51 | A53 | A56 | I_MW_B1* |
|---|---|---|---|---|---|---|---|---|
| Date | 19/01/2023 | 19/01/2023 | 20/01/2023 | 19/01/2023 | 19/01/2023 | 19/01/2023 | 19/01/2023 | 20/01/2023 |
| Water Level (m btoc) | 1.204 | 3.305 | 5.659 | 4.17 | 3.795 | 3.756 | 3.835 | 3.709 |
| Water Level (m btow) | 1.462 | 3.36 | 5.6015 | - | 3.9 | 4.17 | 4.16 | - |
| water level (m bgl) | 0.713 | 2.675 | 5.00 | 3.745 | 3.59 | 3.845 | 3.825 | 3.744 |
| Total Depth (m btow) | 6.179 | 4.57 | 7.45 * | 7.4 | 6.07 | 6.44 | 6.14 | 5.43 |
| Top of Casing (m) | 0.491 | 0.63 | 0.659 | 0.425 | 0.205 | -0.089 | 0.01 | -0.035 |
| Top of well (m) | 0.749 | 0.685 | 0.6015 | - | 0.31 | 0.325 | 0.335 | - |
| Water level measurement time | 8:45 | 10:25 | 11:00 | 11:32 | - | 16:37 | 17:45 | 12:30 |
| logger removed | 9:12 | 10:27 | 10:51 | 11:23 | 14:59 | 16:32 | 17:38 | 12:27 |

Notes:

m bgl = Meters below ground level.

m btoc = Meters below top of PVC well casing.

m btow = Meters below top of well head.

*= Measurements below top of well PVC casing.

**EHS Support**

## GROUNDWATER SAMPLING FORM

**Monitoring Well ID:** 4-S

**Sample Code (name):** MW4/5

Job Number: NZL.00445

Location: Tiwai Point.

Date and time: 19/01/2023

Sampling Method: low Flow

**Well Measurements**

Top of Well (m):

Coordinates: (NZTM) E

S

Top of Casing (m): PVC +0.425

Well casing Diameter (mm) 50

Sampled By: MG/CC/WS

Water Level measurement point: PVC casing / [✓ well head] / ground level

Weather : Fine

Total Depth of Well (m) : 7.4

Sampling equipment: Peristaltic Pump.

Screened interval (m) : unknown.

**Minimum volume between readings: 1 sample train volume (see formula below)**

**Key Stabilisation Criteria:**
**pH ± 0.1, EC ± 3%, turbidity ± 10% of prior reading and ± 10 for values greater than 10 NTU**

**Water Level Measurement**
Static Water Level (m) : 4.17 11:32pm

**NOTE: purge until well has stabilised using field parameters below (3 consecutive readings)**

| | Time Elapsed | Time | Volume Removed (L) | Water Temp. (°C) | pH | SPC (µS/cm) | ORP (mV) | DO (mg/L) | Water Level (m) * | Turbidity (NTU) / Water Appearance ǂ |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | | 11:48 | | 14.5 | 9.36 | 802 | +13.6 | 9.3 | 4.17 | |
| During | | 11:50 | | 14.9 | 9.36 | 810 | -2.5 | 8.7 | 4.17 | |
| During | | 11:52 | | 14.7 | 9.36 | 822 | -12.5 | 7.5 | 4.17 | |
| During | | 11:54 | | 14.5 | 9.37 | 829 | -22.2 | 6.6 | 4.17 | |
| During | | 11:56 | | 14.4 | 9.37 | 833 | -30.2 | 5.6 | 4.17 | |
| During | | 11:58 | | 14.4 | 9.37 | 835 | -38.3 | 4.9 | 4.17 | |
| During | | 12:00 | | 14.4 | 9.37 | 836 | -45.5 | 4.6 | 4.17 | |
| During | | 12:02 | | 14.5 | 9.37 | 836 | -53.2 | 4.2 | 4.17 | |
| During | | 12:04 | | 14.6 | 9.37 | 837 | -58.7 | 4.0 | 4.17 | |
| During | | 12:06 | | 14.5 | 9.36 | 838 | -61.6 | 3.5 | 4.17 | |
| During | | 12:08 | | 14.5 | 9.36 | 835 | -64.7 | 3.6 | 4.17 | |
| During | | 12:10 | | 14.6 | 9.36 | 835 | -65.8 | 3.8 | 4.17 | |
| During | | 12:12 | | 14.7 | 9.36 | 836 | -64.8 | 3.7 | 4.17 | |
| During | | 12:14 | 12 L | 14.8 | 9.35 | 834 | -62.8 | 3.6 | 4.17. | |
| During | | | | | | | | | | |
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| During | | | | | | | | | | |

ǂ CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

*: needs to be recorded each time you take a set of parameteres

**Sample Train Volume Calculation (L)**

Length of sample tube x 3.141 x $d^2$ / 4000) + flow through cell volume. Where d = internal diameter of sample tube in mm

Water sample internal ø = 6 mm ≈ 30 mL per meter

**Comments**

logger serial 0201091668 removed @ 1123
sampled @ 12:14pm

**QA/QC sample codes:**

Duplicates:

Field Blank:

Trip Blank:

Analyses Required:

Serial number of water quality sensor unit:

**EHS Support**

## GROUNDWATER SAMPLING FORM

**Monitoring Well ID:** A S1

**Sample Code (name):** A S1

Job Number: NZL.0045

Location: Tiwai Point - Landfill bore Beachfront.

Date and time: 19/01/2023

Sampling Method: Low Flow

**Well Measurements**

Top of Well (m): 0.310

Coordinates: (NZTM) E

S

Top of Casing (m): PVC 0.205

Well casing Diameter (mm) 50

Sampled By: CC/ MG/ WS

Water Level measurement point: PVC casing / [✓ well head] / ground level

Weather : Fine

Total Depth of Well (m) : 6.07

Sampling equipment: Peristaltic Pump.

Screened interval (m) : unknown.

**Water Level Measurement**
Static Water Level (m) : 3.90

**Minimum volume between readings: 1 sample train volume (see formula below)**

**Key Stabilisation Criteria:**
**pH ± 0.1, EC ± 3%, turbidity ± 10% of prior reading and ± 10 for values greater than 10 NTU**

**NOTE: purge until well has stabilised using field parameters below (3 consecutive readings)**

| | Time Elapsed | Time | Volume Removed (L) | Water Temp. (°C) | pH | SPC (µS/cm) | ORP (mV) | DO % DO (mg/L) | Water Level (m) * | Turbidity (NTU) / Water Appearance ǂ |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | | 3:45 | | 15.5 | 6.52 | 582 | -10.5 | 25.1 | 3.90 | |
| During | | 3:47 | | 14.3 | 6.54 | 609 | -23.4 | 14.9 | 3.90 | |
| During | | 3:49 | | 13.3 | 6.92 | 637 | -26.6 | 8.4 | 3.90 | |
| During | | 3:51 | | 12.8 | 6.39 | 647 | -26.9 | 5.9 | 3.90 | |
| During | | 3:53 | | 12.5 | 6.42 | 639 | -32.7 | 4.5 | 3.90 | |
| During | | 3:55 | | 12.5 | 6.45 | 665 | -37.0 | 3.8 | 3.90 | |
| During | | 3:58 | | 12.3 | 6.47 | 670 | -40.6 | 3.1 | 3.90 | |
| During | | 4:01 | | 12.2 | 6.50 | 675 | -41.4 | 2.9 | 3.90 | |
| During | | | | | | | | | | |
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| During | | | | | | | | | | |

ǂ CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

*: needs to be recorded each time you take a set of parameteres

**Sample Train Volume Calculation (L)**
Length of sample tube x 3.141 x $d^2$ / 4000) + flow through cell volume. Where d = internal diameter of sample tube in mm

Water sample internal ø = 6 mm ≈ 30 mL per meter

**Comments**

logger serial ID 020-109165 9 @ 1459hrs

sampled @ 4:02pm sample was Orange in hue & slightly murky. Fine Clay on tubing at bottom of well Clay - dark orange / brown

**QA/QC sample codes:**

Duplicates: DUP_01_WG @ 4:05pm

Field Blank:

Trip Blank:

Analyses Required:

Serial number of water quality sensor unit:

**EHS Support**

# GROUNDWATER SAMPLING FORM

**Monitoring Well ID:** A53
**Sample Code (name):** A53
Job Number: NZL.00445
Location: Tiwai Point
Date and time: 19/01/2023
Sampling Method: Low Flow

**Well Measurements**
Top of Well (m): 0.325
Coordinates: (NZTM) E
S
Top of Casing (m): PVC – 0.089
Well casing Diameter (mm)
Sampled By: WS/MG/CC
Water Level measurement point: PVC casing / [✓ well head] / ground level
Weather : Fine
Total Depth of Well (m) : 6.44
Sampling equipment: Peristaltic Pump.
Screened interval (m) : unknown

**Minimum volume between readings: 1 sample train volume (see formula below)**

**Key Stabilisation Criteria:**
**pH ± 0.1, EC ± 3%, turbidity ± 10% of prior reading and ± 10 for values greater than 10 NTU**

**Water Level Measurement**
Static Water Level (m) : 4.17 @ 1637 pm

**NOTE: purge until well has stabilised using field parameters below (3 consecutive readings)**

| | Time Elapsed | Time | Volume Removed (L) | Water Temp. (°C) | pH | SPC (µS/cm) | ORP (mV) | DO (mg/L) | Water Level (m) * | Turbidity (NTU) / Water Appearance ǂ |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | | 5:00 | | 14.4 | 7.10 | 1622 | 174.4 | 24.2 | 4.17 | |
| During | | 5:02 | | 14.2 | 7.09 | 1629 | 170.7 | 11.3 | 4.17 | |
| During | | 5:04 | | 14.1 | 7.10 | 1630 | 168.1 | 9.5 | 4.17 | |
| During | | 5:06 | | 13.9 | 7.10 | 1632 | 165.1 | 7.5 | 4.17 | |
| During | | 5:08 | | 13.8 | 7.10 | 1631 | 162.5 | 5.5 | 4.17 | |
| During | | 5:10 | | 13.7 | 7.10 | 1630 | 154.5 | 4.3 | 4.17 | |
| During | | 5:12 | | 13.6 | 7.10 | 1627 | 156.2 | 3.4 | 4.17 | |
| During | | 5:14 | | 13.6 | 7.10 | 1625 | 154.3 | 2.9 | 4.17 | |
| During | | 5:16 | | 13.5 | 7.10 | 1624 | 151.1 | 2.5 | 4.17 | |
| During | | 5:18 | | 13.6 | 7.10 | 1625 | 149.5 | 2.5 | 4.17 | |
| During | | | | | | | | | | |
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ǂ CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

*: needs to be recorded each time you take a set of parameteres

**Sample Train Volume Calculation (L)**
Length of sample tube x 3.141 x $d^2$ / 4000) + flow through cell volume. Where d = internal diameter of sample tube in mm

**Comments**
Water sample internal ø = 6 mm ≈ 30 mL per meter

logger serial Number 020-1091745 removed @ 1632
sampled at 5:20pm

**QA/QC sample codes:**
Duplicates:
Field Blank:
Trip Blank:
Analyses Required:
Serial number of water quality sensor unit:

**EHS Support**

# GROUNDWATER SAMPLING FORM

**Monitoring Well ID:** A56

**Sample Code (name):** A56

Job Number: NZL.00445

Location: Tiwai Point

Date and time: 19/01/2023

Sampling Method: low Flow

**Well Measurements**

Top of Well (m): 0.335

Coordinates: (NZTM) E

S

Top of Casing (m): 0.334

Well casing Diameter (mm) 50

Sampled By: WS/CC/MG

Water Level measurement point: PVC casing / [✓ well head] / ground level

Weather : Fine

Total Depth of Well (m) : 6.14

Sampling equipment: Pesistaltic Pump

Screened interval (m) : unknown

**Minimum volume between readings: 1 sample train volume (see formula below)**

**Key Stabilisation Criteria:**
**pH ± 0.1, EC ± 3%, turbidity ± 10% of prior reading and ± 10 for values greater than 10 NTU**

**Water Level Measurement**

Static Water Level (m) : 4.16m 5:45pm

**NOTE: purge until well has stabilised using field parameters below (3 consecutive readings)**

| | Time Elapsed | Time | Volume Removed (L) | Water Temp. (°C) | pH | SPC (µS/cm) | ORP (mV) | DO (mg/L) | Water Level (m) * | Turbidity (NTU) / Water Appearance ł |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | | 1800 | | 13.9 | 7.44 | 21789 | 184.8 | 21.5 | 14.75 | |
| During | | 1802 | | 13.3 | 7.53 | 21900 | 165.1 | 7.6 | 14.75 | |
| During | | 1804 | | 13.2 | 7.55 | 21905 | 159.4 | 6.5 | 14.75 | |
| During | | 1806 | | 13.2 | 7.56 | 219.3 | 155.8 | 5.4 | 14.75 | |
| During | | 1808 | | 13.2 | 7.52 | 21908 | 152.2 | 4.7 | 14.75 | |
| During | | 1810 | | 13.1 | 7.58 | 21891 | 148.9 | 4.1 | 14.73 | |
| During | | 1812 | | 13.1 | 7.59 | 21883 | 145.9 | 3.8 | 14.75 | |
| During | | 1814 | | 13.1 | 7.10 | 21888 | 143.7 | 3.4 | 14.75 | |
| During | | 1816 | | 13.1 | 7.60 | 21862 | 141.3 | 3.0 | 14.75 | |
| During | | 1818 | | 13.1 | 7.61 | 21852 | 139.7 | 2.8 | 14.75 | |
| During | | 1820 | | 13.2 | 7.61 | 21855 | 138.2 | 2.8 | 14.75 | |
| During | | 1822 | | 13.1 | 7.61 | 21858 | 137.0 | 2.7 | 14.75 | |
| During | | | | | | | | | | |
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| During | | | | | | | | | | |

ł CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

*: needs to be recorded each time you take a set of parameteres

**Sample Train Volume Calculation (L)**

Length of sample tube x 3.141 x d$^2$ / 4000) + flow through cell volume. Where d = internal diameter of sample tube in mm

Water sample internal ø = 6 mm ≈ 30 mL per meter

**Comments**

logger serial # 020-1091664 removed @ 1738

sampled @ 18:25

**QA/QC sample codes:**

Duplicates:

Field Blank:

Trip Blank:

Analyses Required:

Serial number of water quality sensor unit:

EHS Support

# GROUNDWATER SAMPLING FORM

**Monitoring Well ID:** A63
**Sample Code (name):** A63
Job Number: NZL.00445
Location: Tiwai Point
Date and time: 19/01/2023
Sampling Method: low Flow
**Well Measurements**
Top of Well (m): 0.749
Coordinates: (NZTM) E
S
Top of Casing (m): 0.491
PVC
Well casing Diameter (mm) 50mm
Sampled By: CC/MG/WS
Water Level measurement point: PVC casing / [✓ well head] / ground level
Weather : Fine
Total Depth of Well (m) : 6.179
Sampling equipment: Peristaltic Pump.
Screened interval (m) : unknown

**Minimum volume between readings: 1 sample train volume (see formula below)**

**Key Stabilisation Criteria:**
**pH ± 0.1, EC ± 3%, turbidity ± 10% of prior reading and ± 10 for values greater than 10 NTU**

**Water Level Measurement**
Static Water Level (m) : 1.462 845

**NOTE: purge until well has stabilised using field parameters below (3 consecutive readings)**

| | Time Elapsed | Time | Volume Removed (L) | Water Temp. (°C) | pH | SPC (µS/cm) | ORP (mV) | DO (mg/L) | Water Level (m) * | Turbidity (NTU) / Water Appearance ƚ |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | | 935 | | | | | | | | |
| During | | 940 | | 17.4 | 6.32 | 592 | 101.0 | 12.4 | 1.58 | |
| During | | 942 | | 16.8 | 6.32 | 594 | 86.2 | 8.2 | 1.59 | |
| During | | 944 | | 16.6 | 6.33 | 596 | 71.6 | 6.6 | 1.59 | |
| During | | 946 | | 16.4 | 6.34 | 600 | 61.7 | 5.6 | 1.59 | |
| During | | 948 | | 16.1 | 6.35 | 607 | 58.7 | 4.5 | 1.61 | |
| During | | 950 | | 15.9 | 6.36 | 619 | 49.4 | 4.0 | 1.61 | |
| During | | 952 | | 15.8 | 6.36 | 620 | 45.8 | 3.4 | 1.61 | |
| During | | 956 | | 15.7 | 6.37 | 625 | 39.3 | 3.1 | 1.67 | |
| During | | 1000 | | 15.6 | 6.38 | 633 | 28.8 | 2.7 | 1.68 | |
| During | | | | | | | | | | |
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ƚ CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

*: needs to be recorded each time you take a set of parameteres

**Sample Train Volume Calculation (L)**
Length of sample tube x 3.141 x $d^2$ / 4000) + flow through cell volume. Where d = internal diameter of sample tube in mm

Water sample internal ø = 6 mm ≈ 30 mL per meter

**Comments**
logger serial # 020-1091743 removed @ 9:12
sample collected @ 10:00

**QA/QC sample codes:**
Duplicates:
Field Blank:
Trip Blank:
Analyses Required:
Serial number of water quality sensor unit:

EHS Support

# GROUNDWATER SAMPLING FORM

**Monitoring Well ID:** E-MW-B7

**Sample Code (name):** MWB7

Job Number: NZL.0044S

Location: Tiwai Point

Date and time: 19/01/2023

Sampling Method: Low Flow

**Well Measurements**

Top of Well (m): 0.685

Coordinates: (NZTM) E

Top of Casing (m): 0.630

S

Well casing Diameter (mm) 50

Sampled By: MG/CC/WS

Water Level measurement point: PVC casing / [✓ well head] / ground level

Weather : Fine

Total Depth of Well (m) : 4.57

Sampling equipment: Peristaltic pump

Screened interval (m) : Unkown

**Minimum volume between readings: 1 sample train volume (see formula below)**

**Water Level Measurement**

Static Water Level (m) : 3.36 1025

**Key Stabilisation Criteria:**

**pH ± 0.1, EC ± 3%, turbidity ± 10% of prior reading and ± 10 for values greater than 10 NTU**

**NOTE: purge until well has stabilised using field parameters below (3 consecutive readings)**

| | Time Elapsed | Time | Volume Removed (L) | Water Temp. (°C) | pH | SPC (µS/cm) | ORP (mV) | DO (mg/L) | Water Level (m) * | Turbidity (NTU) / Water Appearance ‡ |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | | 1040 | | 15.1 | 5.67 | 4425 | 223.4 | 42.9 | 3.39 | |
| During | | 1042 | | 14.7 | 5.70 | 442.1 | 221.2 | 38.9 | 3.39 | |
| During | | 1044 | | 14.6 | 5.71 | 441.1 | 221.5 | 37.9 | 3.39 | |
| During | | 1046 | | 14.6 | 5.71 | 439.6 | 221.5 | 37.2 | 3.39 | |
| During | | 1048 | | 14.6 | 5.72 | 437.6 | 221.1 | 37.1 | 3.39 | |
| During | | 1050 | | 14.6 | 5.73 | 436.3 | 222.5 | 37.0 | 3.39 | |
| During | | 1052 | | 14.5 | 5.73 | 435.4 | 223.0 | 37.0 | 3.39 | |
| During | | 1052 | | 14.5 | 5.74 | 434.4 | 223.7 | 36.9 | 3.39 | |
| During | | | | | | | | | | |
| During | | | | | | | | | | |
| During | | | | | | | | | | |
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‡ CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

*: needs to be recorded each time you take a set of parameteres

**Sample Train Volume Calculation (L)**

Length of sample tube x 3.141 x $d^2$ / 4000) + flow through cell volume. Where d = internal diameter of sample tube in mm

**Comments**

Water sample internal ø = 6 mm ≈ 30 mL per meter

logger serial # 0201091661 remared @ 10:27am

sample collected @ 10:55

**QA/QC sample codes:**

Duplicates:

Field Blank:

Trip Blank:

Analyses Required:

Serial number of water quality sensor unit:

EHS Support

# GROUNDWATER SAMPLING FORM

**Monitoring Well ID:** L-MW-B18

**Sample Code (name):** L-MW-B18

Job Number: NZL.00445

Location: Tiwai Point.

Date and time: 20/1/2023

Sampling Method:

**Well Measurements**

Top of Well (m): 0.6015

Coordinates: (NZTM) E

Top of Casing (m): 0.659

S

Well casing Diameter (mm)

Sampled By: WS/MH/CC

Water Level measurement point: PVC casing / [✓ well head] / ground level

Weather : Rain

Total Depth of Well (m) : 7.45

Sampling equipment:

Screened interval (m) : Unknown

**Minimum volume between readings: 1 sample train volume (see formula below)**

**Key Stabilisation Criteria:**
**pH ± 0.1, EC ± 3%, turbidity ± 10% of prior reading and ± 10 for values greater than 10 NTU**

**Water Level Measurement**

Static Water Level (m) : 5.659 @ 11:00am

**NOTE: purge until well has stabilised using field parameters below (3 consecutive readings)**

| | **Time Elapsed** | **Time** | **Volume Removed (L)** | **Water Temp. (°C)** | **pH** | **SPC (µS/cm)** | **ORP (mV)** | **DO (mg/L)** | **Water Level (m) *** | **Turbidity (NTU) / Water Appearance ǂ** |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | | | | | | | | | | |
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ǂ CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

*: needs to be recorded each time you take a set of parameteres

**Sample Train Volume Calculation (L)**

Length of sample tube x 3.141 x $d^2$ / 4000) + flow through cell volume. Where d = internal diameter of sample tube in mm

Water sample internal ø = 6 mm ≈ 30 mL per meter

**Comments**

logger serial 020-1097747 removed @ 10:51
Barologger serial 001-2167771

**QA/QC sample codes:**

Duplicates:

Field Blank:

Trip Blank:

Analyses Required:

Serial number of water quality sensor unit:

EHS Support

# GROUNDWATER SAMPLING FORM

**Monitoring Well ID:** I-MW-B1

**Sample Code (name):**

Job Number: NZL.0445

Location: Tiwai Point

Date and time: 20/1/2023

Sampling Method: Low Flow

**Well Measurements**

Top of Well (m):

Coordinates: (NZTM) E

S

Top of Casing (m): - 0.035

Well casing Diameter (mm) 50

Sampled By: CC/MG/WS

Water Level measurement point: [✓ PVC casing] / well head / ground level

Weather : Rainy

Total Depth of Well (m) : 4.82

Sampling equipment: Pesistaltic Pump.

Screened interval (m) : —

**Minimum volume between readings: 1 sample train volume (see formula below)**

**Key Stabilisation Criteria:**
**pH ± 0.1, EC ± 3%, turbidity ± 10% of prior reading and ± 10 for values greater than 10 NTU**

**Water Level Measurement**
Static Water Level (m) : 3.709 @1230

**NOTE: purge until well has stabilised using field parameters below (3 consecutive readings)**

| | Time Elapsed | Time | Volume Removed (L) | Water Temp. (°C) | pH | SPC (µS/cm) | ORP (mV) | DO ~~(mg/L)~~ % | Water Level (m) * | Turbidity (NTU) / Water Appearance ǂ |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | 1 | 1318 | | 14.9 | 5.94 | 3886 | 44.8 | 13.8 | 4.08 | 75 dark red/Brown sediment. |
| During | | 1320 | | 15.2 | 5.94 | 390.8 | 40.1 | 7.7 | 4.08 | 65 |
| During | | 1324 | | 15.0 | 5.94 | 395.1 | 36.6 | 5.5 | 4.08 | 67 |
| During | | 1326 | | 15.0 | 5.94 | 395.2 | 33.6 | 4.7 | 4.08 | |
| During | | 1328 | | 14.9 | 5.94 | 395.5 | 32.0 | 4.2 | 4.08 | |
| During | | 1330 | | 15.0 | 5.94 | 395.0 | 29.4 | 3.3 | 4.08 | |
| During | | 1337 | | 14.7 | 5.95 | 395.8 | 26.8 | 2.7 | 4.08 | |
| During | | | | | | | | | | |
| During | | | | | | | | | | |
| During | | | | | | | | | | |
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| During | | | | | | | | | | |
| During | | | | | | | | | | |

ǂ CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

*: needs to be recorded each time you take a set of parameteres

**Sample Train Volume Calculation (L)**

Length of sample tube x 3.141 x $d^2$ / 4000) + flow through cell volume. Where d = internal diameter of sample tube in mm

Water sample internal ø = 6 mm ≈ 30 mL per meter

**Comments**

logger serial # 0201091667 removed @ 12:27

**QA/QC sample codes:**

Duplicates:

Field Blank:

Trip Blank:

Analyses Required:

Serial number of water quality sensor unit:

EHS Support

# GROUNDWATER SAMPLING FORM

**Monitoring Well ID:** L_MW-B18

**Sample Code (name):** L-MW-B18

Job Number: NZL.00445

Location: Tiwai Point

Date and time: 20/1/2023

Sampling Method: low Flow

**Well Measurements**

Top of Well (m): 0.6015

Coordinates: (NZTM) E

S

Top of Casing (m): 0.659m

Well casing Diameter (mm) 50

Sampled By: CC/MG/WS

Water Level measurement point: PVC casing / [✓ well head] / ground level

Weather : Reiny

Total Depth of Well (m) : 7.45

Sampling equipment: peristaltic pump

Screened interval (m) : —

**Water Level Measurement**

Static Water Level (m) : 5.659 @ 11:00

**Minimum volume between readings: 1 sample train volume (see formula below)**

**Key Stabilisation Criteria:**

**pH ± 0.1, EC ± 3%, turbidity ± 10% of prior reading and ± 10 for values greater than 10 NTU**

**NOTE: purge until well has stabilised using field parameters below (3 consecutive readings)**

| | Time Elapsed | Time | Volume Removed (L) | Water Temp. (°C) | pH | SPC (µS/cm) | ORP (mV) | DO (~~mg/L~~) % | Water Level (m) * | Turbidity (NTU) / Water Appearance ⱡ |
|---|---|---|---|---|---|---|---|---|---|---|
| Before | | 11.22 | | 12.6 | 7.23 | 623 | 138.5 | 25.3 | 5.65 | — |
| During | | 1124 | | 12.4 | 7.30 | 623 | 136.0 | 15.3 | 5.65 | — |
| During | | 1126 | | 12.3 | 7.38 | 623 | 118.7 | 13.7 | 5.65 | 4.2 |
| During | | 1128 | | 12.3 | 7.43 | 623 | 112.3 | 11.3 | 5.65 | 8.9 |
| During | | 1130 | | 12.3 | 7.46 | 620 | 108.4 | 10.6 | 5.65 | 8.4 |
| During | | 1132 | | 12.2 | 7.48 | 619 | 104.4 | 9.7 | 5.65 | 6.2 |
| During | | 1134 | | 12.2 | 7.55 | 617 | 99.1 | 9.1 | 5.65 | 4.8 |
| During | | 1136 | | 12.2 | 7.58 | 613 | 95.7 | 8.5 | 5.65 | 3.5 |
| During | | 1138 | | 12.3 | 7.60 | 609 | 94.1 | 8.5 | 5.65 | 3.9 |
| During | | 1140 | | 12.3 | 7.60 | 608 | 93.6 | 8.1 | 5.65 | 4.9 |
| During | | 1142 | | 12.3 | 7.60 | 607 | 92.9 | 8.2 | 5.65 | 4.9 |
| During | | | | | | | | | | |
| During | | | | | | | | | | |
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| During | | | | | | | | | | |

ⱡ CL=clear, CO=cloudy, TU=turbid, SI=silty, SA=sandy

*: needs to be recorded each time you take a set of parameteres

**Sample Train Volume Calculation (L)**

Length of sample tube x 3.141 x $d^2$ / 4000) + flow through cell volume. Where d = internal diameter of sample tube in mm

**Comments**

Water sample internal ø = 6 mm ≈ 30 mL per meter

logger serial # 020-1091747 removed @ 1051

**QA/QC sample codes:** barologger serial # 001-216 7771

Duplicates:

Field Blank:

Trip Blank:

Analyses Required:

Serial number of water quality sensor unit:

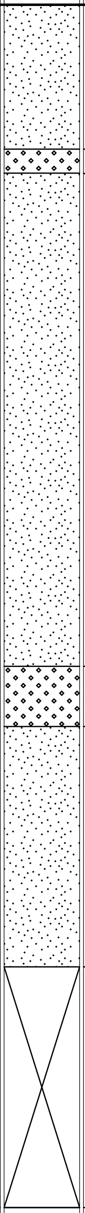
# Appendix F Sediment Bore Logs

# Drilling Log
# Soil Bore ID: BAB-SE-01

Page 1 of 1

Comments
Awarua Bay - Background

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | | Client: Environment Southland | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 27-Jan-23 | Date Finished: 27-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1254930.0 | Northing (m): 4832345.2 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |



| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | USCS Classification | Material Description |
|---|---|---|---|---|---|---|
| | | | BAB-SE-01_<br>0.00-0.10 m | | SP | Medium to coarse SAND; orangey brown; uniform grading. Loosely packed. |
| | | | | | SP | Colour change to grey |
| | | | BAB-SE-01_<br>0.10-0.50 m | | | |
| | | | | | SW | Medium to coarse SAND with some gravel; orangey brown; gap graded. Loosely packed; gravels are fine to medium, rounded quartzite. |
| | | | | | SP | Medium to coarse SAND; medium grey; poor to uniform grading. Loosely packed. |
| 0.2 | | | | | | |
| 0.4 | | | | | | |
| | | | BAB-SE-01_<br>0.50-1.00 m | | | |
| | | | | | SW | Medium to coarse SAND with some gravel; medium grey; gap graded. Loosely packed; gravels are fine to medium, rounded quartzite. |
| 0.6 | | | | | SP | Medium to coarse SAND; medium grey; poor to uniform grading. Loosely packed. |
| 0.8 | | | | | | Core loss. |
| 1.0 | | | | 1.00 m | | Hole Terminated at 1.00 m<br>Target depth reached |

| | | | | | |
|---|---|---|---|---|---|
| ▨ Concrete | ▨ Cuttings | ▨ Grout | ■ Bentonite | ⁘ Sand | ○ Gravel |

# Drilling Log
# Soil Bore ID: BAB-SE-02

Page 1 of 1

Comments
Awarua Bay - Background

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 25-Jan-23 | Date Finished: 25-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1255067.5 | Northing (m): 4832354.4 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: CC | Driller's License: N/A | Logged By: CC | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | BAB-SE-02_ 0.00-0.10 m | | ⁘ | SP<br>SP | Fine SAND; dark reddish brown; uniform grading. Sand is sub-angular quartz with trace black grains.<br>Colour change to blackish grey with marine odour. |
| | | | BAB-SE-02_ 0.10-0.50 m | | ⁘ | SP | Fine SAND with trace gravel; blackish grey; uniformly graded. Gravel is medium; sand is sub-angular quartz with trace black grains. |
| 0.2 | | | | | | | |
| 0.4 | | | | | | | |
| | | | BAB-SE-02_ 0.50-1.00 m | | ⁘ | SP | Fine SAND; dark grey; uniform grading. |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▨ Concrete ▦ Cuttings ▧ Grout ■ Bentonite ⁘ Sand ○ Gravel

EHS Support

# Drilling Log
# Soil Bore ID: BAB-SE-03

Page 1 of 1

Comments
Awarua Bay - Background

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 27-Jan-23 | Date Finished: 27-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1254772.1 | Northing (m): 4832382.5 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| 0.0 | | | BAB-SE-03_ 0.00-0.10 m | | ⁚ | SP | Medium to coarse SAND with trace gravels; medium grey; bedded, poor to uniform grading. Loosely packed; gravels are fine to medium, rounded white quartzite and predominantly located in 10 mm bands at 0.35 m, 0.44 m, 0.60 m and 0.75 m. |
| | | | BAB-SE-03_ 0.10-0.50 m | | ⁚ | | |
| 0.2 | | | | | ⁚ | | |
| 0.4 | | | | | ⁚ | SP | Colour change to blue/grey. |
| | | | BAB-SE-03_ 0.50-1.00 m | | ⁚ | | |
| 0.6 | | | | | ⁚ | | |
| 0.8 | | | | | ⁚ | | |
| | | | | | ☒ | | Core Loss. |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▦ Concrete ▦ Cuttings ▨ Grout ■ Bentonite ⁚ Sand ○ Gravel

# Drilling Log
# Soil Bore ID: NOD-SE-01

Page 1 of 1

Comments
Tiwai Point - North Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 03-Feb-23 | Date Finished: 03-Feb-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1246203.1 | Northing (m): 4830758.8 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: MG | Driller's License: N/A | Logged By: MG | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | NOD-SE-01_ 0.00-0.10 m | | | ML-MH | SILT with some sand and trace gravel; dark blackish grey. Soft; dilatant; non-plastic; sand is medium to coarse; gravel is fine with trace coarse gravel, rounded predominantly white in colour; organic odours. |
| | | | NOD-SE-01_ 0.10-0.50 m | | | GWS | Sandy fine to coarse GRAVEL; dark grey; gap graded. Tightly packed; gravel is sub-rounded to rounded predominantly white with some green gravel; sand is medium to coarse. |
| 0.2 | | | | | | | |
| 0.4 | | | | | | GWS | Colour changes to medium grey. |
| | | | NOD-SE-01_ 0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| 0.8 | | | | | | GWS | Fine to coarse GRAVEL with minor sand; brown (overall colour); well graded. Loosely packed; gravels are rounded to sub-rounded, predominantly white quartzite with some green and orange clasts. |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

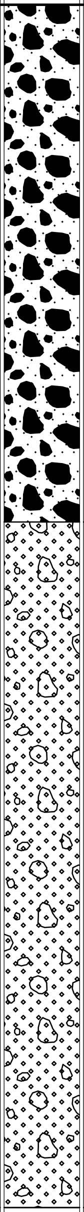
▨ Concrete ▨ Cuttings ▨ Grout ■ Bentonite ⁙ Sand ▨ Gravel

# Drilling Log
# Soil Bore ID: NOD-SE-02

Page 1 of 1

Comments
Tiwai Point - North Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 01-Feb-23 | Date Finished: 01-Feb-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1246205.1 | Northing (m): 4830783.8 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: MG | Driller's License: N/A | Logged By: MG | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | NOD-SE-02_<br>0.00-0.10 m | |  | GWS | Sandy fine to coarse GRAVEL; dark grey lightening with depth; gap graded. Tightly packed; gravel is rounded some sub-rounded, predominantly quartzite; sand is fine to coarse; organic odours. |
| | | | NOD-SE-02_<br>0.10-0.50 m | | | | |
| 0.2 | | | | | | | |
| | | | | | | GWS | Colour change to medium grey |
| 0.4 | | | | | | | |
| | | | | | | SW | Gravelly fine to coarse SAND; medium grey; gap grading. Tightly packed; gravels are fine to coarse, rounded to sub-rounded, predominantly white quartzite. |
| | | | NOD-SE-02_<br>0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▨ Concrete ▦ Cuttings ▧ Grout ■ Bentonite ⬚ Sand ⬚ Gravel

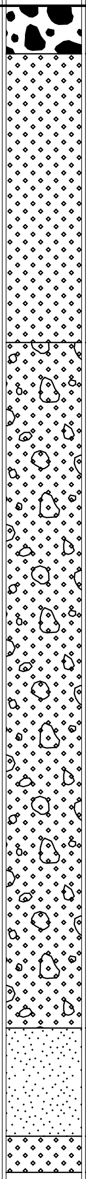
EHS 1.02.1 LIB.GLB Log EHS-AU GROUNDWATER WELL TIWAI POINT_SEDIMENT CORE LOGS_2023 04 11.GPJ <<DrawingFile>> 11/4/2023 16:55 10.03.00.09 Datgel | Lib: EHS 1.02.1 2020-09-22 Prj: EHS 1.02.1 2020-09-22

# Drilling Log
# Soil Bore ID: NOD-SE-03

Page 1 of 1

Comments
Tiwai Point - North Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 01-Feb-23 | Date Finished: 01-Feb-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1246203.1 | Northing (m): 4830808.8 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: MG | Driller's License: N/A | Logged By: MG | Checked By: GJS |



| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | NOD-SE-03_ 0.00-0.10 m | | | GW | Medium to coarse GRAVEL; overall brown colour; well graded. Loosely packed; gravel is rounded to sub-rounded mixed colours (orange, white, green, dark grey). |
| 0.2 | | | NOD-SE-03_ 0.10-0.50 m | | | SW | Gravelly fine to coarse SAND; dark grey; gap grading. Tightly packed; gravels are fine to coarse, rounded to sub-rounded, predominantly white quartzite; organic odours. |
| 0.4<br>0.6<br>0.8 | | | NOD-SE-03_ 0.50-1.00 m | | | SWG | Gravelly fine to coarse SAND; light grey; gap grading. Tightly packed; gravels are fine to coarse, rounded to sub-rounded, predominantly white quartzite |
| | | | | | | SP | Medium SAND; light grey; uniform grading. Loosely packed. |
| | | | | | | SW | Gravelly fine to coarse SAND; light grey; gap grading. Tightly packed; gravels are fine to coarse, rounded to sub-rounded, predominantly white quartzite |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

| | | | | | |
|---|---|---|---|---|---|
| ▨ Concrete | ▨ Cuttings | ▨ Grout | ■ Bentonite | ⛬ Sand | ○ Gravel |

# Drilling Log
# Soil Bore ID: NOD-SE-04

Page 1 of 1

Comments
Tiwai Point - North Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 03-Feb-23 | Date Finished: 03-Feb-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1246202.7 | Northing (m): 4830858.8 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |

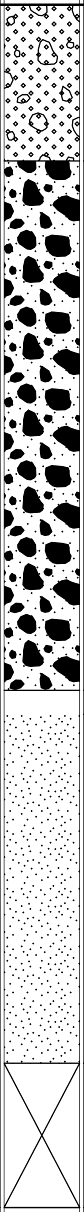
| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | NOD-SE-04_ 0.00-0.10 m | | ∴ | SW | Medium to coarse SAND with some gravel; light brownish grey; gap graded. Loosely packed; gravel is rounded to sub-rounded predominantly quartzite (white). |
| | | | NOD-SE-04_ 0.10-0.50 m | | | | |
| 0.2 | | | | | | | |
| | | | | | ∴ | SW | Medium to coarse SAND with trace gravel; medium grey; uniform grading. Loosely packed. |
| | | | | | ● | GW | Sandy fine to coarse GRAVEL; light grey; gap graded. Loosely packed; gravels are rounded with some sub-rounded, predominantly white quartzite. |
| 0.4 | | | | | | | |
| | | | NOD-SE-04_ 0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| | | | | | ☒ | | Core loss. |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

| | | | | | |
|---|---|---|---|---|---|
| ▨ Concrete | ▦ Cuttings | ▧ Grout | ■ Bentonite | ∴ Sand | ○ Gravel |

# Drilling Log
# Soil Bore ID: NOD-SE-05

Comments
Tiwai Point - North Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 03-Feb-23 | Date Finished: 03-Feb-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1246202.7 | Northing (m): 4830883.8 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |



| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | NOD-SE-05_ 0.00-0.10 m | | | SW | Gravelly fine to coarse SAND; grey; gap graded. Loosely packed; gravel is rounded to sub-rounded, predominantly quartzite (white). |
| | | | NOD-SE-05_ 0.10-0.50 m | | | SW | Colour change to dark grey |
| | | | | | | GWS | Sandy fine to coarse GRAVEL; dark grey; gap graded. Loosely packed; gravels are rounded with some sub-rounded, predominantly white quartzite with some green and grey clasts. |
| 0.2 | | | | | | | |
| | | | | | | GWS | Colour change to medium grey |
| 0.4 | | | | | | | |
| | | | NOD-SE-05_ 0.50-1.00 m | | | | |
| | | | | | | SP | Becomes gravelly |
| 0.6 | | | | | | SP | Medium to coarse SAND with trace gravel; medium grey; generally uniform grading. Loosely packed; gravels are rounded with some sub-rounded, predominantly white quartzite with some green and grey clasts. |
| 0.8 | | | | | | | |
| | | | | | | | Core Loss. |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▨ Concrete ▦ Cuttings ▧ Grout ■ Bentonite ⬚ Sand ⬚ Gravel

EHS Support

# Drilling Log
## Soil Bore ID: SOD-SE-01

Page 1 of 1

Comments
Tiwai Point - South Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | | Client: Environment Southland | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 26-Jan-23 | Date Finished: 26-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245555.6 | Northing (m): 4829799.6 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: CC | Driller's License: N/A | Logged By: CC | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | SOD-SE-01_ 0.00-0.10 m | | | GP | Sandy fine GRAVEL with some medium gravel; light brownish grey; gap graded. Gravels are well rounded and predominantly quartzite. |
| | | | SOD-SE-01_ 0.10-0.50 m | | | | |
| 0.2 | | | | | | GP | Sandy fine GRAVEL with minor medium; light greenish grey; gap graded. Gravel is predominantly well rounded quartzite and dacite. |
| 0.4 | | | | | | | |
| | | | SOD-SE-01_ 0.50-1.00 m | | | GP | Sandy fine to medium GRAVEL; brown; gap graded. Gravel is predominantly well rounded quartzite and dacite. |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

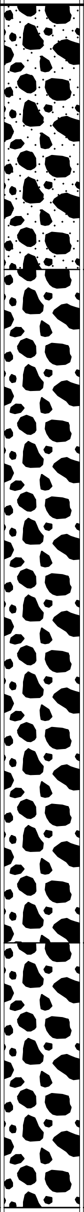
▩ Concrete ▦ Cuttings ▧ Grout ■ Bentonite ⬚ Sand ○ Gravel

EHS Support

# Drilling Log
# Soil Bore ID: SOD-SE-02

Comments
Tiwai Point - South Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 26-Jan-23 | Date Finished: 26-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245555.1 | Northing (m): 4829817.0 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | SOD-SE-02_ 0.00-0.10 m | |  | GW | Sandy fine to coarse GRAVEL ; trace of shell; reddish brown; gap graded. Gravel is sub-rounded to rounded, predominantly white quartzite with some green gravels. |
| | | | SOD-SE-02_ 0.10-0.50 m | | | GW | Colour change to dark brown. |
| 0.2 | | | | | | GW | Fine to coarse GRAVEL with some sand and trace silt orange/brown; gap graded |
| 0.4 | | | | | | GW | gravels to 110 mm with predominantly coarse gravels. |
| | | | SOD-SE-02_ 0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| 0.8 | | | | | | GW | Fine to medium GRAVEL with some sand; grey/brown; gap graded. Gravel is predominantly well rounded quartzite and dacite. |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▨ Concrete ▨ Cuttings ▨ Grout ■ Bentonite ▨ Sand ▨ Gravel

# Drilling Log
# Soil Bore ID: SOD-SE-03

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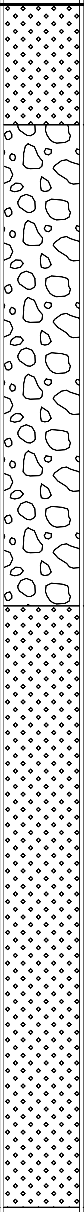
Comments
Tiwai Point - South Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | | Client: Environment Southland | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 25-Jan-23 | Date Finished: 25-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245553.2 | Northing (m): 4829831.5 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: MG | Driller's License: N/A | Logged By: MG | Checked By: GJS |



| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | SOD-SE-03_ 0.00-0.10 m | | | SW | Fine SAND with some coarse sand and minor gravels; brownish grey; well graded. Gravels are well rounded; sand grains quartz, micas and dark/black grains. |
| | | | SOD-SE-03_ 0.10-0.50 m | | | GP | Fine GRAVEL with minor sand; brownish grey; gap graded and fining with depth. Gravel is predominantly well rounded quartzite. |
| 0.2 | | | | | | | |
| 0.4 | | | | | | | |
| | | | | | | GP | Colour change to grey. |
| | | | SOD-SE-03_ 0.50-1.00 m | | | SW | Fine to medium SAND with trace gravel; dark grey. Sand is subangular quartz and dark grains; gravels are fine, well rounded and dark grey in colour (dacite). |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▨ Concrete ▨ Cuttings ▨ Grout ■ Bentonite ⛆ Sand ▨ Gravel

EHS Support

# Drilling Log
# Soil Bore ID: SOD-SE-04

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Comments
Tiwai Point - South Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 25-Jan-23 | Date Finished: 25-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245538.3 | Northing (m): 4829881.5 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: CC | Driller's License: N/A | Logged By: CC | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | SOD-SE-04_ 0.00-0.10 m | | | SP | Fine SAND with trace gravel and shells; dark grey; uniform grading. Gravel is rounded; sand grains composed of quartz, micas and dark/black grains. |
| | | | SOD-SE-04_ 0.10-0.50 m | | | GW | Sandy medium to coarse GRAVEL with trace shells; well graded. |
| 0.2 | | | | | | | |
| 0.4 | | | | | | | |
| | | | SOD-SE-04_ 0.50-1.00 m | | | GW | Organic odours. |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▩ Concrete ▦ Cuttings ▨ Grout ■ Bentonite ⁘ Sand ○ Gravel

# Drilling Log
# Soil Bore ID: WLF-SE-01

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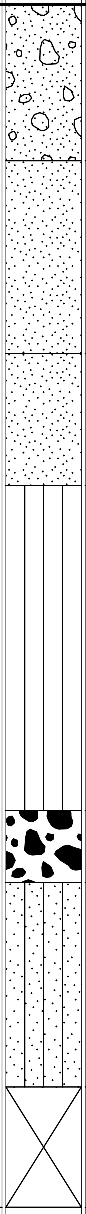
Comments
Tiwai Point - West Landfill

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 26-Jan-23 | Date Finished: 26-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245010.6 | Northing (m): 4829332.0 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: MG | Driller's License: N/A | Logged By: MG | Checked By: GJS |



| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | WLF-SE-01_<br>0.00-0.10 m | | | SP | Gravelly medium SAND; black; gap graded. Loosely packed; gravel is fine to medium; well rounded; organic odour. |
| | | | WLF-SE-01_<br>0.10-0.50 m | | | SP | Medium SAND with some gravel and shell; medium to dark grey; gap graded. Loosely packed; gravels predominantly quartzite with some green gravel. |
| 0.2 | | | | | | | |
| | | | | | | SP | Fine to medium SAND with some amorphous organics; dark brown; Fining downwards, poorly graded becoming well graded at 0.4 m. Loosely packed. |
| 0.4 | | | | | | ML-MH | SILT with some fine to medium sand and amorphous organics; dark brown; fining with depth. Soft; non-plastic. |
| | | | WLF-SE-01_<br>0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| | | | | | | GW | Fine to coarse GRAVEL with some sand; dark grey; well graded. Loosely packed; gravels are sub-rounded to rounded and predominantly quartzite with some dark green gravel; sand is fine to coarse. |
| | | | | | | ML-MH | Sandy SILT with trace fine gravel; medium grey; sand content decreasing with depth. Firm; low to moderate plasticity; sand is fine to medium; gravel is rounded quartzite. |
| 0.8 | | | | | | ML-MH | grades into SILT with some sand |
| | | | | | | | Core Loss |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▨ Concrete ▨ Cuttings ▨ Grout ■ Bentonite ⬚ Sand ⬚ Gravel

EHS Support

# Drilling Log
# Soil Bore ID: WLF-SE-02

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Comments
Tiwai Point - West Landfill

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 31-Jan-23 | Date Finished: 31-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245033.9 | Northing (m): 4829448.5 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | WLF-SE-02_ 0.00-0.10 m<br>WLF-SE-02_ 0.10-0.50 m | | | SP<br>SP | Medium SAND with some shells and trace silt; dark brownish grey; uniform grading. Loosely packed.<br>Colour change to grey. |
| 0.2 | | | | | | ML-MH | SILT; brownish grey. Soft; non-plastic with wood fragment |
| | | | | | | SP | Medium SAND with some shells and trace silt; brownish grey; uniform grading. Loosely packed. |
| | | | | | | ML-MH | SILT; brownish grey. Soft; non-plastic. |
| 0.4 | | | | | | Pt | PEAT. Fibrous and amorphous organics and SILT; dark brown. Soft. |
| 0.6<br>0.8 | | | WLF-SE-02_ 0.50-1.00 m | | | Pt | PEAT. Fibrous ORGANICS with some silt and trace amorphous organics; dark brown. Soft and Spongy; trace pieces of wood; organic odours. |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▨ Concrete ▨ Cuttings ▨ Grout ■ Bentonite ⁘ Sand ▨ Gravel

# Drilling Log
# Soil Bore ID: WLF-SE-03

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Comments
Tiwai Point - West Landfill

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 31-Jan-23 | Date Finished: 31-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245041.6 | Northing (m): 4829571.2 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | WLF-SE-03_<br>0.00-0.10 m | | ⁙ | SP | Medium to coarse SAND; orangey brown; uniform grading. Loosely packed. |
| | | | | | | SP | Colour change to dark grey. |
| | | | WLF-SE-03_<br>0.10-0.50 m | | | | |
| 0.2 | | | | | | | |
| | | | | | ⁙ | ML-MH | Sandy SILT; dark brown. Soft; non-plastic; sand is fine to medium. |
| | | | | | ● | GW | Fine to coarse GRAVEL with some sand and minor-trace silt; light/medium brown; gap graded and fining downwards. Firmly packed; gravel is rounded with some sub-rounded, predominantly quartzite |
| 0.4 | | | | | | | |
| | | | | | ⁙ | SP | Fine to medium SAND with trace gravels; dark grey-brown; uniform grading. Loosely packed; gravels are rounded and predominantly in beds at 0.65 and 0.77-0.85 m. |
| | | | WLF-SE-03_<br>0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| | | | | | ☒ | | Core Loss. |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

| | | | | | |
|---|---|---|---|---|---|
| ▨ Concrete | ▨ Cuttings | ▨ Grout | ■ Bentonite | ⁙ Sand | ▨ Gravel |

# Drilling Log
## Soil Bore ID: WOD-SE-01

Page 1 of 1

Comments
Tiwai Point - West Drain

| | |
|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland |

| | | | |
|---|---|---|---|
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 30-Jan-23 | Date Finished: 30-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245693.5 | Northing (m): 4830134.6 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | WOD-SE-01_ 0.00-0.10 m | | | GW<br>GW | Water is 'tea coloured'.<br>Fine to coarse GRAVEL with some sand; light grey and orangey brown; gap graded. Loosely packed; wet; Gravel is rounded, largely unweathered to slightly weathered granodiorite and dacite; sand is medium to coarse<br>Colour black (staining). |
| | | | WOD-SE-01_ 0.10-0.50 m | | | | |
| | | | | | | GW | Becomes grey. |
| 0.2 | | | | | | | |
| | | | | | | GW | Sand content increases between 0.3 and 0.6 m |
| 0.4 | | | | | | | |
| | | | WOD-SE-01_ 0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▨ Concrete ▦ Cuttings ▧ Grout ■ Bentonite ⬚ Sand ▢ Gravel

# Drilling Log
# Soil Bore ID: WOD-SE-02

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Comments
Tiwai Point - West Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 31-Jan-23 | Date Finished: 31-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245667.8 | Northing (m): 4830131.7 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | WOD-SE-02_ 0.00-0.10 m | | | GW | Fine to coarse GRAVEL with some sand; light grey with dark grey staining; gap graded. Loosely packed; wet; gravel is sub-rounded to rounded, predominantly white quartzite with some unweathered to slightly weathered granodiorite and dacite with occasional schist; sand is medium |
| | | | WOD-SE-02_ 0.10-0.50 m | | | GW | Light grey to medium grey. |
| 0.2 | | | | | | | |
| | | | | | | GW | Sand content increases between 0.3 and 0.6 m |
| 0.4 | | | | | | | |
| | | | WOD-SE-02_ 0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▩ Concrete ▦ Cuttings ▨ Grout ■ Bentonite ⁘ Sand ○ Gravel

# Drilling Log
# Soil Bore ID: WOD-SE-03

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Comments
Tiwai Point - West Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 31-Jan-23 | Date Finished: 31-Jan-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245644.0 | Northing (m): 4830130.1 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |

| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | WOD-SE-03_ 0.00-0.10 m | | | GW | Sandy fine to coarse GRAVEL; medium grey with dark grey staining; gap graded. Loosely packed; wet; gravel is sub-rounded to rounded, predominantly white quartzite with some unweathered to slightly weathered granodiorite and dacite with occasional schist; sand is medium to coarse |
| | | | WOD-SE-03_ 0.10-0.50 m | | | | |
| | | | | | | GW | Medium grey. |
| 0.2 | | | | | | | |
| | | | | | | GW | Sand content increases between 0.3 and 0.6 m |
| 0.4 | | | | | | | |
| | | | WOD-SE-03_ 0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

▨ Concrete ▨ Cuttings ▨ Grout ■ Bentonite ▨ Sand ▨ Gravel

# Drilling Log
# Soil Bore ID: WOD-SE-75m

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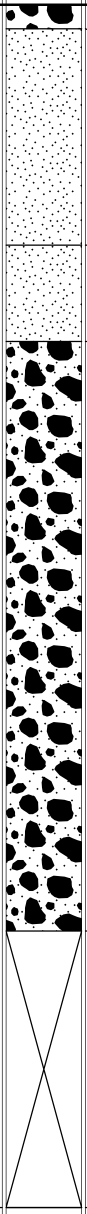
Comments
Tiwai Point - West Drain

| | | | |
|---|---|---|---|
| Project: Tiwai Point Coastal Marine Area Investigation | Client: Environment Southland | | |
| Location: Tiwai Point, New Zealand | | Project No.: NZL.00445 | |
| Date Started: 01-Feb-23 | Date Finished: 01-Feb-23 | Total Depth (mbgs): 1.00 | |
| Ground Surface (m NZVD): N/A | Top Casing (m NZVD): N/A | Easting (m): 1245622.0 | Northing (m): 4830130.4 |
| Hole Dia. (mm): 100 | Water Level Initial (mbgs): N/A | Water Level Static (mbgs): N/A | Coord. System: NZTM2000 |
| Concrete Coring (Y/N): N | NDD (mbgs): N/A | Headworks: N/A | Headworks height (mm): N/A |
| Screen Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Casing Dia. (mm): N/A | Length (m): N/A | Type/Size (mm): N/A | |
| Drilling Co.: EHS Support | Drill Rig: AMS Redi-driver | Method: AMS Core | Bore Permit #: N/A |
| Drilled By: GJS | Driller's License: N/A | Logged By: GJS | Checked By: GJS |



| Depth (m) | Well Completion | PID (ppm) | Sample Collected | % Recovery | Graphic Log | USCS Classification | Material Description |
|---|---|---|---|---|---|---|---|
| | | | BAB-SE-75m_ 0.00-0.10 m | | | GW | Fine to coarse GRAVEL; medium grey; Well graded. Loosely packed; wet; Gravel is sub-rounded to rounded, predominantly white quartzite. |
| | | | | | | SP | Fine to medium SAND with trace gravels; black; uniform grading. Loosely packed. |
| | | | BAB-SE-75m_ 0.10-0.50 m | | | SP | Becomes dark grey. |
| 0.2 | | | | | | SP | Fine to medium SAND with some shells and trace gravels; dark grey-brown; uniform grading. Loosely packed. |
| | | | | | | GW | Sandy fine to coarse GRAVEL with trace shells; dark grey; gap graded. Loosely packed; gravel is sub-rounded to rounded, predominantly white quartzite, dacite and some gree, black and orange; sand is medium to coarse. |
| 0.4 | | | | | | GW | Colour change to medium grey. |
| | | | | | | GW | Orangey brown colour for 20 mm. |
| | | | BAB-SE-75m_ 0.50-1.00 m | | | | |
| 0.6 | | | | | | | |
| 0.8 | | | | | | | Core Loss. |
| 1.0 | | | | 1.00 m | | | Hole Terminated at 1.00 m<br>Target depth reached |

| | | | | | |
|---|---|---|---|---|---|
| ▨ Concrete | ▦ Cuttings | ▧ Grout | ■ Bentonite | ⁘ Sand | ○ Gravel |

# Appendix G Surface Water and Pore Water Field Form

RMC Troutdale
October 2022 Sampling Campaign

| Sample ID | Sample_Time_ID | Sample_Time | Date | Start Time | End Time | Notes | Water_Depth_m | Temp_C | SPC_uScm | TDS_ppt | pH_SU | ORP_mV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SOD-WP-0m | 900 | 900 | 26/01/2023 | 26/01/2023 7:20 | 26/01/2023 9:00 | Pre-sampling | 0.1 | 16.4 | 55.61 | 66.94 | 7.11 | 233 |
| SOD-WP-0m | 900 | 900 | 26/01/2023 | 26/01/2023 7:20 | 26/01/2023 9:00 | Post-sampling | 0.1 | 16.4 | 53.43 | 63.18 | 7.14 | 232 |
| SOD-WS-0m-TWC | 900 | 900 | 26/01/2023 | 26/01/2023 7:20 | 26/01/2023 9:00 | 100mm water | 0.1 | 16.2 | 50.44 | 58.54 | 7.73 | 246 |
| SOD-WS-25m-TWC | 900 | 900 | 26/01/2023 | 26/01/2023 7:20 | 26/01/2023 9:00 | Top of water column | 0.3 | 16.5 | 50.5 | 58.22 | 8.06 | 216 |
| SOD-WS-25m-BWC | 900 | 900 | 26/01/2023 | 26/01/2023 7:20 | 26/01/2023 9:00 | Bottom of water colum | 0.3 | 16.7 | 50.37 | 57.93 | 8.05 | 214 |
| SOD-WP-25m | 900 | 900 | 26/01/2023 | 26/01/2023 7:20 | 26/01/2023 9:00 | Pre-sampling | 0.3 | 16.5 | 53.42 | 63.19 | 7.37 | -64 |
| SOD-WP-25m | 900 | 900 | 26/01/2023 | 26/01/2023 7:20 | 26/01/2023 9:00 | Post-sampling | 0.3 | 16.6 | 51.22 | 59.27 | 7.32 | -37 |
| SOD-WS-50m-TWC | 830 | 830 | 25/01/2023 | 25/01/2023 8:30 | 25/01/2023 8:30 | Top of water column | 0.25 | 15.2 | 49.77 | 56.8 | 8 | 230 |
| SOD-WS-50m-BWC | 835 | 835 | 25/01/2023 | 25/01/2023 8:35 | 25/01/2023 8:35 | Bottom of water colum | 0.25 | 15.8 | 49.72 | 56.55 | 8.03 | 245 |
| SOD-WP-50m | 840 | -- | 25/01/2023 | 25/01/2023 8:20 | 25/01/2023 8:40 | Pre-sampling | 0.25 | 15.3 | 51.77 | 59.72 | 7.36 | 95 |
| SOD-WP-50m | 830 | 840 | 25/01/2023 | 25/01/2023 8:40 | 25/01/2023 8:40 | Post-sampling | 0.25 | 15.6 | 51.39 | 59.12 | 7.35 | 54 |
| SOD-TWC-100 | 900 | 900 | 25/01/2023 |  |  | Top of water column | 0.4 | 15.4 | 51.02 | 58.55 | 8.04 | 194 |
| SOD-BWC-100 | 900 | 900 | 25/01/2023 |  |  | Bottom of water colum | 0.4 | 15.9 | 50.83 | 58.14 | 7.42 | 94 |
| SOD-WP-100m | 900 | 900 | 25/01/2023 |  |  | Pre-sampling | 0.4 | 15.6 | 50.6 | 57.91 | 7.66 | -176 |
| SOD-WP-100m | 900 | 900 | 25/01/2023 |  |  | Post-sampling | 0.4 | 15.5 | 50.73 | 58.21 | 7.58 | -146 |
| SOD-SEEP-hole1 | 915 | 915 | 25/01/2023 |  |  | Reading 1 - Multiple groundwater seeps north of South Drain. Samples collected SOD-SEEP-01 and SOD-SEEP-02 | N/A | 13.1 | 741 | 524.8 | 7.37 | 97 |
| SOD-SEEP-hole1 | 915 | 915 | 25/01/2023 |  |  | Reading 2 - Multiple groundwater seeps north of South Drain. Samples collected SOD-SEEP-01 and SOD-SEEP-02 | N/A | 13 | 2153 | 1615 | 7.2 | 128 |
| SOD-SEEP-hole2 | 915 | 915 | 25/01/2023 |  |  | Multiple groundwater seeps north of South Drain. Samples collected SOD-SEEP-01 and SOD-SEEP-02 | N/A | 12.7 | 591.6 | 417.2 | 7.21 | 127 |
| SOD-SEEP-hole3 | 915 | 915 | 25/01/2023 |  |  | Multiple groundwater seeps north of South Drain. Samples collected SOD-SEEP-01 and SOD-SEEP-02 | N/A | 12.5 | 619 | 133 | 7.22 | 128 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NOD-WP-0m | 1050 | 1050 | 29/01/2023 | 29/01/2023 10:50 | 29/01/2023 12:17 | Pre-sampling | 0.7 | 19.7 | 48.46 | 54.13 | 7.11 | -289 |
| NOD-WP-0m | 1217 | 1217 | 29/01/2023 | 29/01/2023 10:50 | 29/01/2023 12:17 | Post-sampling | 0.6 | 23.3 | 45.49 | 49.42 | 7.18 | -284 |
| NOD-WS-0m-TWC | 1050 | 1050 | 29/01/2023 | 29/01/2023 10:50 | 29/01/2023 12:17 | Top of water column | 0.7 | 17 | 49.48 | 55.96 | 7.82 | 251 |
| NOD SW 0m BWC | 1054 | 1054 | 29/01/2023 | 29/01/2023 10:54 | 29/01/2023 10:54 | Bottom of water colum | 0.7 | 17.4 | 49.58 | 55.97 | 7.86 | -60 |
| NOD-WP-25m | 1133 | 1143 | 29/01/2023 | 29/01/2023 11:33 | 29/01/2023 11:43 | Pre-sampling | 0.5 | 19.7 | 48.22 | 53.62 | 7.17 | -277 |
| NOD-WP-25m | 1133 | 1143 | 29/01/2023 | 29/01/2023 11:33 | 29/01/2023 11:43 | Post-sampling | 0.5 | 21.8 | 46.14 | 50.18 | 7.17 | -298 |
| NOD-WS-25m-TWC | 1113 | 1113 | 29/01/2023 | 29/01/2023 11:13 | 29/01/2023 11:13 | Top of water column | 0.5 | 18.6 | 48.5 | 54.26 | 7.84 | 21 |
| NOD SW 25m BWC | 1120 | 1120 | 29/01/2023 | 29/01/2023 11:20 | 29/01/2023 11:20 | Bottom of water colum | 0.5 | 18 | 49.3 | 55.37 | 7.86 | 42 |
| NOD-WP-50m | 1232 | 1232 | 31/01/2023 | 31/01/2023 12:32 | 31/01/2023 12:51 | Pre-sampling | 0.5 | 20.4 | 56.49 | 65.77 | 7.4 | -241 |
| NOD-WP-50m | 1251 | 1251 | 31/01/2023 | 31/01/2023 12:32 | 31/01/2023 12:51 | Post-sampling | 0.5 | 21 | 55.29 | 63.62 | 7.41 | -230 |
| NOD-WS-50m-TWC | 1227 | 1227 | 31/01/2023 | 31/01/2023 12:27 | 31/01/2023 12:27 | Top of water column | 0.5 | 20.2 | 51.02 | 56.86 | 8.05 | 213 |
| NOD SW 50m BWC | 1239 | 1239 | 31/01/2023 | 31/01/2023 12:39 | 31/01/2023 12:39 | Bottom of water colum | 0.5 | 21.8 | 50.12 | 55.66 | 8.01 | 86 |
| NOD-WG-03 | 730 | 730 | 3/02/2023 | 3/02/2023 19:30 | 3/02/2023 19:30 | Pre - Tide out | 0 | 19.9 | 49.43 | 54.87 | 7.21 | 276 |
| NOD-WG-03 | 730 | 730 | 3/02/2023 | 3/02/2023 19:30 | 3/02/2023 19:30 | Post - Tide out 1 | 0 | 19.8 | 49.75 | 59.87 | 7.58 | 265 |
| NOD-WP-100m | 1240 | 1240 | 29/01/2023 | 29/01/2023 12:40 | 29/01/2023 13:00:00 pm | Pre-sampling | 0.5 | 19.5 | 59.01 | 41.71 | 7.93 | -210 |
| NOD-WP-100m | 1300 | 1300 | 29/01/2023 | 29/01/2023 12:40 | 29/01/2023 13:00:00 pm | Post-sampling | 0.5 | 19.8 | 41.53 | 44.6 | 7.4 | -208 |
| NOD SW 100m TWC | 1241 | 1241 | 29/01/2023 | 29/01/2023 11:13 | 29/01/2023 11:13 | Top of water column | 0.5 | 22.2 | 50.07 | 55.33 | 7.94 | 56 |
| NOD SW 100m BWC | 1250 | 1250 | 29/01/2023 | 29/01/2023 11:20 | 29/01/2023 11:20 | Bottom of water colum | 0.5 | 21.2 | 50.1 | 56.03 | 8 | 19 |
| NOD-WG-04 | 800 | 800 | 3/02/2023 | 3/02/2023 20:00 | 3/02/2023 20:00 | Pre - Tide out probe pushed an additional 50mm deeper | 0 | notes cut off | 56.03 | 65.37 | 7.08 | -33 |
| NOD-WG-04 | 800 | 800 | 3/02/2023 | 3/02/2023 20:00 | 3/02/2023 20:00 | Post - Tide out 1 | 0 | notes cut off | 55.52 | 64.33 | 7.26 | -76 |
| NOD-WP-125m | 1325 | 1325 | 29/01/2023 | 29/01/2023 13:25 | 29/01/2023 13:40 | Pre-sampling | 0.5 | 19.9 | 45.23 | 49.65 | 7.23 | -128 |
| NOD-WP-125m | 1340 | 1340 | 29/01/2023 | 29/01/2023 13:25 | 29/01/2023 13:40 | Post-sampling | 0.5 | 20 | 44.18 | 48.07 | 7.24 | -88 |
| NOD SW 125m TWC | 1315 | 1315 | 29/01/2023 | 29/01/2023 13:15 | 29/01/2023 13:15 | Top of water column | 0.5 | 21.2 | 50.34 | 56.36 | 8.02 | -4 |
| NOD SW 125m BWC | 1310 | 1310 | 29/01/2023 | 29/01/2023 13:10 | 29/01/2023 13:10 | Bottom of water column | 0.5 | 19.9 | 50.34 | 56.42 | 8.01 | -15 |
| NOD-125m bottom | 1800 | 1800 | 2/02/2023 | 2/02/2023 18:00 | 2/02/2023 18:00 | Post heavy rainfall event: Bottom of water column test at 125m mark during stormwater discharge event into harbour from NOD | 0.3 | 20.9 | 50.3 | 55.41 | 8.11 | 117 |
| NOD-125m top | 1800 | 1800 | 2/02/2023 | 2/02/2023 18:00 | 2/02/2023 18:00 | Post heavy rainfall event: Top of water column test at 125m mark during stormwater discharge event into harbour from NOD | 0.3 | 21.6 | 32.53 | 33.25 | 6.55 | 129 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Environment Southland Stormwater 1 | 1801 | 1801 | 2/02/2023 | 2/02/2023 18:01 | 2/02/2023 18:01 | Post heavy rainfall event: Water test within the stormwater discharged into the harbour from NOD | 0.2 | 22.5 | 14.14 | 12.57 | 6.34 | 149 |
| Environment Southland Stormwater 1 | 1803 | 1803 | 2/02/2023 | 2/02/2023 18:03 | 2/02/2023 18:03 | Post heavy rainfall event: Water test in seawater 2.0m east of stormwater being discharged into harbour from NOD | 0.2 | 21 | 48.69 | 55.5 | 8.05 | 130 |
| Environment Southland Stormwater Sample | 1734 | 1734 | 2/02/2023 | 2/02/2023 17:34 | 2/02/2023 17:34 | Water sample collected from weir structure in NOD | | 23.4 | 401.6 | 270.4 | 5.88 | 166 |
| WLF-WP-01 | 900 | 900 | 26/01/2023 | 26/01/2023 9:00 | 26/01/2023 9:40 | Pre-sampling | 0.3 | 17.4 | 46.12 | 51.67 | 7.4 | -222 |
| WLF-WP-01 | 900 | 900 | 26/01/2023 | 26/01/2023 9:00 | 26/01/2023 9:40 | Post-sampling | 0.3 | 17 | 48.34 | 54.9 | 7.5 | -216 |
| WLF-SW-01-TWC | 900 | 900 | 26/01/2023 | 26/01/2023 9:00 | 26/01/2023 9:40 | Top of water column | 0.3 | 17.5 | 49.8 | 57.04 | 8.04 | 160 |
| WLF-WS-01-BWC | 900 | 900 | 26/01/2023 | 26/01/2023 9:00 | 26/01/2023 9:40 | Bottom of water colum | 0.3 | 17 | 50.04 | 57.43 | 8.04 | -35 |
| WLF-WP-02 | 1220 | 1236 | 30/01/2023 | 30/01/2023 12:20 | 30/01/2023 12:36 | Pre-sampling | 0.6 | 18.3 | 50.18 | 56.57 | 7.43 | -184 |
| WLF-WP-02 | 1220 | 1236 | 30/01/2023 | 30/01/2023 12:20 | 30/01/2023 12:36 | Post-sampling | 0.6 | 18.3 | 49.97 | 56.32 | 7.52 | -200 |
| WLF-SW-02-TWC | 1234 | 1234 | 30/01/2023 | 30/01/2023 12:34 | 30/01/2023 12:34 | Top of water column | 0.6 | 18.1 | 51.05 | 57.93 | 8.06 | 119 |
| WLF-WS-02-BWC | 1225 | 1225 | 30/01/2023 | 30/01/2023 12:25 | 30/01/2023 12:25 | Bottom of water colum | 0.6 | 18.1 | 51.01 | 57.92 | 8.05 | 14 |
| WLF-WP-03 | 1256 | 1309 | 30/01/2023 | 30/01/2023 12:56 | 30/01/2023 13:09 | Pre-sampling | 0.4 | 18.6 | 50.96 | 57.91 | 7.65 | -111 |
| WLF-WP-03 | 1256 | 1309 | 30/01/2023 | 30/01/2023 12:56 | 30/01/2023 13:09 | Post-sampling | 0.4 | 18.8 | 50.43 | 56.95 | 7.7 | -87 |
| WLF-SW-03-TWC | 1308 | 1308 | 30/01/2023 | 30/01/2023 13:08 | 30/01/2023 13:08 | Top of water column | 0.4 | 18.6 | 51.03 | 57.81 | 8.08 | 92 |
| WLF-WS-03-BWC | 1251 | 1251 | 30/01/2023 | 30/01/2023 12:51 | 30/01/2023 12:51 | Bottom of water colum | 0.4 | 16.7 | 50.98 | 57.74 | 8.06 | -55 |
| ELF-WP-01 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Pre-sampling | | 15 | 51.15 | 58.75 | 8.05 | 269 |
| ELF-WP-01 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Post-sampling | | 15.2 | 51.28 | 59.1 | 8.04 | 307 |
| ELF-WS-01 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Water column sample | | 15.5 | 51.3 | 58.97 | 8.09 | 245 |
| ELF-WP-02 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Pre-sampling | | 15 | 49.37 | 55.81 | 8.08 | 243 |
| ELF-WP-02 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Post-sampling | | 15.5 | 50.9 | 58.33 | 8.09 | 292 |
| ELF-WS-02 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Water column sample | | 14.9 | 51.43 | 59.28 | 8.09 | 221 |
| ELF-WP-03 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Pre-sampling | | 15.2 | 50.79 | 58.14 | 7.95 | 300 |
| ELF-WP-03 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Post-sampling | | 15 | 50.95 | 58.68 | 7.97 | 250 |
| ELF-WS-03 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Water column sample | | 15.7 | 50.62 | 57.78 | 7.61 | 295 |
| ISA-WP-02 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Pre-sampling | | 15.9 | 50.98 | 58.48 | 8.02 | 235 |
| ISA-WP-02 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Post-sampling | | 16 | 50.86 | 58.11 | 8.03 | 293 |
| ISA-WS-02 | 715 | 715 | 24/01/2023 | 24/01/2023 7:15 | 24/01/2023 7:15 | Water column sample | | 15.9 | 51.28 | 58.66 | 8.05 | 204 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WOD-WP-01 | 906 | 906 | 27/01/2023 | 27/01/2023 9:06 | 27/01/2023 9:30 | Pre-sampling | 0.6 | 16.4 | 35.77 | 37.48 | 7.38 | -93 |
| WOD-WP-01 | 906 | 906 | 27/01/2023 | 27/01/2023 9:06 | 27/01/2023 9:30 | Post-sampling | 0.6 | 16 | 32.06 | 32.85 | 7.43 | -104 |
| WOD-WS-01-TWC | 906 | 906 | 27/01/2023 | 27/01/2023 9:06 | 27/01/2023 9:30 | Top of water column (raining during sampling with stormwater discharge) | 0.6 | 16 | 32.05 | 32.98 | 6.99 | 208 |
| WOD-WS-01-BWC | 906 | 906 | 27/01/2023 | 27/01/2023 9:06 | 27/01/2023 9:30 | Bottom of water column (raining during sampling with stormwater discharge) | 0.6 | 16.1 | 40.25 | 43.05 | 7.89 | 69 |
| WOD-WP-02 | 930 | 930 | 27/01/2023 | 27/01/2023 9:30 | 27/01/2023 10:00 | Pre-sampling | 0.8 | 15.9 | 52.85 | 60.22 | 7.43 | -46 |
| WOD-WP-02 | 930 | 930 | 27/01/2023 | 27/01/2023 9:30 | 27/01/2023 10:00 | Post-sampling | 0.8 | 15.8 | 78.87 | 54.37 | 7.46 | 4 |
| WOD-WS-02-TWC | 930 | 930 | 27/01/2023 | 27/01/2023 9:30 | 27/01/2023 10:00 | Top of water column (raining during sampling with stormwater discharge) | 0.8 | 16.2 | 39.78 | 42.44 | 7.9 | 79 |
| WOD-WS-02-BWC | 930 | 930 | 27/01/2023 | 27/01/2023 9:30 | 27/01/2023 10:00 | Bottom of water column (raining during sampling with stormwater discharge) | 0.8 | 16.3 | 46.14 | 50.46 | 8.01 | 99 |
| WOD-WG-02 | 1815 | 1815 | 1/02/2023 | 1/02/2023 18:15 | 1/02/2023 18:15 | Pre - Tide out | 0 | 22 | 16.92 | 15.37 | 7.76 | -131 |
| WOD-WG-02 | 1815 | 1815 | 1/02/2023 | 1/02/2023 18:15 | 1/02/2023 18:15 | Post - Tide out 1 | 0 | 21.2 | 26.42 | 26.05 | 7.78 | -134 |
| WOD-WG-02 | 1815 | 1815 | 1/02/2023 | 1/02/2023 18:15 | 1/02/2023 18:15 | Post - Tide out 2 | 0 | 21.2 | 32.21 | 32.84 | 7.84 | -140 |
| WOD-WP-03 | 1000 | 1000 | 27/01/2023 | 27/01/2023 10:00 | 27/01/2023 10:30 | Pre-sampling | 0.4 | 16.4 | 30.33 | 30.65 | 6.56 | -27 |
| WOD-WP-03 | 1000 | 1000 | 27/01/2023 | 27/01/2023 10:00 | 27/01/2023 10:30 | Post-sampling | 0.4 | 16.3 | 33.01 | 34.01 | 6.6 | -51 |
| WOD-WS-03-TWC | 1000 | 1000 | 27/01/2023 | 27/01/2023 10:00 | 27/01/2023 10:30 | Top of water column (raining during sampling with stormwater discharge) | 0.4 | 16.7 | 50.55 | 56.92 | 7.98 | 23 |
| WOD-WS-03-BWC | 1000 | 1000 | 27/01/2023 | 27/01/2023 10:00 | 27/01/2023 10:30 | Bottom of water column (raining during sampling with stormwater discharge) | 0.4 | 16.3 | 50.84 | 57.16 | 8 | 60 |
| WOD-WG-03 | 1840 | 1840 | 1/02/2023 | 1/02/2023 18:40 | 1/02/2023 18:40 | Pre - Tide out | 0 | 20.2 | 17.66 | 16.25 | 6.63 | -20 |
| WOD-WG-03 | 1840 | 1840 | 1/02/2023 | 1/02/2023 18:40 | 1/02/2023 18:40 | Post - Tide out 1 | 0 | 19.8 | 19.53 | 18.3 | 6.67 | -37 |
| WOD-WP-04 | 1109 | 1109 | 27/01/2023 | 27/01/2023 11:09 | 27/01/2023 11:23 | Pre-sampling | 1.2 | 17 | 43.88 | 47.62 | 7.56 | -103 |
| WOD-WP-04 | 1123 | 1123 | 27/01/2023 | 27/01/2023 11:09 | 27/01/2023 11:23 | Post-sampling | 1.2 | 17.1 | 47.1 | 51.64 | 7.57 | -90 |
| WOD-WS-04-TWC | 1102 | 1102 | 27/01/2023 | 27/01/2023 11:02 | 27/01/2023 11:02 | Top of water column (raining during sampling with stormwater discharge) | 1.2 | 16.9 | 50.93 | 57.08 | 7.94 | 101 |
| WOD-WS-04-BWC | 1102 | 1102 | 27/01/2023 | 27/01/2023 11:02 | 27/01/2023 11:02 | Bottom of water column (raining during sampling with stormwater discharge) | 1.2 | 16.7 | 50.67 | 56.82 | 7.9 | 130 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BAB-WP-01 | 1928 | 1928 | 23/01/2023 | 23/01/2023 19:28 | 23/01/2023 19:28 | Pre-sampling | | 15.8 | 44.49 | 48.15 | 6.8 | -49 |
| BAB-WP-01 | 1940 | 1940 | 23/01/2023 | 23/01/2023 19:40 | 23/01/2023 19:40 | Post-sampling | | - | 48.45 | 53.16 | 6.63 | -54 |
| BAB-WS-01-TWC | 1922 | 1922 | 23/01/2023 | 23/01/2023 19:22 | 23/01/2023 19:22 | Top of water column | | 16.9 | 54.79 | 62.53 | 8.27 | -2 |
| BAB-WS-01-BWC | 1927 | 1927 | 23/01/2023 | 23/01/2023 19:27 | 23/01/2023 19:27 | Bottom of water colum | | 16.2 | 54.96 | 63.3 | 8.36 | 57 |
| BAB-WP-03 | 2014 | 2014 | 23/01/2023 | 23/01/2023 20:14 | 23/01/2023 20:14 | Pre-sampling | | 15.7 | 42.69 | 45.78 | 6.95 | -50 |
| BAB-WP-03 | 2020 | 2020 | 23/01/2023 | 23/01/2023 20:20 | 23/01/2023 20:20 | Post-sampling | | 16 | 46.43 | 50.43 | 6.86 | -91 |
| BAB-WS-03-BWC | 1955 | 1955 | 23/01/2023 | 23/01/2023 19:55 | 23/01/2023 19:55 | Top of water column | | 17 | 54.8 | 62.78 | 8.35 | 38 |
| BAB-WS-03-TWC | 2000 | 2000 | 23/01/2023 | 23/01/2023 20:00 | 23/01/2023 20:00 | Bottom of water colum | | 16.6 | 55 | 62.87 | 8.37 | 17.1 |
| BFS-WS-01 | 1130 | 1130 | 22/01/2023 | 22/01/2023 11:30 | 22/01/2023 11:30 | Surface Water | | 17.7 | 50.04 | 55.09 | 7.93 | 260 |
| BFS-WP-01 | 1130 | 1130 | 22/01/2023 | 22/01/2023 11:30 | 22/01/2023 11:30 | Pore Water | | 16.8 | 51.84 | 58.02 | 7.39 | 227 |
| BFS-WS-02 | 1206 | 1206 | 22/01/2023 | 22/01/2023 12:06 | 22/01/2023 12:07 | Water column sample | | 17.6 | 50.04 | 55.09 | 7.93 | 264 |
| BFS-WP-02 | 1228 | 1228 | 22/01/2023 | 22/01/2023 12:28 | 22/01/2023 12:28 | Pre-sampling | | 16.8 | 51.77 | 58.02 | 7.39 | 227 |
| BFS-WP-02 | 1241 | 1241 | 22/01/2023 | 22/01/2023 12:41 | 22/01/2023 12:41 | Post-sampling | | 16.7 | 51.51 | 57.55 | 7.57 | 217 |
| BFS-WS-03 | 1130 | 1130 | 22/01/2023 | 22/01/2023 11:30 | 22/01/2023 13:45 | Surface Water | | 16.6 | 51.51 | 57.55 | 7.57 | 217 |
| BFS-WP-03 | 1130 | 1130 | 22/01/2023 | 22/01/2023 11:30 | 22/01/2023 13:45 | Pore Water | | 16.7 | 51.66 | 57.85 | 7.74 | 216 |

# Appendix H CMA Results – Detailed Evaluation

# Table H-1
# Soil Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | Location ID | BAB-SO-01 | | BAB-SO-02 | | BAB-SO-03 | | BFS-SO-01 | | BFS-SO-02 | | BFS-SO-03 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | BAB-SO-01 | | BAB-SO-02 | | BAB-SO-03 | | BFS-SO-01 | | BFS-SO-02 | | BFS-SO-03 | |
| | | | Matrix | SO | | SO | | SO | | SO | | SO | | SO | |
| | | | Sample Date | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 | | 22 Jan 2023 | | 22 Jan 2023 | | 22 Jan 2023 | |
| | | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | µS/cm | 160 | | 110 | | 92 | | 67 | | 88 | | 74 | |
| Cyanide | 57-12-5 | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Fluoride | 16984-48-8 | **165** | mg/kg | < 100 | U | < 100 | U | < 100 | U | **260** | | < 100 | U | < 100 | U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | < 0.1 | U | < 0.1 | U | 3.1 | | 1.3 | | 1 | | 0.3 | |
| High Molecular Weight PAHs | PAHs_highMW | **3.7** | mg/kg | 1.22 | | 2.43 | | 0.57 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Low Molecular Weight PAHs | PAHS_lowMW | **1.4** | mg/kg | 0.04 | | 0.05 | | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 17 | | 23 | | 13 | | 1.5 | | 2.7 | | 1.6 | |
| pH | PH | | SU | 6.4 | | 6 | | 6.3 | | 7.8 | | 7.7 | | 7.6 | |
| Total Organic Carbon | TOC | | % | 11 | | 14 | | 6.2 | | 0.2 | | 1.2 | | < 0.1 | U |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 3100 | | 3000 | | 2700 | | 2000 | | 2100 | | 1900 | |
| Arsenic | 7440-38-2 | **6** | mg/kg | 1.8 | | 1.5 | | 2 | | 3.7 | | 3.5 | | 3.7 | |
| Barium | 7440-39-3 | | mg/kg | 12 | | < 10 | U | 14 | | < 10 | U | < 10 | U | < 10 | U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 | U | < 2 | U | < 2 | U | < 2 | U | < 2 | U | < 2 | U |
| Boron | 7440-42-8 | **4** | mg/kg | **14** | | < 10 | U | **10** | | < 10 | U | < 10 | U | < 10 | U |
| Cadmium | 7440-43-9 | 1.5 | mg/kg | 0.16 | | 0.02 | | 0.15 | | < 0.01 | U | 0.01 | | < 0.01 | U |
| Cation Exchange Capacity | CEC | | meq/100g | 7.3 | | 19 | | 9.4 | | 14 | | 14 | | 16 | |
| Chromium, total | 7440-47-3 | 100 | mg/kg | 4 | | 2.6 | | 2.7 | | 2.7 | | 2.8 | | 2.7 | |
| Cobalt | 7440-48-4 | 61.7 | mg/kg | 1.8 | | 1.9 | | 1.3 | | 1.3 | | 1.2 | | 1.2 | |
| Copper | 7440-50-8 | | mg/kg | 3.4 | | 5.1 | | 4 | | 1.3 | | 1.3 | | 1 | |
| Iron | 7439-89-6 | | mg/kg | 4500 | | 4000 | | 3800 | | 4200 | | 4100 | | 4100 | |
| Lead | 7439-92-1 | 55 | mg/kg | 5.6 | | 20 | | 6.2 | | 1.3 | | 1.2 | | 1.2 | |
| Lithium | 7439-93-2 | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Manganese | 7439-96-5 | | mg/kg | 630 | | 1300 | | 530 | | 54 | | 56 | | 53 | |
| Mercury | 7439-97-6 | | mg/kg | 0.1 | | 0.14 | | 0.08 | | < 0.01 | U | 0.01 | | < 0.01 | U |
| Nickel | 7440-02-0 | 66.5 | mg/kg | 3.9 | | 2.6 | | 2.5 | | 1.8 | | 1.9 | | 1.6 | |
| Titanium | 7440-32-6 | | mg/kg | 170 | | 81 | | 140 | | 170 | | 170 | | 170 | |
| Vanadium | 7440-62-2 | | mg/kg | 14 | | 12 | | 13 | | 8.9 | | 8.9 | | 8.6 | |
| Zinc | 7440-66-6 | **110** | mg/kg | 28 | | 21 | | 28 | | 7.1 | | 6.9 | | 6.3 | |

# Table H-1
# Soil Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | Location ID | BAB-SO-01 | | BAB-SO-02 | | BAB-SO-03 | | BFS-SO-01 | | BFS-SO-02 | | BFS-SO-03 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | BAB-SO-01 | | BAB-SO-02 | | BAB-SO-03 | | BFS-SO-01 | | BFS-SO-02 | | BFS-SO-03 | |
| | | | Matrix | SO | | SO | | SO | | SO | | SO | | SO | |
| | | | Sample Date | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 | | 22 Jan 2023 | | 22 Jan 2023 | | 22 Jan 2023 | |
| | | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **SVOC** | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | | mg/kg | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Acenaphthylene | 208-96-8 | | mg/kg | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Anthracene | 120-12-7 | | mg/kg | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | 0.37 | | 0.74 | | 0.16 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | 0.08 | | 0.14 | | 0.03 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Benzo[a]pyrene | 50-32-8 | | mg/kg | 0.12 | | 0.23 | | 0.05 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.25 | | 0.53 | | 0.11 | | 0.04 | | 0.04 | | 0.04 | |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.27 | | 0.53 | | 0.13 | | 0.08 | | 0.08 | | 0.08 | |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | 0.23 | | 0.53 | | 0.1 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Benzo[g,h,i]perylene | 191-24-2 | | mg/kg | 0.08 | | 0.1 | | 0.03 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Benzo[k]fluoranthene | 207-08-9 | | mg/kg | 0.19 | | 0.36 | | 0.08 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Chrysene | 218-01-9 | | mg/kg | 0.11 | | 0.21 | | 0.06 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Dibenz(A,H)Anthracene | 53-70-3 | | mg/kg | < 0.03 | U | 0.04 | | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Fluoranthene | 206-44-0 | | mg/kg | 0.11 | | 0.26 | | 0.06 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Fluorene | 86-73-7 | | mg/kg | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | | mg/kg | 0.08 | | 0.13 | | 0.05 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Naphthalene | 91-20-3 | | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Phenanthrene | 85-01-8 | | mg/kg | 0.04 | | 0.05 | | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Pyrene | 129-00-0 | | mg/kg | 0.08 | | 0.22 | | 0.05 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Sum of PAHs | TOTALPAH | | mg/kg | 1.5 | | 3.2 | | 0.7 | | < 0.1 | U | < 0.1 | U | < 0.1 | U |

**Table H-1**
**Soil Sampling Results**
**Coastal Marine Area Report**
**Environment Southland**
**Tiwai, NZ**

| | | | **Location ID** | **ELF-SO-01** | | **ELF-SO-02** | | **ELF-SO-03** | | **ISA-SO-01** | | **ISA-SO-02** | | **ISA-SO-03** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **ELF-SO-01** | | **ELF-SO-02** | | **ELF-SO-03** | | **ISA-SO-01** | | **ISA-SO-02** | | **ISA-SO-03** | |
| | | | **Matrix** | **SO** | | **SO** | | **SO** | | **SO** | | **SO** | | **SO** | |
| | | | **Sample Date** | **24 Jan 2023** | | **24 Jan 2023** | | **24 Jan 2023** | | **24 Jan 2023** | | **24 Jan 2023** | | **24 Jan 2023** | |
| | | | **Sample Depth** | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | µS/cm | 110 | | 140 | | 56 | | 57 | | 74 | | 58 | |
| Cyanide | 57-12-5 | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Fluoride | 16984-48-8 | **165** | mg/kg | < 100 | U | **340** | | **570** | | < 100 | U | 120 | | 150 | |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | 9.6 | | 4.8 | | < 0.1 | U | 16 | | 14 | | 9.8 | |
| High Molecular Weight PAHs | PAHs_highMW | **3.7** | mg/kg | **45.04** | | **72.2** | | **30.24** | | **5.36** | | **23.4** | | **16.13** | |
| Low Molecular Weight PAHs | PAHS_lowMW | **1.4** | mg/kg | **2.41** | | **4.78** | | **1.89** | | 0.22 | | **2.26** | | 0.75 | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 7.1 | | 14 | | 13 | | 7.3 | | 5.4 | | 2.5 | |
| pH | PH | | SU | 5.7 | | 7.1 | | 6.3 | | 5.9 | | 6 | | 5.8 | |
| Total Organic Carbon | TOC | | % | 3.9 | | 8.2 | | 14 | | 1.4 | | 3.2 | | 2.5 | |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 4600 | | 2400 | | 6600 | | 2700 | | 5200 | | 4200 | |
| Arsenic | 7440-38-2 | **6** | mg/kg | **8.6** | | 4.7 | | **13** | | **8.3** | | **10** | | **10** | |
| Barium | 7440-39-3 | | mg/kg | < 10 | U | < 10 | U | 12 | | < 10 | U | < 10 | U | < 10 | U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 | U | < 2 | U | < 2 | U | < 2 | U | < 2 | U | < 2 | U |
| Boron | 7440-42-8 | **4** | mg/kg | < 10 | U | < 10 | U | < 10 | U | < 10 | U | < 10 | U | < 10 | U |
| Cadmium | 7440-43-9 | 1.5 | mg/kg | 0.07 | | 0.13 | | 0.36 | | 0.05 | | 0.07 | | 0.06 | |
| Cation Exchange Capacity | CEC | | meq/100g | 2.3 | | 27 | | 13 | | 2.2 | | 4.7 | | 1.6 | |
| Chromium, total | 7440-47-3 | 100 | mg/kg | 3.7 | | 2.1 | | 6.3 | | 3.2 | | 4.1 | | 4.1 | |
| Cobalt | 7440-48-4 | 61.7 | mg/kg | 1.5 | | 0.9 | | 2.2 | | 1.5 | | 2 | | 1.9 | |
| Copper | 7440-50-8 | | mg/kg | 1.8 | | 3 | | 5.8 | | 1.2 | | 2.5 | | 1.8 | |
| Iron | 7439-89-6 | | mg/kg | 6600 | | 3500 | | 9200 | | 5600 | | 7100 | | 7000 | |
| Lead | 7439-92-1 | 55 | mg/kg | 3.6 | | 3.8 | | 13 | | 2.1 | | 3.9 | | 3.2 | |
| Lithium | 7439-93-2 | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Manganese | 7439-96-5 | | mg/kg | 290 | | 140 | | 250 | | 150 | | 110 | | 120 | |
| Mercury | 7439-97-6 | | mg/kg | 0.02 | | 0.03 | | 0.04 | | 0.02 | | 0.02 | | 0.01 | |
| Nickel | 7440-02-0 | 66.5 | mg/kg | 3.2 | | 4.5 | | 22 | | 3.7 | | 9.5 | | 5.5 | |
| Titanium | 7440-32-6 | | mg/kg | 250 | | 120 | | 300 | | 260 | | 250 | | 260 | |
| Vanadium | 7440-62-2 | | mg/kg | 31 | | 13 | | 27 | | 18 | | 22 | | 19 | |
| Zinc | 7440-66-6 | **110** | mg/kg | 16 | | 20 | | 35 | | 18 | | 29 | | 22 | |

**Table H-1**
**Soil Sampling Results**
**Coastal Marine Area Report**
**Environment Southland**
**Tiwai, NZ**

| | | | Location ID | ELF-SO-01 | | ELF-SO-02 | | ELF-SO-03 | | ISA-SO-01 | | ISA-SO-02 | | ISA-SO-03 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | ELF-SO-01 | | ELF-SO-02 | | ELF-SO-03 | | ISA-SO-01 | | ISA-SO-02 | | ISA-SO-03 | |
| | | | Matrix | SO | | SO | | SO | | SO | | SO | | SO | |
| | | | Sample Date | 24 Jan 2023 | | 24 Jan 2023 | | 24 Jan 2023 | | 24 Jan 2023 | | 24 Jan 2023 | | 24 Jan 2023 | |
| | | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **SVOC** | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | | mg/kg | 0.14 | | 0.43 | | 0.15 | | < 0.03 | U | 0.09 | | 0.05 | |
| Acenaphthylene | 208-96-8 | | mg/kg | 0.04 | | 0.14 | | 0.06 | | < 0.03 | U | 0.03 | | < 0.03 | U |
| Anthracene | 120-12-7 | | mg/kg | 0.46 | | 0.81 | | < 0.03 | U | < 0.03 | U | 1 | | < 0.03 | U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | 4.9 | | 7.8 | | 3.8 | | 0.83 | | 2.9 | | 2.2 | |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | 4.3 | | 7.5 | | 2.8 | | 0.46 | | 2.1 | | 1.5 | |
| Benzo[a]pyrene | 50-32-8 | | mg/kg | 6.3 | | 10 | | 4.1 | | 0.74 | | 3.2 | | 2.2 | |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 8.9 | | 15 | | 6.3 | | 1.1 | | 4.8 | | 3.3 | |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 8.9 | | 15 | | 6.3 | | 1.1 | | 4.8 | | 3.3 | |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | 8.9 | | 15 | | 6.3 | | 1.1 | | 4.8 | | 3.3 | |
| Benzo[g,h,i]perylene | 191-24-2 | | mg/kg | 4.9 | | 8.6 | | 3.3 | | 0.53 | | 2.4 | | 1.6 | |
| Benzo[k]fluoranthene | 207-08-9 | | mg/kg | 2.9 | | 5.5 | | 2.1 | | 0.37 | | 1.6 | | 1.1 | |
| Chrysene | 218-01-9 | | mg/kg | 3.9 | | 4.6 | | 2.7 | | 0.47 | | 2.1 | | 1.5 | |
| Dibenz(A,H)Anthracene | 53-70-3 | | mg/kg | 0.84 | | 1.8 | | 0.94 | | 0.16 | | 0.7 | | 0.43 | |
| Fluoranthene | 206-44-0 | | mg/kg | 6.3 | | 9.3 | | 3.9 | | 0.67 | | 3.1 | | 2.1 | |
| Fluorene | 86-73-7 | | mg/kg | 0.07 | | 0.2 | | 0.08 | | < 0.03 | U | 0.04 | | < 0.03 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | | mg/kg | 4.4 | | 7.6 | | 2.8 | | 0.54 | | 2.3 | | 1.5 | |
| Naphthalene | 91-20-3 | | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Phenanthrene | 85-01-8 | | mg/kg | 1.7 | | 3.2 | | 1.6 | | 0.22 | | 1.1 | | 0.7 | |
| Pyrene | 129-00-0 | | mg/kg | 6.3 | | 9.5 | | 3.8 | | 0.59 | | 3 | | 2 | |
| Sum of PAHs | TOTALPAH | | mg/kg | 47 | | 77 | | 32 | | 5.6 | | 26 | | 17 | |

# Table H-1
# Soil Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | **Location ID** | **ISA-SO-04** | | **ISA-SO-05** | | **NOD-SO-01** | | **NOD-SO-02** | | **NOD-SO-03** | | **SCL-SO-01** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **ISA-SO-04** | | **ISA-SO-05** | | **NOD-SO-01** | | **NOD-SO-02** | | **NOD-SO-03** | | **SCL-SO-01** | |
| | | | **Matrix** | **SO** | | **SO** | | **SO** | | **SO** | | **SO** | | **SO** | |
| | | | **Sample Date** | **24 Jan 2023** | | **24 Jan 2023** | | **29 Jan 2023** | | **29 Jan 2023** | | **29 Jan 2023** | | **23 Jan 2023** | |
| | | | **Sample Depth** | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | µS/cm | 72 | | 95 | | 60 | | 46 | | 46 | | 85 | |
| Cyanide | 57-12-5 | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Fluoride | 16984-48-8 | **165** | mg/kg | 150 | | 130 | | < 100 | U | < 100 | U | **210** | | < 100 | U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | 12 | | 18 | | < 0.1 | U | < 0.1 | U | < 0.1 | U | 1.6 | |
| High Molecular Weight PAHs | PAHs_highMW | **3.7** | mg/kg | **22.22** | | **30.18** | | 0.58 | | < 0.03 | U | 1.8 | | **4.39** | |
| Low Molecular Weight PAHs | PAHS_lowMW | **1.4** | mg/kg | **2.11** | | **3.02** | | < 0.1 | U | < 0.1 | U | 0.04 | | 0.2 | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 5.7 | | 5.9 | | 1.9 | | 2.9 | | 1.7 | | 4.1 | |
| pH | PH | | SU | 6.3 | | 6.1 | | 6.7 | | 7.5 | | 6.5 | | 7.5 | |
| Total Organic Carbon | TOC | | % | 2.5 | | 3.2 | | 0.3 | | 0.2 | | 0.8 | | 2.7 | |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 2700 | | 5100 | | 3600 | | 2800 | | 2900 | | 2000 | |
| Arsenic | 7440-38-2 | **6** | mg/kg | 5 | | **9.8** | | 3.1 | | 2.4 | | 2.3 | | **7** | |
| Barium | 7440-39-3 | | mg/kg | < 10 | U | 13 | | < 10 | U | < 10 | U | < 10 | U | < 10 | U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 | U | < 2 | U | < 2 | U | < 2 | U | < 2 | U | < 2 | U |
| Boron | 7440-42-8 | **4** | mg/kg | < 10 | U | < 10 | U | < 10 | U | < 10 | U | < 10 | U | < 10 | U |
| Cadmium | 7440-43-9 | 1.5 | mg/kg | 0.05 | | 0.1 | | 0.05 | | 0.02 | | 0.04 | | 0.03 | |
| Cation Exchange Capacity | CEC | | meq/100g | 2.7 | | 5.3 | | 7.7 | | 0.61 | | 1.3 | | 23 | |
| Chromium, total | 7440-47-3 | 100 | mg/kg | 1.9 | | 3.9 | | 4.2 | | 4.1 | | 3 | | 2.5 | |
| Cobalt | 7440-48-4 | 61.7 | mg/kg | 0.8 | | 1.6 | | 1.7 | | 1.4 | | 1.1 | | 1.1 | |
| Copper | 7440-50-8 | | mg/kg | 1.4 | | 2.7 | | 2.2 | | 1.3 | | 1.2 | | 1.6 | |
| Iron | 7439-89-6 | | mg/kg | 3100 | | 6400 | | 4700 | | 4300 | | 3400 | | 4300 | |
| Lead | 7439-92-1 | 55 | mg/kg | 4.4 | | 6.1 | | 2 | | 1.4 | | 1.8 | | 1.5 | |
| Lithium | 7439-93-2 | | mg/kg | < 5 | U | < 5 | U | 8.1 | | 8.4 | | < 5 | U | < 5 | U |
| Manganese | 7439-96-5 | | mg/kg | 110 | | 260 | | 62 | | 52 | | 45 | | 81 | |
| Mercury | 7439-97-6 | | mg/kg | 0.02 | | 0.04 | | 0.03 | | 0.03 | | 0.02 | | 0.02 | |
| Nickel | 7440-02-0 | 66.5 | mg/kg | 5.7 | | 11 | | 5.5 | | 2.6 | | 3.5 | | 3.3 | |
| Titanium | 7440-32-6 | | mg/kg | 110 | | 180 | | 280 | | 280 | | 240 | | 110 | |
| Vanadium | 7440-62-2 | | mg/kg | 18 | | 25 | | 15 | | 13 | | 12 | | 10 | |
| Zinc | 7440-66-6 | **110** | mg/kg | 21 | | 31 | | 26 | | 9.5 | | 11 | | 7.4 | |

# Table H-1
## Soil Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Location ID** | **ISA-SO-04** | | **ISA-SO-05** | | **NOD-SO-01** | | **NOD-SO-02** | | **NOD-SO-03** | | **SCL-SO-01** | |
| | | | **Sample ID** | **ISA-SO-04** | | **ISA-SO-05** | | **NOD-SO-01** | | **NOD-SO-02** | | **NOD-SO-03** | | **SCL-SO-01** | |
| | | | **Matrix** | **SO** | | **SO** | | **SO** | | **SO** | | **SO** | | **SO** | |
| | | | **Sample Date** | **24 Jan 2023** | | **24 Jan 2023** | | **29 Jan 2023** | | **29 Jan 2023** | | **29 Jan 2023** | | **23 Jan 2023** | |
| | | | **Sample Depth** | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **SVOC** | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | | mg/kg | 0.09 | | 0.13 | | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Acenaphthylene | 208-96-8 | | mg/kg | < 0.03 | U | 0.04 | | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Anthracene | 120-12-7 | | mg/kg | 0.99 | | 1.4 | | < 0.03 | U | < 0.03 | U | < 0.03 | U | 0.06 | |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | 2.8 | | 3.6 | | 0.22 | | < 0.03 | U | 0.32 | | 0.78 | |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | 2 | | 2.7 | | 0.03 | | < 0.03 | U | 0.13 | | 0.34 | |
| Benzo[a]pyrene | 50-32-8 | | mg/kg | 3 | | 4.2 | | 0.03 | | < 0.03 | U | 0.2 | | 0.54 | |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 4.5 | | 6.2 | | 0.09 | | 0.04 | | 0.34 | | 0.82 | |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 4.5 | | 6.2 | | 0.1 | | 0.08 | | 0.34 | | 0.82 | |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | 4.5 | | 6.2 | | 0.07 | | < 0.03 | U | 0.34 | | 0.82 | |
| Benzo[g,h,i]perylene | 191-24-2 | | mg/kg | 2.4 | | 3.7 | | 0.03 | | < 0.03 | U | 0.12 | | 0.47 | |
| Benzo[k]fluoranthene | 207-08-9 | | mg/kg | 1.5 | | 1.9 | | 0.12 | | < 0.03 | U | 0.3 | | 0.3 | |
| Chrysene | 218-01-9 | | mg/kg | 2 | | 2.7 | | 0.06 | | < 0.03 | U | 0.28 | | 0.44 | |
| Dibenz(A,H)Anthracene | 53-70-3 | | mg/kg | 0.62 | | 0.88 | | < 0.03 | U | < 0.03 | U | 0.04 | | 0.09 | |
| Fluoranthene | 206-44-0 | | mg/kg | 3 | | 3.9 | | 0.03 | | < 0.03 | U | 0.14 | | 0.51 | |
| Fluorene | 86-73-7 | | mg/kg | 0.03 | | 0.05 | | < 0.03 | U | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | | mg/kg | 2.1 | | 2.8 | | 0.03 | | < 0.03 | U | 0.14 | | 0.39 | |
| Naphthalene | 91-20-3 | | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Phenanthrene | 85-01-8 | | mg/kg | 1 | | 1.4 | | < 0.03 | U | < 0.03 | U | 0.04 | | 0.14 | |
| Pyrene | 129-00-0 | | mg/kg | 2.8 | | 3.8 | | 0.03 | | < 0.03 | U | 0.13 | | 0.53 | |
| Sum of PAHs | TOTALPAH | | mg/kg | 24 | | 33 | | 0.6 | | < 0.1 | U | 1.9 | | 4.6 | |

# Table H-1
# Soil Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | Location ID | SCL-SO-02 | | SCL-SO-03 | | SOD-SO-01 | | SOD-SO-02 | | WLF-SO-01 | | WLF-SO-02 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | SCL-SO-02 | | SCL-SO-03 | | SOD-SO-01 | | SOD-SO-02 | | WLF-01 | | WLF-02 | |
| | | | Matrix | SO | | SO | | SO | | SO | | SO | | SO | |
| | | | Sample Date | 23 Jan 2023 | | 23 Jan 2023 | | 25 Jan 2023 | | 25 Jan 2023 | | 24 Jan 2023 | | 25 Jan 2023 | |
| | | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | µS/cm | 44 | | 170 | | 64 | | 100 | | 39 | | 1600 | |
| Cyanide | 57-12-5 | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Fluoride | 16984-48-8 | **165** | mg/kg | **7300** | | **220** | | **180** | | < 100 | U | < 100 | U | < 100 | U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | 14 | | 2.2 | | 3.1 | | 7.7 | | 4.2 | | 1.2 | |
| High Molecular Weight PAHs | PAHs_highMW | **3.7** | mg/kg | **14.92** | | 1.54 | | **91.3** | | **314** | | 0.03 | | 2.6 | |
| Low Molecular Weight PAHs | PAHS_lowMW | **1.4** | mg/kg | 1.26 | | 0.06 | | **4.81** | | **26.55** | | < 0.1 | U | 0.12 | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 3.1 | | 2.8 | | 7.1 | | 6.8 | | 1.5 | | 3.2 | |
| pH | PH | | SU | 6.8 | | 7.4 | | 5.5 | | 6.7 | | 7.6 | | 5.9 | |
| Total Organic Carbon | TOC | | % | 5.6 | | 2.8 | | 5.4 | | 4 | | 0.6 | | 0.1 | |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 12000 | | 1600 | | 4100 | | 6300 | | 2400 | | 2600 | |
| Arsenic | 7440-38-2 | **6** | mg/kg | 4.4 | | **8.5** | | 1.9 | | 3.2 | | 4.2 | | 4 | |
| Barium | 7440-39-3 | | mg/kg | 13 | | < 10 | U | < 10 | U | 12 | | < 10 | U | < 10 | U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 | U | < 2 | U | < 2 | U | < 2 | U | < 2 | U | < 2 | U |
| Boron | 7440-42-8 | **4** | mg/kg | < 10 | U | < 10 | U | < 10 | U | < 10 | U | < 10 | U | < 10 | U |
| Cadmium | 7440-43-9 | 1.5 | mg/kg | 0.03 | | 0.02 | | 0.06 | | 0.1 | | 0.01 | | 0.02 | |
| Cation Exchange Capacity | CEC | | meq/100g | 7.7 | | 23 | | 3.5 | | 3.7 | | 2.5 | | 0.7 | |
| Chromium, total | 7440-47-3 | 100 | mg/kg | 3.8 | | 2 | | 2.7 | | 5.2 | | 4.5 | | 4.7 | |
| Cobalt | 7440-48-4 | 61.7 | mg/kg | 1.2 | | 1 | | 0.9 | | 2.2 | | 1.3 | | 1.1 | |
| Copper | 7440-50-8 | | mg/kg | 1.7 | | 1.1 | | 1.8 | | 6.3 | | 1.4 | | 1.2 | |
| Iron | 7439-89-6 | | mg/kg | 5000 | | 4200 | | 3300 | | 6300 | | 4200 | | 4100 | |
| Lead | 7439-92-1 | 55 | mg/kg | 2.5 | | 1.1 | | 3.6 | | 4 | | 1.4 | | 5.2 | |
| Lithium | 7439-93-2 | | mg/kg | 5.8 | | < 5 | U | < 5 | U | < 5 | U | 5.1 | | < 5 | U |
| Manganese | 7439-96-5 | | mg/kg | 89 | | 61 | | 52 | | 100 | | 51 | | 48 | |
| Mercury | 7439-97-6 | | mg/kg | 0.01 | | 0.01 | | 0.03 | | 0.02 | | < 0.01 | U | < 0.01 | U |
| Nickel | 7440-02-0 | 66.5 | mg/kg | 6 | | 2.1 | | 2.7 | | 7.8 | | 2.4 | | 2.1 | |
| Titanium | 7440-32-6 | | mg/kg | 250 | | 120 | | 150 | | 260 | | 240 | | 270 | |
| Vanadium | 7440-62-2 | | mg/kg | 15 | | 10 | | 11 | | 15 | | 10 | | 11 | |
| Zinc | 7440-66-6 | **110** | mg/kg | 11 | | 5.2 | | 20 | | **160** | | 11 | | 8.7 | |

# Table H-1
# Soil Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | **Location ID** | **SCL-SO-02** | | **SCL-SO-03** | | **SOD-SO-01** | | **SOD-SO-02** | | **WLF-SO-01** | | **WLF-SO-02** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **SCL-SO-02** | | **SCL-SO-03** | | **SOD-SO-01** | | **SOD-SO-02** | | **WLF-01** | | **WLF-02** | |
| | | | **Matrix** | **SO** | | **SO** | | **SO** | | **SO** | | **SO** | | **SO** | |
| | | | **Sample Date** | **23 Jan 2023** | | **23 Jan 2023** | | **25 Jan 2023** | | **25 Jan 2023** | | **24 Jan 2023** | | **25 Jan 2023** | |
| | | | **Sample Depth** | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | | **0-10cm** | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **SVOC** | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | | mg/kg | 0.06 | | < 0.03 | U | 0.36 | | 1.1 | | < 0.03 | U | < 0.03 | U |
| Acenaphthylene | 208-96-8 | | mg/kg | < 0.03 | U | < 0.03 | U | 0.12 | | < 0.03 | U | < 0.03 | U | < 0.03 | U |
| Anthracene | 120-12-7 | | mg/kg | 0.31 | | < 0.03 | U | 0.95 | | 12 | | < 0.03 | U | < 0.03 | U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | 1.8 | | 0.23 | | 8.7 | | 35 | | 0.03 | | 0.46 | |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | 1.3 | | 0.11 | | 8.5 | | 30 | | < 0.03 | U | 0.22 | |
| Benzo[a]pyrene | 50-32-8 | | mg/kg | 1.8 | | 0.16 | | 12 | | 43 | | < 0.03 | U | 0.33 | |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 2.7 | | 0.26 | | 18 | | 66 | | 0.04 | | 0.52 | |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 2.7 | | 0.26 | | 18 | | 66 | | 0.08 | | 0.52 | |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | 2.7 | | 0.26 | | 18 | | 66 | | < 0.03 | U | 0.52 | |
| Benzo[g,h,i]perylene | 191-24-2 | | mg/kg | 1.3 | | 0.15 | | 9.6 | | 38 | | < 0.03 | U | 0.29 | |
| Benzo[k]fluoranthene | 207-08-9 | | mg/kg | 1.2 | | 0.17 | | 6.5 | | 19 | | < 0.03 | U | 0.2 | |
| Chrysene | 218-01-9 | | mg/kg | 1.4 | | 0.2 | | 8.3 | | 29 | | < 0.03 | U | 0.28 | |
| Dibenz(A,H)Anthracene | 53-70-3 | | mg/kg | 0.32 | | 0.03 | | 2.1 | | 11 | | < 0.03 | U | 0.07 | |
| Fluoranthene | 206-44-0 | | mg/kg | 2.5 | | 0.19 | | 13 | | 39 | | < 0.03 | U | 0.28 | |
| Fluorene | 86-73-7 | | mg/kg | 0.04 | | < 0.03 | U | 0.18 | | 0.45 | | < 0.03 | U | < 0.03 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | | mg/kg | 1.1 | | 0.13 | | 9.6 | | 31 | | < 0.03 | U | 0.24 | |
| Naphthalene | 91-20-3 | | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Phenanthrene | 85-01-8 | | mg/kg | 0.85 | | 0.06 | | 3.2 | | 13 | | < 0.03 | U | 0.12 | |
| Pyrene | 129-00-0 | | mg/kg | 2.2 | | 0.17 | | 13 | | 39 | | < 0.03 | U | 0.23 | |
| Sum of PAHs | TOTALPAH | | mg/kg | 16 | | 1.6 | | 96 | | 340 | | < 0.1 | U | 2.7 | |

# Table H-1
## Soil Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | Location ID | WLF-SO-03 | | WLF-SO-04 | | WOD-SO-01 | | WOD-SO-02 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | WLF-03 | | WLF-SO-03 | | WOD-SO-01 | | WOD-SO-02 | |
| | | | Matrix | SO | | SO | | SO | | SO | |
| | | | Sample Date | 25 Jan 2023 | | 31 Jan 2023 | | 25 Jan 2023 | | 25 Jan 2023 | |
| | | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | µS/cm | 33 | | 650 | | 88 | | 53 | |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | | < 5 U | | < 5 U | | < 5 U | |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | | < 5 U | | < 5 U | | < 5 U | |
| Fluoride | 16984-48-8 | **165** | mg/kg | < 100 U | | **210** | | < 100 U | | < 100 U | |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | < 0.1 U | | 2.9 | | 3.1 | | 1 | |
| High Molecular Weight PAHs | PAHs_highMW | **3.7** | mg/kg | 1.74 | | 0.17 | | **4.09** | | **60.6** | |
| Low Molecular Weight PAHs | PAHS_lowMW | **1.4** | mg/kg | 0.08 | | < 0.1 U | | 0.16 | | **3.46** | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 3.2 | | 3.9 | | < 1 U | | 13 | |
| pH | PH | | SU | 7.1 | | 7.2 | | 7.6 | | 6 | |
| Total Organic Carbon | TOC | | % | 1.2 | | 1.2 | | 0.2 | | 4.5 | |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | | < 5 U | | < 5 U | | < 5 U | |
| **METALS** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 3300 | | 3700 | | 1900 | | 2100 | |
| Arsenic | 7440-38-2 | **6** | mg/kg | 5.4 | | 3.3 | | 2.4 | | 2.1 | |
| Barium | 7440-39-3 | | mg/kg | < 10 U | | < 10 U | | < 10 U | | < 10 U | |
| Beryllium | 7440-41-7 | | mg/kg | < 2 U | | < 2 U | | < 2 U | | < 2 U | |
| Boron | 7440-42-8 | **4** | mg/kg | < 10 U | | < 10 U | | < 10 U | | < 10 U | |
| Cadmium | 7440-43-9 | 1.5 | mg/kg | 0.03 | | 0.03 | | 0.04 | | 0.05 | |
| Cation Exchange Capacity | CEC | | meq/100g | 4.3 | | 0.12 | | 2.6 | | 1.7 | |
| Chromium, total | 7440-47-3 | 100 | mg/kg | 5.7 | | 5.5 | | 2.5 | | 2 | |
| Cobalt | 7440-48-4 | 61.7 | mg/kg | 1.8 | | 1.9 | | 0.8 | | 0.7 | |
| Copper | 7440-50-8 | | mg/kg | 1.9 | | 2.4 | | 0.9 | | 1.2 | |
| Iron | 7439-89-6 | | mg/kg | 5700 | | 5100 | | 3000 | | 2600 | |
| Lead | 7439-92-1 | 55 | mg/kg | 2.3 | | 2.4 | | 1.1 | | 3.2 | |
| Lithium | 7439-93-2 | | mg/kg | < 5 U | | 6.4 | | < 5 U | | < 5 U | |
| Manganese | 7439-96-5 | | mg/kg | 72 | | 83 | | 36 | | 57 | |
| Mercury | 7439-97-6 | | mg/kg | 0.02 | | < 0.01 U | | < 0.01 U | | 0.02 | |
| Nickel | 7440-02-0 | 66.5 | mg/kg | 3.4 | | 3.7 | | 2.4 | | 2.3 | |
| Titanium | 7440-32-6 | | mg/kg | 360 | | 370 | | 200 | | 140 | |
| Vanadium | 7440-62-2 | | mg/kg | 15 | | 19 | | 8.8 | | 9.3 | |
| Zinc | 7440-66-6 | **110** | mg/kg | 11 | | 14 | | 31 | | 10 | |

## Table H-1
## Soil Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | Location ID | WLF-SO-03 | | WLF-SO-04 | | WOD-SO-01 | | WOD-SO-02 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | WLF-03 | | WLF-SO-03 | | WOD-SO-01 | | WOD-SO-02 | |
| | | | Matrix | SO | | SO | | SO | | SO | |
| | | | Sample Date | 25 Jan 2023 | | 31 Jan 2023 | | 25 Jan 2023 | | 25 Jan 2023 | |
| | | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 0-10cm | |
| **Chemical** | **CAS No.** | **Site-Specific Boundary Area Screening Criteria - Sensitive Ecological Soil Contaminant** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **SVOC** | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | | mg/kg | < 0.03 | U | < 0.03 | U | < 0.03 | U | 0.21 | |
| Acenaphthylene | 208-96-8 | | mg/kg | < 0.03 | U | < 0.03 | U | < 0.03 | U | 0.08 | |
| Anthracene | 120-12-7 | | mg/kg | < 0.03 | U | < 0.03 | U | < 0.03 | U | 0.57 | |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | 0.3 | | 0.05 | | 0.74 | | 6.4 | |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | 0.14 | | 0.05 | | 0.36 | | 5.6 | |
| Benzo[a]pyrene | 50-32-8 | | mg/kg | 0.19 | | < 0.03 | U | 0.4 | | 8.2 | |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.31 | | 0.05 | | 0.68 | | 12 | |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.31 | | 0.08 | | 0.68 | | 12 | |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | 0.31 | | < 0.03 | U | 0.68 | | 12 | |
| Benzo[g,h,i]perylene | 191-24-2 | | mg/kg | 0.2 | | < 0.03 | U | 0.45 | | 7.1 | |
| Benzo[k]fluoranthene | 207-08-9 | | mg/kg | 0.12 | | 0.04 | | 0.33 | | 4.1 | |
| Chrysene | 218-01-9 | | mg/kg | 0.18 | | 0.03 | | 0.49 | | 5.3 | |
| Dibenz(A,H)Anthracene | 53-70-3 | | mg/kg | 0.05 | | < 0.03 | U | 0.1 | | 1.3 | |
| Fluoranthene | 206-44-0 | | mg/kg | 0.22 | | < 0.03 | U | 0.46 | | 8.3 | |
| Fluorene | 86-73-7 | | mg/kg | < 0.03 | U | < 0.03 | U | < 0.03 | U | 0.1 | |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | | mg/kg | 0.14 | | < 0.03 | U | 0.3 | | 5.9 | |
| Naphthalene | 91-20-3 | | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Phenanthrene | 85-01-8 | | mg/kg | 0.08 | | < 0.03 | U | 0.16 | | 2.5 | |
| Pyrene | 129-00-0 | | mg/kg | 0.2 | | < 0.03 | U | 0.46 | | 8.4 | |
| Sum of PAHs | TOTALPAH | | mg/kg | 1.8 | | 0.2 | | 4.3 | | 64 | |

**Notes**
% = Percent
µS/cm = Micro-Siemens per Centimeter
°C = Degrees in Celsius
cm = Centimeter
LOR = Limit of Reporting
meq/100g = Milliequivalents per 100 grams of Soil
mg/kg = Milligrams per Kilogram
PAH = Polycyclic Aromatic Hydrocarbon
SO = Soil
SU = Standard Units
SVOC = Semi-Volatile Organic Compound
TEQ = Toxic Equivalency
U = Result Not Detected

**Table H-2**
**Sediment Sampling Results**
**Coastal Marine Area Report**
**Environment Southland**
**Tiwai, NZ**

| | | | Location ID | BAB-01 | BAB-01 | BAB-01 | BAB-02 | BAB-02 | BAB-02 | BAB-03 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | BAB-SE-01_0-10cm | BAB-SE-01_10-50cm | BAB-SE-01_50-100cm | BAB-SE-02_0-10cm | BAB-SE-02_10-50cm | BAB-SE-02_50-100cm | BAB-SE-03_0-10cm |
| | | | Matrix | SE | SE | SE | SE | SE | SE | SE |
| | | | Sample Date | 27 Jan 2023 | 27 Jan 2023 | 27 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 27 Jan 2023 |
| | | | Sample Depth | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm | 50-100cm | 0-10cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | 1800 | 640 | 340 | 3000 | 1200 | 910 | 2600 |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | < 100 U | < 100 U | < 100 U | < 100 U | < 100 U | < 100 U | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 18 | 17 | 29 | 20 | 17 | 20 | 19 |
| pH | PH | | SU | 6.2 | 2.9 | 5.2 | 3.6 | 3.8 | 4.3 | 6.3 |
| Total Organic Carbon | TOC | | % | 0.2 | 0.2 | < 0.1 U | 0.3 | 0.2 | 0.2 | 0.2 |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 3600 | 5000 | 9000 | 3900 | 4700 | 6200 | 3700 |
| Arsenic | 7440-38-2 | **20** | mg/kg | 4.8 | 16 | 8.3 | 8.9 | 15 | 6.7 | 2 |
| Barium | 7440-39-3 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U |
| Boron | 7440-42-8 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | < 0.01 U | 0.02 | 0.02 | < 0.01 U | 0.02 | 0.02 | < 0.01 U |
| Calcium | 7440-70-2 | | mg/kg | | | | | | | |
| Cation Exchange Capacity | CEC | | meq/100g | 1.1 | 0.28 | 0.55 | 0.51 | 0.26 | 0.57 | 1 |
| Chromium, total | 7440-47-3 | 80 | mg/kg | 4.6 | 7.4 | 10 | 5.6 | 6.5 | 8.3 | 5.1 |
| Cobalt | 7440-48-4 | 50 | mg/kg | 1.4 | 5.1 | 6.7 | 2.2 | 11 | 7.4 | 1.5 |
| Copper | 7440-50-8 | 65 | mg/kg | 1.2 | 2.6 | 7.9 | 2.3 | 2.8 | 4.1 | 1.4 |
| Hardness (As CaCO3) | HARD | | mg/kg | | | | | | | |
| Iron | 7439-89-6 | | mg/kg | 4900 | 6800 | 9000 | 6600 | 7800 | 7300 | 4500 |
| Lead | 7439-92-1 | **50** | mg/kg | 1.7 | 1.7 | 2.1 | 1.9 | 1.9 | 2.4 | 1.2 |
| Lithium | 7439-93-2 | | mg/kg | 8.8 | 14 | 31 | 13 | 16 | 28 | 8.6 |
| Magnesium | 7439-95-4 | | mg/kg | | | | | | | |
| Manganese | 7439-96-5 | | mg/kg | 54 | 77 | 120 | 83 | 120 | 110 | 64 |
| Mercury | 7439-97-6 | **0.15** | mg/kg | 0.02 | 0.03 | 0.02 | < 0.01 U | < 0.01 U | < 0.01 U | 0.04 |
| Nickel | 7440-02-0 | **21** | mg/kg | 2.6 | 5.4 | 9.1 | 4.3 | 6.7 | 8.4 | 2.7 |
| Titanium | 7440-32-6 | | mg/kg | 310 | 500 | 730 | 400 | 510 | 610 | 370 |
| Vanadium | 7440-62-2 | | mg/kg | 17 | 24 | 28 | 23 | 25 | 23 | 14 |
| Zinc | 7440-66-6 | **200** | mg/kg | 8.6 | 14 | 24 | 13 | 19 | 22 | 8.9 |

# Table H-2
# Sediment Sampling Results
Coastal Marine Area Report
Environment Southland
Tiwai, NZ

| | | | Location ID | BAB-01 | BAB-01 | BAB-01 | BAB-02 | BAB-02 | BAB-02 | BAB-03 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | BAB-SE-01_0-10cm | BAB-SE-01_10-50cm | BAB-SE-01_50-100cm | BAB-SE-02_0-10cm | BAB-SE-02_10-50cm | BAB-SE-02_50-100cm | BAB-SE-03_0-10cm |
| | | | Matrix | SE | SE | SE | SE | SE | SE | SE |
| | | | Sample Date | 27 Jan 2023 | 27 Jan 2023 | 27 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 27 Jan 2023 |
| | | | Sample Depth | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm | 50-100cm | 0-10cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.04 | 0.04 | 0.05 | 0.04 | 0.04 | 0.04 | 0.05 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.09 | 0.09 | 0.11 | 0.08 | 0.08 | 0.08 | 0.09 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Chrysene | 218-01-9 | **0.108** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |

### Table H-2
### Sediment Sampling Results
### Coastal Marine Area Report
### Environment Southland
### Tiwai, NZ

| | | | Location ID | BAB-03 | BAB-03 | BFS-01 | BFS-02 | BFS-03 | ELF-01 | ELF-02 | ELF-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | BAB-SE-03_10-50cm | BAB-SE-03_50-100cm | BFS-SE-01 | BFS02-SED | BFS-SE-03 | ELF-SE-01 | ELF-SE-02 | ELF-SE-03 |
| | | | Matrix | SE | SE | SE | SE | SE | SE | SE | SE |
| | | | Sample Date | 27 Jan 2023 | 27 Jan 2023 | 22 Jan 2023 | 17 Jan 2023 | 22 Jan 2023 | 24 Jan 2023 | 24 Jan 2023 | 24 Jan 2023 |
| | | | Sample Depth | 10-50cm | 50-100cm | 0-10cm | 0-10cm | 0-10cm | 0-10cm | 0-10cm | 0-10cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | 1800 | 1900 | 790 | 1000 | 590 | 1300 | 63 | 570 |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | 160 | < 100 U | 120 | < 100 U | < 100 U | < 100 U | < 100 U | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | 2.2 | < 0.1 U | 1.9 | 13 | 2.3 |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | | |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 16 | 23 | 7.5 | 7.2 | 7.2 | 8.2 | 12 | 3.2 |
| pH | PH | | SU | 4.1 | 6.3 | 8.1 | 7.3 | 8.8 | 9 | 9.2 | 9.2 |
| Total Organic Carbon | TOC | | % | 0.2 | 0.1 | 0.1 | < 0.1 U | < 0.1 U | < 0.1 U | 0.2 | 3 |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 5900 | 9900 | 1700 | 1600 | 2600 | 1700 | 2000 | 1300 |
| Arsenic | 7440-38-2 | **20** | mg/kg | 4.7 | 2.3 | 3.1 | 3.1 | 4.2 | 8.8 | 12 | 8.4 |
| Barium | 7440-39-3 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U |
| Boron | 7440-42-8 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | 0.02 | 0.03 | < 0.01 U | < 0.01 U | < 0.01 U | 0.02 | 0.07 | 0.01 |
| Calcium | 7440-70-2 | | mg/kg | | | | | | | | |
| Cation Exchange Capacity | CEC | | meq/100g | 1 | 2.2 | 23 | 21 | 25 | 0.6 | 1 | 0.6 |
| Chromium, total | 7440-47-3 | 80 | mg/kg | 7 | 11 | 2.3 | 2.6 | 3.2 | 2.9 | 3.4 | 2.1 |
| Cobalt | 7440-48-4 | 50 | mg/kg | 5.2 | 4.4 | 1 | 1.2 | 1.6 | 1.2 | 1.5 | 1 |
| Copper | 7440-50-8 | 65 | mg/kg | 4 | 8.6 | 1 | 1.3 | 1.9 | 1.2 | 1.6 | 1.3 |
| Hardness (As CaCO3) | HARD | | mg/kg | | | | | | | | |
| Iron | 7439-89-6 | | mg/kg | 6000 | 9600 | 3500 | 4000 | 5200 | 4800 | 6100 | 4400 |
| Lead | 7439-92-1 | **50** | mg/kg | 2.1 | 2.9 | 1.7 | 1.2 | 1.6 | 0.9 | 1.1 | 0.9 |
| Lithium | 7439-93-2 | | mg/kg | 12 | 22 | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Magnesium | 7439-95-4 | | mg/kg | | | | | | | | |
| Manganese | 7439-96-5 | | mg/kg | 72 | 120 | 64 | 54 | 72 | 61 | 77 | 66 |
| Mercury | 7439-97-6 | **0.15** | mg/kg | 0.05 | 0.04 | < 0.01 U | < 0.01 U | 0.01 | < 0.01 U | 0.01 | < 0.01 U |
| Nickel | 7440-02-0 | **21** | mg/kg | 6.2 | 8.8 | 1.6 | 1.6 | 2.4 | 2 | 2.2 | 1.6 |
| Titanium | 7440-32-6 | | mg/kg | 470 | 860 | 130 | 110 | 200 | 180 | 200 | 100 |
| Vanadium | 7440-62-2 | | mg/kg | 21 | 31 | 6.8 | 6.8 | 10 | 11 | 14 | 8.8 |
| Zinc | 7440-66-6 | **200** | mg/kg | 19 | 27 | 5.2 | 6.8 | 8.3 | 5.8 | 8.1 | 5.2 |

**Table H-2**

**Sediment Sampling Results**

**Coastal Marine Area Report**

**Environment Southland**

**Tiwai, NZ**

| | | | **Location ID** | **BAB-03** | **BAB-03** | **BFS-01** | **BFS-02** | **BFS-03** | **ELF-01** | **ELF-02** | **ELF-03** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **BAB-SE-03_10-50cm** | **BAB-SE-03_50-100cm** | **BFS-SE-01** | **BFS02-SED** | **BFS-SE-03** | **ELF-SE-01** | **ELF-SE-02** | **ELF-SE-03** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **27 Jan 2023** | **27 Jan 2023** | **22 Jan 2023** | **17 Jan 2023** | **22 Jan 2023** | **24 Jan 2023** | **24 Jan 2023** | **24 Jan 2023** |
| | | | **Sample Depth** | **10-50cm** | **50-100cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.04 | 0.05 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.09 | 0.1 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Chrysene | 218-01-9 | **0.108** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |

# Table H-2
# Sediment Sampling Results
Coastal Marine Area Report
Environment Southland
Tiwai, NZ

| | | | Location ID | FARM TEST | ISA-01 | ISA-02 | ISA-03 | NOD-01 | NOD-01 | NOD-01 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **SED-01** | **ISA-SE-01** | **ISA-SE-02** | **ISA-SE-03** | **NOD-SE-01_0-10cm** | **NOD-SE-01_10-50cm** | **NOD-SE-01_50-100cm** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **22 Jan 2023** | **24 Jan 2023** | **24 Jan 2023** | **24 Jan 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** |
| | | | **Sample Depth** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **10-50cm** | **50-100cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | | | | | 150 | 87 | < 50 U |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | | | | | 9200 | 830 | 490 |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | | 1100 | 1000 | 450 | 3700 | 610 | 460 |
| Cyanide | 57-12-5 | | mg/kg | | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | | < 100 U | < 100 U | < 100 U | 170 | < 100 U | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | | < 0.1 U | 2 | 0.4 | 180 | 13 | 16 |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 24 | 8.9 | 11 | 4.6 | 40 | 8.3 | 6 |
| pH | PH | | SU | | 9.3 | 9.2 | 9.3 | 7.4 | 9.2 | 8 |
| Total Organic Carbon | TOC | | % | | 1.8 | 3.3 | 2 | 0.6 | 0.1 | 0.3 |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | | 1600 | 1800 | 1200 | 65000 | 3800 | 3000 |
| Arsenic | 7440-38-2 | **20** | mg/kg | | 8.2 | 9.7 | 5.1 | **30** | 3.4 | 1.9 |
| Barium | 7440-39-3 | | mg/kg | | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Beryllium | 7440-41-7 | | mg/kg | | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U |
| Boron | 7440-42-8 | | mg/kg | | < 10 U | < 10 U | < 10 U | 52 | < 10 U | < 10 U |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | | < 0.01 U | < 0.01 U | < 0.01 U | **1.6** | 0.04 | 0.06 |
| Calcium | 7440-70-2 | | mg/kg | | | | | 5600 | 2200 | 1200 |
| Cation Exchange Capacity | CEC | | meq/100g | | 0.69 | 0.67 | 0.76 | | | |
| Chromium, total | 7440-47-3 | 80 | mg/kg | | 2.6 | 2.8 | 1.8 | 22 | 6 | 4.2 |
| Cobalt | 7440-48-4 | 50 | mg/kg | | 1.1 | 1.3 | 0.8 | 4.1 | 1.8 | 1.5 |
| Copper | 7440-50-8 | 65 | mg/kg | | 1.4 | 1.5 | 1.4 | 58 | 2.3 | 2.2 |
| Hardness (As CaCO3) | HARD | | mg/kg | | | | | 35000 | 11000 | 7600 |
| Iron | 7439-89-6 | | mg/kg | | 4600 | 5300 | 3400 | 9400 | 5700 | 2800 |
| Lead | 7439-92-1 | **50** | mg/kg | | 0.8 | 0.8 | 0.9 | **58** | 2.5 | 1.6 |
| Lithium | 7439-93-2 | | mg/kg | | < 5 U | < 5 U | < 5 U | 24 | 10 | 8.8 |
| Magnesium | 7439-95-4 | | mg/kg | | | | | 5900 | 1300 | 960 |
| Manganese | 7439-96-5 | | mg/kg | | 70 | 69 | 54 | 88 | 67 | 45 |
| Mercury | 7439-97-6 | **0.15** | mg/kg | | < 0.01 U | 0.01 | < 0.01 U | < 0.01 U | 0.03 | < 0.01 U |
| Nickel | 7440-02-0 | **21** | mg/kg | | 1.8 | 1.8 | 1.2 | **260** | 6.7 | 7 |
| Titanium | 7440-32-6 | | mg/kg | | 150 | 160 | 100 | 440 | 290 | 220 |
| Vanadium | 7440-62-2 | | mg/kg | | 9.8 | 12 | 7 | 130 | 18 | 10 |
| Zinc | 7440-66-6 | **200** | mg/kg | | 6 | 6.3 | < 5 U | **530** | 24 | 36 |

# Table H-2
# Sediment Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | **Location ID** | **FARM TEST** | **ISA-01** | **ISA-02** | **ISA-03** | **NOD-01** | **NOD-01** | **NOD-01** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **SED-01** | **ISA-SE-01** | **ISA-SE-02** | **ISA-SE-03** | **NOD-SE-01_0-10cm** | **NOD-SE-01_10-50cm** | **NOD-SE-01_50-100cm** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **22 Jan 2023** | **24 Jan 2023** | **24 Jan 2023** | **24 Jan 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** |
| | | | **Sample Depth** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **10-50cm** | **50-100cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.1** | 0.03 | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.63 | 0.32 | 0.16 |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.37 | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.4** | **0.13** | **0.13** |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.04 | 0.04 | 0.04 | 0.04 | 0.78 | 0.21 | 0.19 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.08 | 0.08 | 0.08 | 0.08 | 0.78 | 0.23 | 0.2 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.78 | 0.19 | 0.17 |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.28** | 0.07 | 0.03 |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **1.2** | **0.26** | 0.18 |
| Chrysene | 218-01-9 | **0.108** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **1.4** | **0.17** | 0.09 |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.1** | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.97** | **0.12** | 0.09 |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.37** | < 0.03 U | **0.05** |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.1** | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.47** | 0.11 | 0.07 |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | **10.67** | 6 | 2.67 |

**Table H-2**
**Sediment Sampling Results**
**Coastal Marine Area Report**
**Environment Southland**
**Tiwai, NZ**

| | | | Location ID | NOD-02 | NOD-02 | NOD-02 | NOD-03 | NOD-03 | NOD-03 | NOD-04 | NOD-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | NOD-SE-02_0-10cm | NOD-SE-02_10-50cm | NOD-SE-02_50-100cm | NOD-SE-03_0-10cm | NOD-SE-03_10-50cm | NOD-SE-03_50-100cm | NOD-SE-04_0-10cm | NOD-SE-04_10-50cm |
| | | | Matrix | SE | SE | SE | SE | SE | SE | SE | SE |
| | | | Sample Date | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 03 Feb 2023 | 03 Feb 2023 |
| | | | Sample Depth | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm |
| Chemical | CAS No. | Sediment Ecological Screening Criteria | Unit | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual |
| **GENERAL CHEMISTRY** | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | 130 | 53 | < 50 U | 53 | < 50 U | < 50 U | 110 | < 50 U |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | 1500 | 1300 | 2000 | 1500 | 1200 | 1500 | 2000 | 1400 |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | 970 | 1100 | 890 | 1000 | 960 | 1000 | 1300 | 950 |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | 200 | 110 | 150 | **310** | 200 | < 100 U | 120 | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | 120 | 40 | 4.7 | 50 | 10 | 4.6 | 200 | 5.4 |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | | |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 15 | 7.2 | 11 | 11 | 6.3 | 10 | 18 | 11 |
| pH | PH | | SU | 8.2 | 8 | 7.6 | 8 | 7.9 | 7.5 | 7.9 | 7.7 |
| Total Organic Carbon | TOC | | % | 0.3 | 0.2 | 0.8 | 0.3 | 0.1 | < 0.1 U | 0.5 | 27 |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 10000 | 5600 | 2800 | 2800 | 3200 | 3400 | 9800 | 3600 |
| Arsenic | 7440-38-2 | **20** | mg/kg | 4.4 | 2.6 | 0.8 | 1.8 | 3.1 | 1.1 | 4.1 | 1.8 |
| Barium | 7440-39-3 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U |
| Boron | 7440-42-8 | | mg/kg | 11 | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | 0.16 | 0.07 | 0.02 | 0.06 | 0.06 | 0.03 | 0.14 | 0.04 |
| Calcium | 7440-70-2 | | mg/kg | 4600 | 4000 | 1100 | 1700 | 1800 | 2100 | 2800 | 1300 |
| Cation Exchange Capacity | CEC | | meq/100g | | | | | | | | |
| Chromium, total | 7440-47-3 | 80 | mg/kg | 5.5 | 6.5 | 3.5 | 3.7 | 5.6 | 5.1 | 6.6 | 5 |
| Cobalt | 7440-48-4 | 50 | mg/kg | 1.6 | 2.4 | 1.2 | 1.2 | 1.6 | 1.7 | 2.1 | 1.8 |
| Copper | 7440-50-8 | 65 | mg/kg | 8.7 | 5.2 | 1.7 | 2 | 2.1 | 2.2 | 7 | 2.1 |
| Hardness (As CaCO3) | HARD | | mg/kg | 29000 | 25000 | 7000 | 11000 | 11000 | 9900 | 18000 | 7900 |
| Iron | 7439-89-6 | | mg/kg | 4600 | 5400 | 3000 | 3100 | 4600 | 4500 | 5300 | 4900 |
| Lead | 7439-92-1 | **50** | mg/kg | 7.2 | 3 | 1.3 | 1.6 | 1.9 | 1.6 | 6.1 | 1.8 |
| Lithium | 7439-93-2 | | mg/kg | 9.9 | 6.4 | 6.3 | < 5 U | 6.3 | 6.7 | 6 | < 5 U |
| Magnesium | 7439-95-4 | | mg/kg | 1800 | 960 | 910 | 660 | 1200 | 1100 | 1300 | 660 |
| Manganese | 7439-96-5 | | mg/kg | 62 | 94 | 51 | 45 | 67 | 70 | 78 | 70 |
| Mercury | 7439-97-6 | **0.15** | mg/kg | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | 0.02 | 0.01 | < 0.01 U | < 0.01 U |
| Nickel | 7440-02-0 | **21** | mg/kg | **39** | 11 | 3.1 | 5.4 | 4.9 | 3.6 | **34** | 4.1 |
| Titanium | 7440-32-6 | | mg/kg | 330 | 380 | 230 | 200 | 330 | 360 | 450 | 370 |
| Vanadium | 7440-62-2 | | mg/kg | 30 | 22 | 8.8 | 13 | 14 | 15 | 30 | 20 |
| Zinc | 7440-66-6 | **200** | mg/kg | 95 | 42 | 16 | 26 | 20 | 17 | 75 | 15 |

**Table H-2**
**Sediment Sampling Results**
**Coastal Marine Area Report**
**Environment Southland**
**Tiwai, NZ**

| | | | Location ID | NOD-02 | NOD-02 | NOD-02 | NOD-03 | NOD-03 | NOD-03 | NOD-04 | NOD-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | NOD-SE-02_0-10cm | NOD-SE-02_10-50cm | NOD-SE-02_50-100cm | NOD-SE-03_0-10cm | NOD-SE-03_10-50cm | NOD-SE-03_50-100cm | NOD-SE-04_0-10cm | NOD-SE-04_10-50cm |
| | | | Matrix | SE | SE | SE | SE | SE | SE | SE | SE |
| | | | Sample Date | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 03 Feb 2023 | 03 Feb 2023 |
| | | | Sample Depth | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | 0.24 | 0.12 | < 0.03 U | < 0.03 U | 0.06 | < 0.03 U | 0.2 | 0.03 |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | 0.28 | 0.12 | < 0.03 U | < 0.03 U | 0.05 | < 0.03 U | 0.24 | 0.03 |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | 0.08 | 0.04 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.18** | < 0.03 U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.17 | 0.09 | 0.04 | 0.04 | 0.05 | 0.04 | 0.26 | 0.04 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.19 | 0.11 | 0.08 | 0.08 | 0.08 | 0.08 | 0.28 | 0.08 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | 0.16 | 0.08 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.24 | < 0.03 U |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | 0.04 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | 0.22 | 0.11 | < 0.03 U | < 0.03 U | 0.04 | < 0.03 U | 0.18 | < 0.03 U |
| Chrysene | 218-01-9 | **0.108** | mg/kg | **0.2** | 0.09 | < 0.03 U | < 0.03 U | 0.03 | < 0.03 U | **0.17** | < 0.03 U |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | 0.08 | 0.04 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.07 | < 0.03 U |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | 0.05 | 0.03 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.04 | < 0.03 U |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | 4 | 3 | < 0.1 U | < 0.1 U | 1 | < 0.1 U | 2.2 | < 0.1 U |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | **NOD-04** | **NOD-05** | **NOD-05** | **NOD-05** | **NOD-T1-01** | **NOD-T1-02** | **NOD-T1-04** | **NOD-T1-05** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **NOD-SE-04_50-100cm** | **NOD-SE-05_0-10cm** | **NOD-SE-05_10-50cm** | **NOD-SE-05_50-100cm** | **NOD-SE-T100E-147m** | **NOD-SE-T100E-100m** | **NOD-SE-T100W-25m** | **NOD-SE-T100W-50m** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** |
| | | | **Sample Depth** | **50-100cm** | **0-10cm** | **10-50cm** | **50-100cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | < 50 U | 78 | < 50 U | < 50 U | | | | |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | 1700 | 3200 | 1600 | 2700 | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | 950 | 1300 | 1000 | 1300 | | | | |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | **480** | 210 | 210 | **370** | < 100 U | < 100 U | < 100 U | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | 4.4 | 200 | 6 | 2.4 | < 0.1 U | 5.8 | 57 | < 0.1 U |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | | |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 11 | 19 | 9.4 | 15 | 16 | 12 | 16 | 23 |
| pH | PH | | SU | 7.7 | 7.8 | 7.6 | 7.4 | | | | |
| Total Organic Carbon | TOC | | % | < 0.1 U | < 0.1 U | 6.3 | < 0.1 U | | | | |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 3100 | 6700 | 3300 | 2400 | | | | |
| Arsenic | 7440-38-2 | **20** | mg/kg | 1 | 3.4 | 2.8 | 1.2 | | | | |
| Barium | 7440-39-3 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | | | | |
| Beryllium | 7440-41-7 | | mg/kg | < 2 U | < 2 U | < 2 U | < 2 U | | | | |
| Boron | 7440-42-8 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | | | | |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | < 0.01 U | 0.1 | 0.05 | < 0.01 U | | | | |
| Calcium | 7440-70-2 | | mg/kg | 1600 | 2800 | 2200 | 1700 | | | | |
| Cation Exchange Capacity | CEC | | meq/100g | | | | | | | | |
| Chromium, total | 7440-47-3 | 80 | mg/kg | 4.2 | 4.3 | 4.9 | 3.3 | | | | |
| Cobalt | 7440-48-4 | 50 | mg/kg | 1.9 | 1.5 | 1.6 | 1.4 | | | | |
| Copper | 7440-50-8 | 65 | mg/kg | 1.9 | 5 | 3 | 1.6 | | | | |
| Hardness (As CaCO3) | HARD | | mg/kg | 10000 | 18000 | 14000 | 11000 | | | | |
| Iron | 7439-89-6 | | mg/kg | 4700 | 3900 | 4500 | 3100 | | | | |
| Lead | 7439-92-1 | **50** | mg/kg | 1.3 | 4.5 | 2.1 | 1 | | | | |
| Lithium | 7439-93-2 | | mg/kg | < 5 U | < 5 U | 7.5 | 6 | | | | |
| Magnesium | 7439-95-4 | | mg/kg | 870 | 1100 | 1400 | 1000 | | | | |
| Manganese | 7439-96-5 | | mg/kg | 71 | 55 | 58 | 49 | | | | |
| Mercury | 7439-97-6 | **0.15** | mg/kg | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | | | | |
| Nickel | 7440-02-0 | **21** | mg/kg | 3.3 | **27** | 5.3 | 2.6 | | | | |
| Titanium | 7440-32-6 | | mg/kg | 290 | 290 | 300 | 250 | | | | |
| Vanadium | 7440-62-2 | | mg/kg | 14 | 23 | 17 | 11 | | | | |
| Zinc | 7440-66-6 | **200** | mg/kg | 11 | 50 | 21 | 7 | | | | |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | **NOD-04** | **NOD-05** | **NOD-05** | **NOD-05** | **NOD-T1-01** | **NOD-T1-02** | **NOD-T1-04** | **NOD-T1-05** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **NOD-SE-04_50-100cm** | **NOD-SE-05_0-10cm** | **NOD-SE-05_10-50cm** | **NOD-SE-05_50-100cm** | **NOD-SE-T100E-147m** | **NOD-SE-T100E-100m** | **NOD-SE-T100W-25m** | **NOD-SE-T100W-50m** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** |
| | | | **Sample Depth** | **50-100cm** | **0-10cm** | **10-50cm** | **50-100cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.18 | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.21 | 0.09 | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.05 | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.04 | 0.04 | 0.04 | 0.04 | 0.12 | 0.04 | 0.04 | 0.04 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.08 | 0.08 | 0.08 | 0.08 | 0.14 | 0.08 | 0.08 | 0.08 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.11 | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.14 | < 0.03 U | < 0.03 U | < 0.03 U |
| Chrysene | 218-01-9 | **0.108** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.15** | 0.03 | < 0.03 U | < 0.03 U |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.11 | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | 0.8** | 0.1** | < 0.1 U | < 0.1 U |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | **NOD-T1-06** | **NOD-T1-07** | **NOD-T1-08** | **SCL-01** | **SCL-02** | **SCL-03** | **SOD-01** | **SOD-01** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **NOD-SE-T100W-100m** | **NOD-SE-T100W-150m** | **NOD-SE-T100W-200m** | **SCL-SE-01** | **SCL-SE-02** | **SCL-SE-03** | **SOD-SE-01_0-10cm** | **SOD-SE-01_10-50cm** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **03 Feb 2023** | **03 Feb 2023** | **03 Feb 2023** | **23 Jan 2023** | **23 Jan 2023** | **23 Jan 2023** | **26 Jan 2023** | **26 Jan 2023** |
| | | | **Sample Depth** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **0-10cm** | **10-50cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | | | | 840 | 440 | 530 | 1300 | 500 |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | < 100 U | 150 | < 100 U | 180 | < 100 U | 110 | < 100 U | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | 1.5 | 3.1 | 2.7 | 2.1 | 2.9 |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | | |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 17 | 22 | 21 | 5 | 2.6 | 3.3 | 8.2 | 8.9 |
| pH | PH | | SU | | | | 7.8 | 7.9 | 8.3 | 7.8 | 7.7 |
| Total Organic Carbon | TOC | | % | | | | < 0.1 U | < 0.1 U | < 0.1 U | 0.1 | 0.2 |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | | | | 1500 | 1500 | 1400 | 3300 | 4200 |
| Arsenic | 7440-38-2 | **20** | mg/kg | | | | 7.4 | 9 | 8.5 | 3.3 | 1.5 |
| Barium | 7440-39-3 | | mg/kg | | | | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Beryllium | 7440-41-7 | | mg/kg | | | | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U |
| Boron | 7440-42-8 | | mg/kg | | | | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | | | | < 0.01 U | < 0.01 U | < 0.01 U | 0.08 | 0.07 |
| Calcium | 7440-70-2 | | mg/kg | | | | | | | | |
| Cation Exchange Capacity | CEC | | meq/100g | | | | 25 | 24 | 24 | 1.3 | 1 |
| Chromium, total | 7440-47-3 | 80 | mg/kg | | | | 2.3 | 1.9 | 2 | 6.6 | 5.4 |
| Cobalt | 7440-48-4 | 50 | mg/kg | | | | 1.1 | 1.2 | 1 | 2.4 | 2.3 |
| Copper | 7440-50-8 | 65 | mg/kg | | | | 1.2 | 1.3 | 1.1 | 41 | 3.1 |
| Hardness (As CaCO3) | HARD | | mg/kg | | | | | | | | |
| Iron | 7439-89-6 | | mg/kg | | | | 4300 | 5000 | 4500 | 15000 | 5600 |
| Lead | 7439-92-1 | **50** | mg/kg | | | | 0.7 | 0.7 | 0.7 | 2.8 | 1.4 |
| Lithium | 7439-93-2 | | mg/kg | | | | < 5 U | < 5 U | < 5 U | 11 | 13 |
| Magnesium | 7439-95-4 | | mg/kg | | | | | | | | |
| Manganese | 7439-96-5 | | mg/kg | | | | 58 | 64 | 59 | 100 | 73 |
| Mercury | 7439-97-6 | **0.15** | mg/kg | | | | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U |
| Nickel | 7440-02-0 | **21** | mg/kg | | | | 1.6 | 1.6 | 1.6 | 5.7 | 4.2 |
| Titanium | 7440-32-6 | | mg/kg | | | | 150 | 120 | 130 | 280 | 280 |
| Vanadium | 7440-62-2 | | mg/kg | | | | 10 | 11 | 9.8 | 21 | 21 |
| Zinc | 7440-66-6 | **200** | mg/kg | | | | < 5 U | 5.7 | < 5 U | 70 | 14 |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | Location ID | NOD-T1-06 | NOD-T1-07 | NOD-T1-08 | SCL-01 | SCL-02 | SCL-03 | SOD-01 | SOD-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | NOD-SE-T100W-100m | NOD-SE-T100W-150m | NOD-SE-T100W-200m | SCL-SE-01 | SCL-SE-02 | SCL-SE-03 | SOD-SE-01_0-10cm | SOD-SE-01_10-50cm |
| | | | Matrix | SE | SE | SE | SE | SE | SE | SE | SE |
| | | | Sample Date | 03 Feb 2023 | 03 Feb 2023 | 03 Feb 2023 | 23 Jan 2023 | 23 Jan 2023 | 23 Jan 2023 | 26 Jan 2023 | 26 Jan 2023 |
| | | | Sample Depth | 0-10cm | 0-10cm | 0-10cm | 0-10cm | 0-10cm | 0-10cm | 0-10cm | 10-50cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Chrysene | 218-01-9 | **0.108** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | Location ID | SOD-02 | SOD-02 | SOD-02 | SOD-03 | SOD-03 | SOD-03 | SOD-04 | SOD-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | SOD-SE-02_0-10cm | SOD-SE-02_10-50cm | SOD-SE-02_50-100cm | SOD-SE-03_0-10cm | SOD-SE-03_10-50cm | SOD-SE-03_50-100cm | SOD-SE-04_0-10cm | SOD-SE-04_10-50cm |
| | | | Matrix | SE | SE | SE | SE | SE | SE | SE | SE |
| | | | Sample Date | 26 Jan 2023 | 26 Jan 2023 | 26 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 |
| | | | Sample Depth | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm |
| Chemical | CAS No. | Sediment Ecological Screening Criteria | Unit | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual |
| **GENERAL CHEMISTRY** | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | 1200 | 1000 | 500 | 960 | 550 | 870 | 2400 | 1200 |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | < 100 U | 180 | 270 | 160 | **570** | < 100 U | < 100 U | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | < 0.1 U | 5.4 | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | | |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 8.3 | 13 | 9 | 8.6 | 7.6 | 15 | 16 | 7 |
| pH | PH | | SU | 7.4 | 6.9 | 7 | 7.4 | 7.3 | 6.9 | 7.1 | 7.8 |
| Total Organic Carbon | TOC | | % | 0.2 | 0.5 | 0.4 | 0.2 | 0.2 | < 0.1 U | 0.3 | < 0.1 U |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 3400 | 6500 | 6600 | 4700 | 4200 | 3100 | 3200 | 2300 |
| Arsenic | 7440-38-2 | **20** | mg/kg | 2.8 | 6.3 | 3.2 | 4.7 | 3.6 | 2.1 | 6.4 | 2.4 |
| Barium | 7440-39-3 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U |
| Boron | 7440-42-8 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | 0.04 | 0.04 | 0.04 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 |
| Calcium | 7440-70-2 | | mg/kg | | | | | | | | |
| Cation Exchange Capacity | CEC | | meq/100g | 1.6 | 3.4 | 2.4 | 2.1 | 1.2 | 0.59 | 3.8 | 7.9 |
| Chromium, total | 7440-47-3 | 80 | mg/kg | 4.8 | 11 | 7.8 | 8.1 | 6.4 | 5.1 | 6.9 | 4.6 |
| Cobalt | 7440-48-4 | 50 | mg/kg | 1.8 | 3.2 | 3.5 | 2.6 | 2.1 | 2 | 1.8 | 1.6 |
| Copper | 7440-50-8 | 65 | mg/kg | 3.2 | 2.8 | 4 | 3 | 2.7 | 2 | 2.6 | 2.4 |
| Hardness (As CaCO3) | HARD | | mg/kg | | | | | | | | |
| Iron | 7439-89-6 | | mg/kg | 5200 | 9200 | 9600 | 8100 | 6300 | 5300 | 6100 | 4800 |
| Lead | 7439-92-1 | **50** | mg/kg | 2.5 | 2.2 | 2.7 | 2.7 | 1.9 | 1.6 | 1.7 | 1.3 |
| Lithium | 7439-93-2 | | mg/kg | 12 | 29 | 25 | 22 | 18 | 9.6 | 11 | 9.6 |
| Magnesium | 7439-95-4 | | mg/kg | | | | | | | | |
| Manganese | 7439-96-5 | | mg/kg | 77 | 93 | 120 | 110 | 73 | 72 | 73 | 66 |
| Mercury | 7439-97-6 | **0.15** | mg/kg | < 0.01 U | 0.06 | 0.01 | 0.04 | < 0.01 U | < 0.01 U | 0.04 | < 0.01 U |
| Nickel | 7440-02-0 | **21** | mg/kg | 4.2 | 6.2 | 6.9 | 6 | 5.2 | 3.6 | 4.3 | 3.4 |
| Titanium | 7440-32-6 | | mg/kg | 280 | 380 | 570 | 370 | 320 | 400 | 380 | 250 |
| Vanadium | 7440-62-2 | | mg/kg | 21 | 45 | 40 | 28 | 20 | 17 | 21 | 16 |
| Zinc | 7440-66-6 | **200** | mg/kg | 54 | 15 | 22 | 21 | 13 | 9.1 | 16 | 11 |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | **SOD-02** | **SOD-02** | **SOD-02** | **SOD-03** | **SOD-03** | **SOD-03** | **SOD-04** | **SOD-04** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **SOD-SE-02_0-10cm** | **SOD-SE-02_10-50cm** | **SOD-SE-02_50-100cm** | **SOD-SE-03_0-10cm** | **SOD-SE-03_10-50cm** | **SOD-SE-03_50-100cm** | **SOD-SE-04_0-10cm** | **SOD-SE-04_10-50cm** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **26 Jan 2023** | **26 Jan 2023** | **26 Jan 2023** | **25 Jan 2023** | **25 Jan 2023** | **25 Jan 2023** | **25 Jan 2023** | **25 Jan 2023** |
| | | | **Sample Depth** | **0-10cm** | **10-50cm** | **50-100cm** | **0-10cm** | **10-50cm** | **50-100cm** | **0-10cm** | **10-50cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | 0.22 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | 0.03 | < 0.03 U | < 0.03 U | 0.09 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | **0.19** | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.04 | 0.04 | 0.04 | 0.27 | 0.04 | 0.04 | 0.04 | 0.04 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.08 | 0.08 | 0.08 | 0.28 | 0.08 | 0.08 | 0.08 | 0.08 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | 0.25 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | 0.08 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | 0.12 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Chrysene | 218-01-9 | **0.108** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | **0.16** | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | **0.35** | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | **0.12** | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | **0.16** | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | **0.25** | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | < 0.1 U | < 0.1 U | < 0.1 U | 8.5 | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Location ID** | **SOD-04** | **WLF-01** | **WLF-01** | **WLF-01** | **WLF-02** | **WLF-02** | **WLF-02** | **WLF-03** |
| | | | **Sample ID** | **SOD-SE-04_50-100cm** | **WLF-SE-01-0-10cm** | **WLF-SE-01-10-50cm** | **WLF-SE-01-50-100cm** | **WLF-SE-02_0-10cm** | **WLF-SE-02_10-50cm** | **WLF-SE-02_50-100cm** | **WLF-SE-03_0-10cm** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **25 Jan 2023** | **26 Jan 2023** | **26 Jan 2023** | **26 Jan 2023** | **31 Jan 2023** | **31 Jan 2023** | **31 Jan 2023** | **31 Jan 2023** |
| | | | **Sample Depth** | **50-100cm** | **0-10cm** | **10-50cm** | **50-100cm** | **0-10cm** | **10-50cm** | **50-100cm** | **0-10cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | 1300 | 1300 | 790 | 1300 | 2200 | 4500 | 370 | 1000 |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | < 100 U | < 100 U | < 100 U | < 100 U | 100 | < 100 U | **310** | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | 2 | 3.1 | 11 | 1.1 |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | | |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 8.5 | 15 | 22 | 32 | 19 | 34 | 83 | 16 |
| pH | PH | | SU | 7.1 | 8 | 7.6 | 7.7 | 7.3 | 7.7 | 7.3 | 7.5 |
| Total Organic Carbon | TOC | | % | 0.1 | 0.1 | 1.8 | 0.5 | 0.5 | 2.5 | 46 | 0.1 |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 2400 | 2900 | 19000 | 10000 | 3000 | 8700 | 1600 | 3000 |
| Arsenic | 7440-38-2 | **20** | mg/kg | 3.4 | 4 | 1.2 | 2.5 | 3 | 4.2 | 1.4 | 3.4 |
| Barium | 7440-39-3 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U |
| Boron | 7440-42-8 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | 11 | 33 | 370 | < 10 U |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | 0.02 | 0.04 | 0.04 | 0.04 | 0.02 | 0.12 | 0.02 | 0.03 |
| Calcium | 7440-70-2 | | mg/kg | | | | | | | | |
| Cation Exchange Capacity | CEC | | meq/100g | 7.2 | 24 | 6.8 | 29 | 0.87 | 2.6 | 11 | 0.73 |
| Chromium, total | 7440-47-3 | 80 | mg/kg | 4 | 5 | 21 | 14 | 5.4 | 15 | 2.3 | 5.7 |
| Cobalt | 7440-48-4 | 50 | mg/kg | 1.4 | 2.1 | 6.7 | 2.3 | 1.7 | 4.8 | 0.4 | 1.9 |
| Copper | 7440-50-8 | 65 | mg/kg | 1.7 | 3 | 17 | 8.1 | 2.2 | 9.1 | 3.3 | 2.2 |
| Hardness (As CaCO3) | HARD | | mg/kg | | | | | | | | |
| Iron | 7439-89-6 | | mg/kg | 4400 | 6000 | 15000 | 11000 | 4400 | 14000 | 13000 | 4800 |
| Lead | 7439-92-1 | **50** | mg/kg | 1.3 | 3.9 | 6.5 | 4.6 | 1.8 | 4 | 0.7 | 1.9 |
| Lithium | 7439-93-2 | | mg/kg | 9 | 7.4 | 25 | 24 | < 5 U | 12 | < 5 U | 5.7 |
| Magnesium | 7439-95-4 | | mg/kg | | | | | | | | |
| Manganese | 7439-96-5 | | mg/kg | 73 | 86 | 150 | 100 | 71 | 200 | 16 | 79 |
| Mercury | 7439-97-6 | **0.15** | mg/kg | < 0.01 U | < 0.01 U | 0.04 | 0.07 | < 0.01 U | < 0.01 U | **0.38** | < 0.01 U |
| Nickel | 7440-02-0 | **21** | mg/kg | 3.1 | 3.3 | 17 | 7.5 | 3.3 | 12 | 1.1 | 3.3 |
| Titanium | 7440-32-6 | | mg/kg | 210 | 380 | 1400 | 1100 | 360 | 1000 | 140 | 400 |
| Vanadium | 7440-62-2 | | mg/kg | 14 | 21 | 80 | 43 | 18 | 47 | 12 | 19 |
| Zinc | 7440-66-6 | **200** | mg/kg | 8.5 | 17 | 33 | 14 | 11 | 29 | < 5 U | 13 |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

|  |  |  | Location ID | SOD-04 | WLF-01 | WLF-01 | WLF-01 | WLF-02 | WLF-02 | WLF-02 | WLF-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | Sample ID | SOD-SE-04_50-100cm | WLF-SE-01-0-10cm | WLF-SE-01-10-50cm | WLF-SE-01-50-100cm | WLF-SE-02_0-10cm | WLF-SE-02_10-50cm | WLF-SE-02_50-100cm | WLF-SE-03_0-10cm |
|  |  |  | Matrix | SE | SE | SE | SE | SE | SE | SE | SE |
|  |  |  | Sample Date | 25 Jan 2023 | 26 Jan 2023 | 26 Jan 2023 | 26 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 |
|  |  |  | Sample Depth | 50-100cm | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm | 50-100cm | 0-10cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** |  |  |  |  |  |  |  |  |  |  |  |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.06** | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 |  | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]anthracene | 56-55-3 |  | mg/kg | < 0.03 U | 0.07 | < 0.03 U | 0.15 | < 0.03 U | 0.09 | 0.12 | < 0.03 U |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.06 | **8.5** | < 0.03 U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL |  | mg/kg | 0.04 | 0.04 | 0.04 | 0.13 | 0.04 | 0.09 | 9.2 | 0.1 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL |  | mg/kg | 0.08 | 0.08 | 0.08 | 0.15 | 0.08 | 0.11 | 9.2 | 0.13 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL |  | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | 0.11 | < 0.03 U | 0.07 | 9.2 | 0.08 |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | **0.25** | < 0.03 U | **0.33** | **0.53** | < 0.03 U |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Chrysene | 218-01-9 | **0.108** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | 0.04 | < 0.03 U | 0.03 | < 0.03 U | < 0.03 U |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | **0.09** | < 0.03 U | < 0.03 U | **0.65** | **0.08** |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | 0.09 | < 0.03 U | 0.03 | 0.06 | < 0.03 U |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | **0.12** | < 0.03 U |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | 0.09 | < 0.03 U | 0.06 | < 0.03 U | < 0.03 U |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | < 0.1 U | < 0.1 U | < 0.1 U | 1.4 | < 0.1 U | 0.24 | 1 | < 0.1 U |

# Table H-2
# Sediment Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | Location ID | WLF-03 | WLF-03 | WOD-01 | WOD-01 | WOD-01 | WOD-02 | WOD-02 | WOD-02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | WLF-SE-03_10-50cm | WLF-SE-03_50-100cm | WOD-SE-01_0-10cm | WOD-SE-01_10-50cm | WOD-SE-01_50-100cm | WOD-SE-02_0-10cm | WOD-SE-02_10-50cm | WOD-SE-02_50-100cm |
| | | | Matrix | SE | SE | SE | SE | SE | SE | SE | SE |
| | | | Sample Date | 31 Jan 2023 | 31 Jan 2023 | 30 Jan 2023 | 30 Jan 2023 | 30 Jan 2023 | 30 Jan 2023 | 30 Jan 2023 | 30 Jan 2023 |
| | | | Sample Depth | 10-50cm | 50-100cm | 0-10cm | 10-50cm | 50-100cm | 0-10cm | 10-50cm | 50-100cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | | | | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | 1400 | 64 | 220 | 770 | 580 | 430 | 2400 | 750 |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | < 100 U | < 100 U | < 100 U | < 100 U | < 100 U | < 100 U | < 100 U | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | 1.3 | 2.6 | 0.5 | 0.2 | < 0.1 U | < 0.1 U | 4 | 2.7 |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | | |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 20 | 19 | 10 | 7.9 | 2.7 | 8.4 | 9.6 | 10 |
| pH | PH | | SU | 7.9 | 7.1 | 7.5 | 7.2 | 6.5 | 8 | 8.2 | 6.6 |
| Total Organic Carbon | TOC | | % | 15 | 0.1 | 0.2 | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | 0.1 |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 8000 | 16000 | 2900 | 2500 | 2500 | 2500 | 2700 | 2200 |
| Arsenic | 7440-38-2 | **20** | mg/kg | 1.4 | 0.9 | 2.5 | 1.3 | 0.8 | 1.9 | 1.6 | 1 |
| Barium | 7440-39-3 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Beryllium | 7440-41-7 | | mg/kg | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U |
| Boron | 7440-42-8 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | 0.03 | 0.04 | 0.03 | 0.02 | 0.02 | 0.04 | 0.04 | 0.02 |
| Calcium | 7440-70-2 | | mg/kg | | | | | | | | |
| Cation Exchange Capacity | CEC | | meq/100g | 0.83 | 5.6 | 8.7 | 4.6 | 0.42 | 0.28 | 3.6 | 0.1 |
| Chromium, total | 7440-47-3 | 80 | mg/kg | 11 | 24 | 3 | 3.9 | 3.4 | 5.6 | 6.7 | 3.2 |
| Cobalt | 7440-48-4 | 50 | mg/kg | 2.4 | 6.2 | 1.8 | 1.4 | 1.3 | 1.6 | 1.7 | 1.3 |
| Copper | 7440-50-8 | 65 | mg/kg | 5.7 | 12 | 2.6 | 1.4 | 1.3 | 1.8 | 2.4 | 2 |
| Hardness (As CaCO3) | HARD | | mg/kg | | | | | | | | |
| Iron | 7439-89-6 | | mg/kg | 6800 | 11000 | 6000 | 4000 | 3600 | 4100 | 4500 | 3700 |
| Lead | 7439-92-1 | **50** | mg/kg | 3.2 | 5.2 | 1.8 | 1.4 | 1.2 | 3.4 | 1.9 | 1.1 |
| Lithium | 7439-93-2 | | mg/kg | 10 | 8.4 | 5.3 | < 5 U | < 5 U | < 5 U | 5.4 | < 5 U |
| Magnesium | 7439-95-4 | | mg/kg | | | | | | | | |
| Manganese | 7439-96-5 | | mg/kg | 90 | 120 | 87 | 69 | 76 | 64 | 70 | 65 |
| Mercury | 7439-97-6 | **0.15** | mg/kg | 0.01 | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | 0.01 |
| Nickel | 7440-02-0 | **21** | mg/kg | 6.3 | 16 | 3.4 | 3 | 3 | 5.9 | 3.6 | 2.7 |
| Titanium | 7440-32-6 | | mg/kg | 560 | 520 | 310 | 280 | 240 | 310 | 370 | 180 |
| Vanadium | 7440-62-2 | | mg/kg | 34 | 66 | 17 | 13 | 11 | 16 | 17 | 8.7 |
| Zinc | 7440-66-6 | **200** | mg/kg | 15 | 32 | 35 | 17 | 17 | 32 | 11 | 9.6 |

### Table H-2
### Sediment Sampling Results
### Coastal Marine Area Report
### Environment Southland
### Tiwai, NZ

| | | | Location ID | WLF-03 | WLF-03 | WOD-01 | WOD-01 | WOD-01 | WOD-02 | WOD-02 | WOD-02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **WLF-SE-03_10-50cm** | **WLF-SE-03_50-100cm** | **WOD-SE-01_0-10cm** | **WOD-SE-01_10-50cm** | **WOD-SE-01_50-100cm** | **WOD-SE-02_0-10cm** | **WOD-SE-02_10-50cm** | **WOD-SE-02_50-100cm** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **31 Jan 2023** | **31 Jan 2023** | **30 Jan 2023** | **30 Jan 2023** | **30 Jan 2023** | **30 Jan 2023** | **30 Jan 2023** | **30 Jan 2023** |
| | | | **Sample Depth** | **10-50cm** | **50-100cm** | **0-10cm** | **10-50cm** | **50-100cm** | **0-10cm** | **10-50cm** | **50-100cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | < 0.03 U | < 0.03 U | 0.16 | < 0.03 U | < 0.03 U | 0.08 | 0.03 | < 0.03 U |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | < 0.03 U | < 0.03 U | 0.26 | < 0.03 U | < 0.03 U | 0.04 | 0.04 | < 0.03 U |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | 0.04 | < 0.03 U | **0.09** | < 0.03 U | < 0.03 U | < 0.03 U | 0.03 | < 0.03 U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.06 | 0.04 | 0.16 | 0.04 | 0.04 | 0.05 | 0.06 | 0.04 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.09 | 0.08 | 0.18 | 0.08 | 0.08 | 0.09 | 0.08 | 0.08 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | 0.04 | < 0.03 U | 0.14 | < 0.03 U | < 0.03 U | < 0.03 U | 0.04 | < 0.03 U |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | < 0.03 U | 0.03 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | < 0.03 U | < 0.03 U | 0.1 | < 0.03 U | < 0.03 U | 0.08 | 0.03 | < 0.03 U |
| Chrysene | 218-01-9 | **0.108** | mg/kg | < 0.03 U | < 0.03 U | 0.06 | < 0.03 U | < 0.03 U | 0.04 | 0.03 | < 0.03 U |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | < 0.03 U | < 0.03 U | **0.12** | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | < 0.03 U | < 0.03 U | 0.11 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | < 0.1 U | < 0.1 U | 4.5 | < 0.1 U | < 0.1 U | 0.2 | 0.2 | < 0.1 U |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | Location ID | WOD-03 | WOD-03 | WOD-03 | WOD-04 | WOD-04 | WOD-04 | WOD-05 | WOD-T1-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample ID** | **WOD-SE-03_0-10cm** | **WOD-SE-03_10-50cm** | **WOD-SE-03_50-100cm** | **NOD-SE-75m_50-** | **WOD-SE-75m_0-10cm** | **WOD-SE-75m_10-50cm** | **WOD-SE-04_0-10cm** | **WOD-SO-T25-10mN** |
| | | | **Matrix** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** | **SE** |
| | | | **Sample Date** | **30 Jan 2023** | **30 Jan 2023** | **30 Jan 2023** | **01 Feb 2023** | **01 Feb 2023** | **01 Feb 2023** | **01 Feb 2023** | **01 Feb 2023** |
| | | | **Sample Depth** | **0-10cm** | **10-50cm** | **50-100cm** | **50-100cm** | **0-10cm** | **10-50cm** | **0-10cm** | **0-10cm** |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | | | | 100 | 73 | 56 | 140 | |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | | | | 710 | 1000 | 1400 | 1700 | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | 86 | 380 | 3400 | 490 | 750 | 980 | 1100 | |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | < 100 U | < 100 U | < 100 U | **360** | < 100 U | **460** | 120 | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | 2.5 | 2.8 | 2.6 | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | 3.2 |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | | | | | | | | 2.38 |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | | | | | | | | 0.07 |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 8 | 8.8 | 8.2 | 8.9 | 11 | 12 | 13 | 11 |
| pH | PH | | SU | 6.2 | 6.3 | 6.4 | 8.2 | 7.1 | 7.7 | 7.9 | |
| Total Organic Carbon | TOC | | % | 0.2 | 0.2 | < 0.1 U | 0.2 | 0.5 | 0.2 | 0.5 | |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | 3000 | 2600 | 2100 | 2800 | 2400 | 2400 | 2600 | |
| Arsenic | 7440-38-2 | **20** | mg/kg | 1.7 | 1.7 | 0.7 | 3.2 | 1.6 | 3.3 | 1.7 | |
| Barium | 7440-39-3 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | |
| Beryllium | 7440-41-7 | | mg/kg | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | < 2 U | |
| Boron | 7440-42-8 | | mg/kg | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | < 10 U | |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | 0.03 | 0.05 | < 0.01 U | < 0.01 U | 0.04 | 0.04 | 0.04 | |
| Calcium | 7440-70-2 | | mg/kg | | | | 23000 | 1900 | 31000 | 4100 | |
| Cation Exchange Capacity | CEC | | meq/100g | 4.3 | 0.13 | 0.08 | | | | | |
| Chromium, total | 7440-47-3 | 80 | mg/kg | 3.7 | 4.9 | 3.8 | 4.7 | 3.5 | 4.4 | 2.6 | |
| Cobalt | 7440-48-4 | 50 | mg/kg | 1.3 | 1.2 | 1.1 | 2.2 | 1.2 | 1.5 | 1.1 | |
| Copper | 7440-50-8 | 65 | mg/kg | 1.5 | 2 | 1.8 | 2.7 | 1.7 | 1.9 | 2.2 | |
| Hardness (As CaCO3) | HARD | | mg/kg | | | | 140000 | 8800 | 190000 | 26000 | |
| Iron | 7439-89-6 | | mg/kg | 4000 | 4200 | 2900 | 6000 | 3700 | 5100 | 3600 | |
| Lead | 7439-92-1 | **50** | mg/kg | 1.7 | 1.7 | 1.1 | 2 | 1.7 | 1.6 | 1.8 | |
| Lithium | 7439-93-2 | | mg/kg | < 5 U | 9 | < 5 U | < 5 U | 9.7 | 5.9 | 5.9 | |
| Magnesium | 7439-95-4 | | mg/kg | | | | 1300 | 970 | 1400 | 960 | |
| Manganese | 7439-96-5 | | mg/kg | 68 | 64 | 55 | 79 | 41 | 53 | 39 | |
| Mercury | 7439-97-6 | **0.15** | mg/kg | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | < 0.01 U | |
| Nickel | 7440-02-0 | **21** | mg/kg | 2.9 | 2.7 | 2.6 | 3.9 | 2.6 | 2.9 | 5.3 | |
| Titanium | 7440-32-6 | | mg/kg | 330 | 430 | 220 | 320 | 180 | 290 | 200 | |
| Vanadium | 7440-62-2 | | mg/kg | 17 | 22 | 10 | 18 | 12 | 18 | 12 | |
| Zinc | 7440-66-6 | **200** | mg/kg | 26 | 13 | 8.5 | 11 | 22 | 16 | 28 | |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | Location ID | WOD-03 | WOD-03 | WOD-03 | WOD-04 | WOD-04 | WOD-04 | WOD-05 | WOD-T1-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | WOD-SE-03_0-10cm | WOD-SE-03_10-50cm | WOD-SE-03_50-100cm | NOD-SE-75m_50- | WOD-SE-75m_0-10cm | WOD-SE-75m_10-50cm | WOD-SE-04_0-10cm | WOD-SO-T25-10mN |
| | | | Matrix | SE | SE | SE | SE | SE | SE | SE | SE |
| | | | Sample Date | 30 Jan 2023 | 30 Jan 2023 | 30 Jan 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 |
| | | | Sample Depth | 0-10cm | 10-50cm | 50-100cm | 50-100cm | 0-10cm | 10-50cm | 0-10cm | 0-10cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | **0.06** | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | 0.09 | 0.21 | < 0.03 U | < 0.03 U | 0.18 | < 0.03 U | 0.15 | 0.56 |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | 0.07 | 0.24 | < 0.03 U | < 0.03 U | 0.28 | < 0.03 U | 0.14 | 0.8 |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | 0.03 | **0.11** | < 0.03 U | < 0.03 U | **0.1** | < 0.03 U | 0.08 | **0.19** |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.07 | 0.2 | 0.04 | 0.04 | 0.17 | 0.04 | 0.14 | 0.37 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.09 | 0.22 | 0.08 | 0.08 | 0.19 | 0.08 | 0.16 | 0.38 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | 0.05 | 0.19 | < 0.03 U | < 0.03 U | 0.16 | < 0.03 U | 0.12 | 0.35 |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | 0.06 | < 0.03 U | < 0.03 U | 0.05 | < 0.03 U | < 0.03 U | **0.18** |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | 0.07 | 0.24 | < 0.03 U | < 0.03 U | 0.06 | < 0.03 U | 0.14 | 0.18 |
| Chrysene | 218-01-9 | **0.108** | mg/kg | 0.04 | **0.16** | < 0.03 U | < 0.03 U | 0.08 | < 0.03 U | < 0.03 U | **0.22** |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | < 0.03 U | 0.1 | < 0.03 U | < 0.03 U | 0.05 | < 0.03 U | 0.05 | 0.09 |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | **0.08** | < 0.03 U | < 0.03 U | **0.05** | < 0.03 U | < 0.03 U | **0.05** |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | 0.04 | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | 0.07 |
| Pyrene | 129-00-0 | **0.153** | mg/kg | < 0.03 U | 0.09 | < 0.03 U | < 0.03 U | 0.03 | < 0.03 U | 0.03 | 0.11 |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | 1.5 | 1.4 | < 0.1 U | < 0.1 U | 1.8 | < 0.1 U | 1.2 | 2.5** |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | Location ID | WOD-T2-03 | WOD-T2-13 | WOD-T2-22 | WOD-T2-25 | WOD-T3-02 |
|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | WOD-SO-T50-150mN | WOD-SO-T50-50mN | WOD-SO-T50-50mS | WOD-SO-T50-80mS | WOD-SO-T100-150mN |
| | | | Matrix | SE | SE | SE | SE | SE |
| | | | Sample Date | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 |
| | | | Sample Depth | 0-10cm | 0-10cm | 0-10cm | 0-10cm | 0-10cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | | mg/kg | | | | | |
| Chloride (As Cl) | 16887-00-6 | | mg/kg | | | | | |
| Conductivity (1:5 aqueous extract at 25°C as rec.) | COND_EXTRACT | | us/cm | | | | | |
| Cyanide | 57-12-5 | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Fluoride | 16984-48-8 | **290** | mg/kg | < 100 U | < 100 U | < 100 U | < 100 U | < 100 U |
| Fluoride Soluble | 16984-48-8_Sol | | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| High Molecular Weight PAHs | PAHs_highMW | | mg/kg | 0.72 | 1.33 | < 0.03 U | 0.28 | < 0.03 U |
| Low Molecular Weight PAHs | PAHS_lowMW | | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | | % | 20 | 11 | 18 | 18 | 17 |
| pH | PH | | SU | | | | | |
| Total Organic Carbon | TOC | | % | | | | | |
| Weak Acid Dissociable Cyanide | WDCN | | mg/kg | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | |
| Aluminum | 7429-90-5 | | mg/kg | | | | | |
| Arsenic | 7440-38-2 | **20** | mg/kg | | | | | |
| Barium | 7440-39-3 | | mg/kg | | | | | |
| Beryllium | 7440-41-7 | | mg/kg | | | | | |
| Boron | 7440-42-8 | | mg/kg | | | | | |
| Cadmium | 7440-43-9 | **1.5** | mg/kg | | | | | |
| Calcium | 7440-70-2 | | mg/kg | | | | | |
| Cation Exchange Capacity | CEC | | meq/100g | | | | | |
| Chromium, total | 7440-47-3 | 80 | mg/kg | | | | | |
| Cobalt | 7440-48-4 | 50 | mg/kg | | | | | |
| Copper | 7440-50-8 | 65 | mg/kg | | | | | |
| Hardness (As CaCO3) | HARD | | mg/kg | | | | | |
| Iron | 7439-89-6 | | mg/kg | | | | | |
| Lead | 7439-92-1 | **50** | mg/kg | | | | | |
| Lithium | 7439-93-2 | | mg/kg | | | | | |
| Magnesium | 7439-95-4 | | mg/kg | | | | | |
| Manganese | 7439-96-5 | | mg/kg | | | | | |
| Mercury | 7439-97-6 | **0.15** | mg/kg | | | | | |
| Nickel | 7440-02-0 | **21** | mg/kg | | | | | |
| Titanium | 7440-32-6 | | mg/kg | | | | | |
| Vanadium | 7440-62-2 | | mg/kg | | | | | |
| Zinc | 7440-66-6 | **200** | mg/kg | | | | | |

## Table H-2
## Sediment Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | Location ID | WOD-T2-03 | WOD-T2-13 | WOD-T2-22 | WOD-T2-25 | WOD-T3-02 |
|---|---|---|---|---|---|---|---|---|
| | | | Sample ID | WOD-SO-T50-150mN | WOD-SO-T50-50mN | WOD-SO-T50-50mS | WOD-SO-T50-80mS | WOD-SO-T100-150mN |
| | | | Matrix | SE | SE | SE | SE | SE |
| | | | Sample Date | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 | 01 Feb 2023 |
| | | | Sample Depth | 0-10cm | 0-10cm | 0-10cm | 0-10cm | 0-10cm |
| **Chemical** | **CAS No.** | **Sediment Ecological Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **SVOC** | | | | | | | | |
| Acenaphthene | 83-32-9 | **0.00671** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Acenaphthylene | 208-96-8 | 0.00587 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Anthracene | 120-12-7 | **0.0469** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo(b+j)fluoranthene | edms_0016 | | mg/kg | 0.09 | 0.26 | < 0.03 U | 0.04 | < 0.03 U |
| Benzo[a]anthracene | 56-55-3 | | mg/kg | 0.21 | 0.39 | < 0.03 U | 0.11 | < 0.03 U |
| Benzo[a]pyrene | 50-32-8 | **0.0888** | mg/kg | **0.11** | **0.33** | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | | mg/kg | 0.16 | 0.43 | 0.04 | 0.05 | 0.04 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | | mg/kg | 0.18 | 0.45 | 0.08 | 0.08 | 0.08 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | | mg/kg | 0.15 | 0.41 | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[g,h,i]perylene | 191-24-2 | **0.17** | mg/kg | < 0.03 U | 0.08 | < 0.03 U | < 0.03 U | < 0.03 U |
| Benzo[k]fluoranthene | 207-08-9 | **0.24** | mg/kg | 0.05 | 0.09 | < 0.03 U | < 0.03 U | < 0.03 U |
| Chrysene | 218-01-9 | **0.108** | mg/kg | 0.04 | **0.11** | < 0.03 U | 0.04 | < 0.03 U |
| Dibenz(A,H)Anthracene | 53-70-3 | **0.00622** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Fluoranthene | 206-44-0 | **0.113** | mg/kg | 0.11 | < 0.03 U | < 0.03 U | 0.04 | < 0.03 U |
| Fluorene | 86-73-7 | 0.0212 | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | **0.017** | mg/kg | < 0.03 U | **0.07** | < 0.03 U | < 0.03 U | < 0.03 U |
| Naphthalene | 91-20-3 | 0.0346 | mg/kg | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Phenanthrene | 85-01-8 | **0.0867** | mg/kg | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U | < 0.03 U |
| Pyrene | 129-00-0 | **0.153** | mg/kg | 0.11 | < 0.03 U | < 0.03 U | 0.05 | < 0.03 U |
| Sum of PAHs* | TOTALPAH | **10** | mg/kg OC | 0.7** | 1.3** | < 0.1 U | 0.3** | < 0.1 U |

**Notes**

* = Total PAH results are presented as normalised to 1% organic carbon where TOC results are available. Non-normalised results are denoted by **.

% = Percent

µS/cm = Micro-Siemens per Centimeter

˚C = Degrees in Celsius

CaCO3 = Calcium Carbonate

Cl = Chloride

LOR = Limit of Reporting

meq/100g = Milliequivalents per 100 grams of soil

mg/kg = Milligrams per Kilogram

mg/kg OC = Milligrams per Kilogram of Organic Carbon

PAH = Polycyclic Aromatic Hydrocarbon

SCL = Spent Cell Lining

SE = Sediment

SU = Standard Units

SVOC = Semi-Volatile Organic Compound

TEQ = Toxic Equivalency

U = Result Not Detected

# Table H-3
## Groundwater and Sub-surface Aqueous Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | 4-5 | | A51 | | A53 | | A56 | | A63 | | E_MW_B7 | | I_MW_B1 | | L_MW_B18 | | NOD-03 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | MW 4/5 | | A51 | | A53 | | A56 | | A63 | | MWB7 | | I-MW-B1 | | L_MW_B18 | | NOD-WG-03 | |
| | | | | Matrix | WG | | WG | | WG | | WG | | WG | | WG | | WG | | WG | | WG | |
| | | | | Sample Date | 19 Jan 2023 | | 19 Jan 2023 | | 19 Jan 2023 | | 19 Jan 2023 | | 19 Jan 2023 | | 19 Jan 2023 | | 20 Jan 2023 | | 20 Jan 2023 | | 03 Feb 2023 | |
| Chemical | CAS No. | Fraction | Aqueous 80% Marine Screening Criteria | Unit | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual |
| **GENERAL CHEMISTRY** | | | | | | | | | | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | µg/L | 2.10E+06 | | 270000 | | 740000 | | 540000 | | 190000 | | < 20000 | U | 100000 | | 210000 | | 96000 | |
| Chloride (As Cl) | 16887-00-6 | T | | µg/L | 150000 | | 89000 | | 110000 | | 7.30E+06 | | 90000 | | 97000 | | 52000 | | 96000 | | 2.00E+07 | |
| Conductivity | COND | N | | us/cm | | | | | | | | | | | | | | | | | 55000 | |
| Conductivity | COND | T | | us/cm | 770 | | 640 | | 1400 | | 12000 | | 590 | | 410 | | 300 | | 570 | | | |
| Cyanide | 57-12-5 | T | **14** | µg/L | **280** | | < 5 | U | < 5 | U | **50** | | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Cyanide (Free) | FREE CN | T | 14 | µg/L | 9 | | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Fluoride | 16984-48-8 | D | **1500** | µg/L | | | 90 | | **19200** | | **16400** | | 120 | | 330 | | 50 | | 550 | | 1440 | |
| pH Value | pH_Lab | T | | SU | 8.3 | | 8 | | 7.9 | | 8.1 | | 7.7 | | 8 | | 6.8 | | 8.2 | | 7.7 | |
| Total Organic Carbon | TOC | T | | µg/L | 6300 | | 44000 | | 27000 | | 19000 | | 14000 | | 11000 | | 70000 | | 5800 | | < 5000 | U |
| Total Suspended Solids | TSS | T | | µg/L | < 5000 | U | < 5000 | U | < 5000 | U | < 5000 | U | < 5000 | U | < 5000 | U | 81000 | | < 5000 | U | 18000 | |
| Weak Acid Dissociable Cyanide | WDCN | T | | µg/L | 15 | | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **202** | µg/L | **370** | | **2700** | | **2100** | | 80 | | 120 | | **630** | | **1600** | | 100 | | 100 | |
| Aluminum | 7429-90-5 | T | | µg/L | 420 | | 2700 | | 2700 | | 230 | | 240 | | 710 | | 1700 | | 150 | | 90 | |
| Arsenic | 7440-38-2 | D | 140 | µg/L | 21 | | 2 | | 4 | | 13 | | 3 | | < 1 | U | 11 | | 3 | | 2 | |
| Arsenic | 7440-38-2 | T | | µg/L | 24 | | 2 | | 5 | | 14 | | 3 | | < 1 | U | 12 | | 3 | | 2 | |
| Barium | 7440-39-3 | D | | µg/L | < 20 | U | < 20 | U | < 20 | U | 70 | | 30 | | < 20 | U | < 20 | U | < 20 | U | < 20 | U |
| Barium | 7440-39-3 | T | 1000 | µg/L | < 20 | U | < 20 | U | < 20 | U | 80 | | 30 | | < 20 | U | < 20 | U | < 20 | U | < 20 | U |
| Beryllium | 7440-41-7 | D | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Beryllium | 7440-41-7 | T | 100 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Boron | 7440-42-8 | D | 2500 | µg/L | 90 | | 100 | | 1200 | | 1500 | | 60 | | < 50 | U | < 50 | U | 50 | | < 50 | U |
| Boron | 7440-42-8 | T | | µg/L | 120 | | 120 | | 1600 | | 1800 | | 80 | | 50 | | 60 | | 70 | | < 50 | U |
| Cadmium | 7440-43-9 | D | 36 | µg/L | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U |
| Cadmium | 7440-43-9 | T | | µg/L | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U |
| Calcium | 7440-70-2 | T | | µg/L | 6500 | | 30000 | | 32000 | | 350000 | | 9400 | | 10000 | | 12000 | | 38000 | | 380000 | |
| Chromium, total | 7440-47-3 | D | 91 | µg/L | < 1 | U | 7 | | 4 | | < 1 | U | < 1 | U | < 1 | U | 3 | | < 1 | U | < 1 | U |
| Chromium, total | 7440-47-3 | T | | µg/L | < 1 | U | 7 | | 6 | | 1 | | < 1 | U | < 1 | U | 3 | | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | D | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | 4 | | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | T | 150 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | 4 | | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Copper | 7440-50-8 | D | 8 | µg/L | 2 | | < 1 | U | 5 | | 1 | | 3 | | 3 | | < 1 | U | 3 | | < 1 | U |
| Copper | 7440-50-8 | T | | µg/L | 2 | | < 1 | U | 6 | | 2 | | 4 | | 3 | | < 1 | U | 4 | | < 1 | U |
| Hardness (As CaCO3) | HARD | T | | µg/L | 34000 | | 87000 | | 110000 | | 2.60E+06 | | 55000 | | 62000 | | 45000 | | 120000 | | 6.10E+06 | |
| Iron | 7439-89-6 | D | | µg/L | 100 | | 7600 | | 830 | | < 50 | U | 3100 | | 90 | | 61000 | | 70 | | < 50 | U |
| Iron | 7439-89-6 | T | **300** | µg/L | 240 | | **7800** | | **1400** | | 250 | | **4000** | | 160 | | **67000** | | 160 | | < 50 | U |
| Lead | 7439-92-1 | D | 12 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Lead | 7439-92-1 | T | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Lithium | 7439-93-2 | D | | µg/L | < 5 | U | < 5 | U | < 5 | U | 31 | | < 5 | U | < 5 | U | < 5 | U | < 5 | U | 140 | |
| Lithium | 7439-93-2 | T | | µg/L | < 5 | U | < 5 | U | 6 | | 35 | | 6 | | < 5 | U | < 5 | U | < 5 | U | 140 | |

# Table H-3
# Groundwater and Sub-surface Aqueous Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | | Location ID | 4-5 | | A51 | | A53 | | A56 | | A63 | | E_MW_B7 | | I_MW_B1 | | L_MW_B18 | | NOD-03 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | MW 4/5 | | A51 | | A53 | | A56 | | A63 | | MWB7 | | I-MW-B1 | | L_MW_B18 | | NOD-WG-03 | |
| | | | | Matrix | WG | | WG | | WG | | WG | | WG | | WG | | WG | | WG | | WG | |
| | | | | Sample Date | 19 Jan 2023 | | 19 Jan 2023 | | 19 Jan 2023 | | 19 Jan 2023 | | 19 Jan 2023 | | 19 Jan 2023 | | 20 Jan 2023 | | 20 Jan 2023 | | 03 Feb 2023 | |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 80% Marine Screening Criteria** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| Magnesium | 7439-95-4 | T | | µg/L | 4400 | | 2800 | | 8200 | | 430000 | | 7700 | | 8900 | | 3800 | | 5500 | | 1.20E+06 | |
| Manganese | 7439-96-5 | D | | µg/L | < 5 | U | 75 | | 110 | | 730 | | 620 | | < 5 | U | 910 | | < 5 | U | < 5 | U |
| Manganese | 7439-96-5 | T | 3600 | µg/L | < 5 | U | 73 | | 130 | | 780 | | 730 | | 6 | | 1000 | | < 5 | U | < 5 | U |
| Mercury | 7439-97-6 | D | | µg/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Mercury | 7439-97-6 | T | 1.4 | µg/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Nickel | 7440-02-0 | D | 560 | µg/L | < 1 | U | < 1 | U | 2 | | 1 | | 1 | | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Nickel | 7440-02-0 | T | | µg/L | < 1 | U | < 1 | U | 3 | | 2 | | 2 | | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Titanium | 7440-32-6 | D | | µg/L | < 5 | U | 36 | | 14 | | < 5 | U | < 5 | U | < 5 | U | 17 | | < 5 | U | < 5 | U |
| Titanium | 7440-32-6 | T | | µg/L | 6 | | 36 | | 19 | | 19 | | 5 | | 5 | | 19 | | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | D | | µg/L | 36 | | 58 | | 7 | | 13 | | < 5 | U | < 5 | U | 11 | | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | T | 280 | µg/L | 39 | | 56 | | 8 | | 14 | | 5 | | < 5 | U | 11 | | < 5 | U | < 5 | U |
| Zinc | 7440-66-6 | D | **21** | µg/L | < 5 | U | 5 | | < 5 | U | < 5 | U | 6 | | 15 | | < 5 | U | < 5 | U | < 5 | U |
| Zinc | 7440-66-6 | T | | µg/L | < 5 | U | 7 | | < 5 | U | 6 | | 10 | | 20 | | < 5 | U | 7 | | < 5 | U |
| **SVOC** | | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Acenaphthylene | 208-96-8 | T | 28 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Anthracene | 120-12-7 | T | 7 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo(b+j)fluoranthene | edms_0016 | T | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]anthracene | 56-55-3 | T | 0.018 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]pyrene | 50-32-8 | T | 0.7 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Chrysene | 218-01-9 | T | 0.1 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluoranthene | 206-44-0 | T | 2 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluorene | 86-73-7 | T | 3 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Naphthalene | 91-20-3 | T | 120 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Phenanthrene | 85-01-8 | T | 8 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Pyrene | 129-00-0 | T | 0.025 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Sum of PAHs | TOTALPAH | T | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |

# Table H-3
# Groundwater and Sub-surface Aqueous Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | NOD-04 | | SEEP-01 | | WOD-01 | | WOD-02 | | WOD-03 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | NOD-WG-04 | | SOD-SEP-1 | | WOD-WG-01 | | WOD-WG-02 | | WOD-WG-03 | |
| | | | | Matrix | WG | | WG | | WG | | WG | | WG | |
| | | | | Sample Date | 03 Feb 2023 | | 25 Jan 2023 | | 01 Feb 2023 | | 01 Feb 2023 | | 01 Feb 2023 | |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 80% Marine Screening Criteria** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | µg/L | 180000 | | 86000 | | | | 91000 | | 70000 | |
| Chloride (As Cl) | 16887-00-6 | T | | µg/L | 2.10E+07 | | 350000 | | | | 1.10E+07 | | 6.90E+06 | |
| Conductivity | COND | N | | us/cm | 6000 | | | | | | 33000 | | 21000 | |
| Conductivity | COND | T | | us/cm | | | 2300 | | | | | | | |
| Cyanide | 57-12-5 | T | **14** | µg/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Cyanide (Free) | FREE CN | T | 14 | µg/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Fluoride | 16984-48-8 | D | **1500** | µg/L | **9370** | | **1560** | | 870 | | **1720** | | 730 | |
| pH Value | pH_Lab | T | | SU | 7.1 | | 8.1 | | | | 7.4 | | 7 | |
| Total Organic Carbon | TOC | T | | µg/L | < 5000 | U | 9800 | | | | 8600 | | < 5000 | U |
| Total Suspended Solids | TSS | T | | µg/L | 23000 | | < 5000 | U | | | 15000 | | 12000 | |
| Weak Acid Dissociable Cyanide | WDCN | T | | µg/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **202** | µg/L | < 50 | U | < 50 | U | < 50 | U | < 50 | U | < 50 | U |
| Aluminum | 7429-90-5 | T | | µg/L | 170 | | < 50 | U | 50 | | 50 | | 60 | |
| Arsenic | 7440-38-2 | D | 140 | µg/L | 1 | | < 1 | U | 7 | | 2 | | 4 | |
| Arsenic | 7440-38-2 | T | | µg/L | 2 | | < 1 | U | 11 | | 3 | | 8 | |
| Barium | 7440-39-3 | D | | µg/L | 20 | | < 20 | U | 30 | | < 20 | U | 30 | |
| Barium | 7440-39-3 | T | 1000 | µg/L | 30 | | < 20 | U | 30 | | < 20 | U | 30 | |
| Beryllium | 7440-41-7 | D | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Beryllium | 7440-41-7 | T | 100 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Boron | 7440-42-8 | D | 2500 | µg/L | < 50 | U | < 50 | U | < 50 | U | < 50 | U | < 50 | U |
| Boron | 7440-42-8 | T | | µg/L | < 50 | U | < 50 | U | < 50 | U | < 50 | U | < 50 | U |
| Cadmium | 7440-43-9 | D | 36 | µg/L | 0.3 | | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U |
| Cadmium | 7440-43-9 | T | | µg/L | 0.3 | | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U |
| Calcium | 7440-70-2 | T | | µg/L | 490000 | | 27000 | | | | 250000 | | 130000 | |
| Chromium, total | 7440-47-3 | D | 91 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Chromium, total | 7440-47-3 | T | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | D | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | T | 150 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Copper | 7440-50-8 | D | 8 | µg/L | < 1 | U | < 1 | U | < 1 | U | 1 | | < 1 | U |
| Copper | 7440-50-8 | T | | µg/L | < 1 | U | < 1 | U | < 1 | U | 2 | | < 1 | U |
| Hardness (As CaCO3) | HARD | T | | µg/L | 7.00E+06 | | 230000 | | | | 3.80E+06 | | 1.90E+06 | |
| Iron | 7439-89-6 | D | | µg/L | < 50 | U | < 50 | U | 2900 | | < 50 | U | 80 | |
| Iron | 7439-89-6 | T | **300** | µg/L | 240 | | < 50 | U | **3300** | | 180 | | **400** | |
| Lead | 7439-92-1 | D | 12 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Lead | 7439-92-1 | T | | µg/L | < 1 | U | 7 | | < 1 | U | < 1 | U | < 1 | U |
| Lithium | 7439-93-2 | D | | µg/L | 130 | | 6 | | 170 | | 86 | | 37 | |
| Lithium | 7439-93-2 | T | | µg/L | 130 | | 7 | | 170 | | 86 | | 37 | |

## Table H-3
## Groundwater and Sub-surface Aqueous Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | NOD-04 | | SEEP-01 | | WOD-01 | | WOD-02 | | WOD-03 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | NOD-WG-04 | | SOD-SEP-1 | | WOD-WG-01 | | WOD-WG-02 | | WOD-WG-03 | |
| | | | | Matrix | WG | | WG | | WG | | WG | | WG | |
| | | | | Sample Date | 03 Feb 2023 | | 25 Jan 2023 | | 01 Feb 2023 | | 01 Feb 2023 | | 01 Feb 2023 | |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 80% Marine Screening Criteria** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| Magnesium | 7439-95-4 | T | | µg/L | 1.40E+06 | | 39000 | | | | 760000 | | 390000 | |
| Manganese | 7439-96-5 | D | | µg/L | 200 | | < 5 | U | 1000 | | 44 | | 30 | |
| Manganese | 7439-96-5 | T | 3600 | µg/L | 200 | | < 5 | U | 1100 | | 44 | | 30 | |
| Mercury | 7439-97-6 | D | | µg/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Mercury | 7439-97-6 | T | 1.4 | µg/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Nickel | 7440-02-0 | D | 560 | µg/L | 12 | | < 1 | U | 1 | | < 1 | U | < 1 | U |
| Nickel | 7440-02-0 | T | | µg/L | 12 | | < 1 | U | 1 | | < 1 | U | < 1 | U |
| Titanium | 7440-32-6 | D | | µg/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Titanium | 7440-32-6 | T | | µg/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | D | | µg/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | T | 280 | µg/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Zinc | 7440-66-6 | D | **21** | µg/L | **38** | | < 5 | U | < 5 | U | 8 | | < 5 | U |
| Zinc | 7440-66-6 | T | | µg/L | 39 | | < 5 | U | < 5 | U | 10 | | 6 | |
| **SVOC** | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Acenaphthylene | 208-96-8 | T | 28 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Anthracene | 120-12-7 | T | 7 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo(b+j)fluoranthene | edms_0016 | T | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]anthracene | 56-55-3 | T | 0.018 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]pyrene | 50-32-8 | T | 0.7 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Chrysene | 218-01-9 | T | 0.1 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluoranthene | 206-44-0 | T | 2 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluorene | 86-73-7 | T | 3 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Naphthalene | 91-20-3 | T | 120 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Phenanthrene | 85-01-8 | T | 8 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Pyrene | 129-00-0 | T | 0.025 | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Sum of PAHs | TOTALPAH | T | | µg/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |

**Notes**
µg/L = Micrograms per Liter
µS/cm = Micro-Siemens per Centimeter
CaCO3 = Calcium Carbonate
Cl = Chloride
D = Dissolved
PAH = Polycyclic Aromatic Hydrocarbon
SU = Standard Units
SVOC = Semi-Volatile Organic Compound
T = Total
U = Result Not Detected
WG = Groundwater

# Table H-4
## Pore Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | BAB-01 | | BAB-02 | | BAB-03 | | BFS-01 | | BFS-02 | | BFS-03 | | ELF-01 | | ELF-02 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | BAB-WP-01 | | BAB-WP-02 | | BAB-WP-03 | | BFS-WP-01 | | BFS02-WP | | BFS-WP-03 | | ELF-WP-01 | | ELF-WP-02 | |
| | | | | Matrix | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | |
| | | | | Sample Date | 23 Jan 2023 | | 23 Jan 2023 | | 23 Jan 2023 | | 22 Jan 2023 | | 17 Jan 2023 | | 22 Jan 2023 | | 24 Jan 2023 | | 24 Jan 2023 | |
| Chemical | CAS No. | Fraction | Aqueous 95% Marine Screening Criteria | Unit | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual |
| **GENERAL CHEMISTRY** | | | | | | | | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 93000 | | 71000 | | 93000 | | 230000 | | 200000 | | 120000 | | 110000 | | 110000 | |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 1.90E+07 | | 1.10E+07 | | 1.70E+07 | | 1.80E+07 | | 1.90E+07 | | 1.90E+07 | | 2.00E+07 | | 2.00E+07 | |
| Conductivity | COND | T | | us/cm | | | | | | | 34000 | | 34000 | | 32000 | | | | | |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | **11** | | < 5 | U | < 5 | U | < 5 | U |
| Cyanide (Free) | FREE CN | T | **4** | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | **5** | | < 5 | U | < 5 | U | < 5 | U |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | 50000 | | 31000 | | 47000 | | | | | | | | 57000 | | 57000 | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | 520 | | 350 | | 700 | | 1280 | | 910 | | 920 | | 890 | | 900 | |
| pH Value | pH_Lab | T | | SU | 7.7 | | 7.6 | | 7.8 | | 7.9 | | 7.9 | | 7.8 | | 8 | | 8 | |
| Total Organic Carbon | TOC | T | | ug/L | 8300 | | < 5000 | U | < 5000 | U | < 5000 | U | 6300 | | < 5000 | U | < 5000 | U | 5700 | |
| Total Suspended Solids | TSS | T | | ug/L | 25000 | | 12000 | | 33000 | | 16000 | | 13000 | | 20000 | | 22000 | | 29000 | |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | 6 | | < 5 | U | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | < 50 | U | < 50 | U | < 50 | U | **990** | | **160** | | **180** | | < 50 | U | < 50 | U |
| Aluminum | 7429-90-5 | T | | ug/L | < 50 | U | < 50 | U | < 50 | U | 1100 | | 270 | | 240 | | < 50 | U | < 50 | U |
| Arsenic | 7440-38-2 | D | **12** | ug/L | < 1 | U | 2 | | **23** | | 6 | | 4 | | 4 | | 1 | | 1 | |
| Arsenic | 7440-38-2 | T | | ug/L | 1 | | 4 | | 24 | | 7 | | 2 | | 7 | | 2 | | 1 | |
| Barium | 7440-39-3 | D | | ug/L | < 20 | U | 30 | | < 20 | U | < 20 | U | < 20 | U | < 20 | U | < 20 | U | < 20 | U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 | U | 30 | | < 20 | U | < 20 | U | < 20 | U | < 20 | U | < 20 | U | < 20 | U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | 2 | | < 1 | U | < 1 | U |
| Boron | 7440-42-8 | D | **940** | ug/L | < 50 | U | < 50 | U | < 50 | U | **2700** | | **2800** | | **2800** | | < 50 | U | < 50 | U |
| Boron | 7440-42-8 | T | | ug/L | < 50 | U | < 50 | U | < 50 | U | 3100 | | 7900 | | 3300 | | < 50 | U | < 50 | U |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U |
| Calcium | 7440-70-2 | T | | ug/L | 430000 | | 240000 | | 380000 | | 410000 | | 410000 | | 420000 | | 430000 | | 490000 | |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 | U | < 1 | U | < 1 | U | 2 | | 1 | | < 1 | U | < 1 | U | < 1 | U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 | U | < 1 | U | < 1 | U | 3 | | 1 | | 3 | | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | **2** | | < 1 | U | < 1 | U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | < 1 | U | < 1 | U | **6** | | **2** | | < 1 | U | 1 | | < 1 | U | < 1 | U |
| Copper | 7440-50-8 | T | | ug/L | < 1 | U | < 1 | U | 6 | | 3 | | 1 | | 4 | | < 1 | U | 1 | |
| Hardness (As CaCO3) | HARD | T | | ug/L | 6.70E+06 | | 3.70E+06 | | 6.30E+06 | | 6.40E+06 | | 6.10E+06 | | 6.40E+06 | | 6.70E+06 | | 7.40E+06 | |
| Iron | 7439-89-6 | D | | ug/L | 70 | | < 50 | U | < 50 | U | 1700 | | 210 | | 310 | | < 50 | U | < 50 | U |
| Iron | 7439-89-6 | T | **300** | ug/L | 280 | | 140 | | < 50 | U | **1900** | | **310** | | **400** | | < 50 | U | < 50 | U |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Lead | 7439-92-1 | T | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | 2 | | < 1 | U | < 1 | U |
| Lithium | 7439-93-2 | D | | ug/L | 130 | | 48 | | 110 | | 310 | | 300 | | 300 | | 140 | | 150 | |
| Lithium | 7439-93-2 | T | | ug/L | 130 | | 48 | | 110 | | 310 | | 310 | | 310 | | 140 | | 150 | |
| Magnesium | 7439-95-4 | T | | ug/L | 1.40E+06 | | 760000 | | 1.30E+06 | | 1.30E+06 | | 1.20E+06 | | 1.30E+06 | | 1.40E+06 | | 1.50E+06 | |

**Table H-4**
**Pore Water Sampling Results**
**Coastal Marine Area Report**
**Environment Southland**
**Tiwai, NZ**

| | | | | Location ID | BAB-01 | | BAB-02 | | BAB-03 | | BFS-01 | | BFS-02 | | BFS-03 | | ELF-01 | | ELF-02 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | BAB-WP-01 | | BAB-WP-02 | | BAB-WP-03 | | BFS-WP-01 | | BFS02-WP | | BFS-WP-03 | | ELF-WP-01 | | ELF-WP-02 | |
| | | | | Matrix | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | |
| | | | | Sample Date | 23 Jan 2023 | | 23 Jan 2023 | | 23 Jan 2023 | | 22 Jan 2023 | | 17 Jan 2023 | | 22 Jan 2023 | | 24 Jan 2023 | | 24 Jan 2023 | |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| Manganese | 7439-96-5 | D | | ug/L | 31 | | 13 | | 13 | | 35 | | 13 | | 9 | | < 5 | U | < 5 | U |
| Manganese | 7439-96-5 | T | 1900 | ug/L | 35 | | 15 | | 13 | | 36 | | 16 | | 12 | | < 5 | U | < 5 | U |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Nickel | 7440-02-0 | D | 70 | ug/L | 1 | | < 1 | U | 2 | | 2 | | 2 | | < 1 | U | < 1 | U | < 1 | U |
| Nickel | 7440-02-0 | T | | ug/L | 2 | | < 1 | U | 2 | | 3 | | 3 | | 3 | | < 1 | U | < 1 | U |
| Titanium | 7440-32-6 | D | | ug/L | 5 | | < 5 | U | < 5 | U | 41 | | < 5 | U | 6 | | < 5 | U | < 5 | U |
| Titanium | 7440-32-6 | T | | ug/L | < 5 | U | < 5 | U | < 5 | U | 51 | | 9 | | 10 | | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 | U | < 5 | U | < 5 | U | 6 | | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 | U | < 5 | U | 5 | | 7 | | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Zinc | 7440-66-6 | D | **8** | ug/L | < 5 | U | < 5 | U | < 5 | U | 6 | | < 5 | U | **10** | | < 5 | U | < 5 | U |
| Zinc | 7440-66-6 | T | | ug/L | < 5 | U | < 5 | U | < 5 | U | 8 | | 6 | | 6 | | < 5 | U | < 5 | U |
| **SVOC** | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]anthracene | 56-55-3 | T | 0.018 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Phenanthrene | 85-01-8 | T | 0.6 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |

# Table H-4
# Pore Water Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | | Location ID | ELF-03 | | ISA-02 | | NOD-01 | | NOD-02 | | NOD-03 | | NOD-04 | | NOD-05 | | SCL-02 | | SOD-01 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | ELF-WP-03 | | ISA-WP-02 | | NOD-WP-0m | | NOD-WP-25m | | NOD-WP-50m | | NOD-WP-100m | | NOD-WP-125m | | SCL-WP-02 | | SOD-WP-0m | |
| | | | | Matrix | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | |
| | | | | Sample Date | 24 Jan 2023 | | 24 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 | | 31 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 | | 23 Jan 2023 | | 26 Jan 2023 | |
| Chemical | CAS No. | Fraction | Aqueous 95% Marine Screening Criteria | Unit | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual |
| **GENERAL CHEMISTRY** | | | | | | | | | | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 95000 | | 110000 | | 320000 | | 290000 | | 230000 | | 180000 | | 130000 | | 110000 | | 140000 | |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 2.00E+07 | | 2.00E+07 | | 1.70E+07 | | 1.80E+07 | | 2.10E+07 | | 1.50E+07 | | 1.70E+07 | | 1.90E+07 | | 1.90E+07 | |
| Conductivity | COND | T | | us/cm | | | | | 53000 | | 47000 | | | | 40000 | | 45000 | | 32000 | | 66000 | |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Cyanide (Free) | FREE CN | T | **4** | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | 56000 | | 56000 | | | | | | 64000 | | | | | | | | | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | 880 | | 880 | | **14800** | | **5250** | | **8120** | | **8890** | | **4220** | | 870 | | | |
| pH Value | pH_Lab | T | | SU | 8 | | 8 | | 7.6 | | 7.5 | | 7.4 | | 7.6 | | 7.7 | | 8 | | 7.9 | |
| Total Organic Carbon | TOC | T | | ug/L | 6400 | | 5600 | | 8100 | | 12000 | | 7200 | | 13000 | | 6900 | | < 5000 | U | < 5000 | U |
| Total Suspended Solids | TSS | T | | ug/L | 22000 | | 21000 | | 330000 | | 310000 | | 15000 | | 140000 | | 18000 | | 68000 | | 21000 | |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | < 50 | U | < 50 | U | **180** | | **140** | | **60** | | **80** | | < 50 | U | < 50 | U | **210** | |
| Aluminum | 7429-90-5 | T | | ug/L | < 50 | U | < 50 | U | 9100 | | 8600 | | 90 | | 90 | | < 50 | U | 60 | | < 50 | U |
| Arsenic | 7440-38-2 | D | **12** | ug/L | 2 | | 1 | | **17** | | 3 | | 3 | | 3 | | 2 | | 2 | | 1 | |
| Arsenic | 7440-38-2 | T | | ug/L | 2 | | 2 | | 27 | | 16 | | 3 | | 3 | | 3 | | 2 | | 2 | |
| Barium | 7440-39-3 | D | | ug/L | < 20 | U | < 20 | U | 20 | | < 20 | U | 20 | | < 20 | U | < 20 | U | < 20 | U | 20 | |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 | U | < 20 | U | 50 | | 40 | | 20 | | < 20 | U | < 20 | U | < 20 | U | 20 | |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Boron | 7440-42-8 | D | **940** | ug/L | < 50 | U | < 50 | U | **7800** | | **5100** | | < 50 | U | **5000** | | **5000** | | **7800** | | **4900** | |
| Boron | 7440-42-8 | T | | ug/L | < 50 | U | < 50 | U | 8200 | | 5300 | | < 50 | U | 4800 | | 5100 | | 8300 | | 5000 | |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | 1 | |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 | U | < 0.2 | U | 0.2 | | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | 1.1 | |
| Calcium | 7440-70-2 | T | | ug/L | 470000 | | 490000 | | 320000 | | 330000 | | 460000 | | 320000 | | 370000 | | 450000 | | 480000 | |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 | U | < 1 | U | 4 | | 5 | | < 1 | U | < 1 | U | < 1 | U | 1 | | < 1 | U |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 | U | < 1 | U | < 1 | U | **2** | | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | 1 | | 1 | | **6** | | < 1 | U | < 1 | U | **3** | | **4** | | < 1 | U | < 1 | U |
| Copper | 7440-50-8 | T | | ug/L | 1 | | 3 | | 16 | | 9 | | < 1 | U | 3 | | 10 | | < 1 | U | 2 | |
| Hardness (As CaCO3) | HARD | T | | ug/L | 7.20E+06 | | 7.60E+06 | | 5.40E+06 | | 5.70E+06 | | 7.40E+06 | | 4.40E+06 | | 5.20E+06 | | 6.50E+06 | | 6.90E+06 | |
| Iron | 7439-89-6 | D | | ug/L | < 50 | U | < 50 | U | < 50 | U | 110 | | < 50 | U | < 50 | U | < 50 | U | < 50 | U | < 50 | U |
| Iron | 7439-89-6 | T | **300** | ug/L | < 50 | U | < 50 | U | **1800** | | **4300** | | < 50 | U | < 50 | U | < 50 | U | < 50 | U | **350** | |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Lead | 7439-92-1 | T | | ug/L | < 1 | U | < 1 | U | 7 | | 6 | | < 1 | U | < 1 | U | < 1 | U | 1 | | < 1 | U |
| Lithium | 7439-93-2 | D | | ug/L | 160 | | 150 | | 130 | | 120 | | 180 | | 100 | | 110 | | 280 | | 100 | |
| Lithium | 7439-93-2 | T | | ug/L | 160 | | 150 | | 130 | | 130 | | 180 | | 100 | | 110 | | 300 | | 130 | |
| Magnesium | 7439-95-4 | T | | ug/L | 1.50E+06 | | 1.50E+06 | | 1.10E+06 | | 1.20E+06 | | 1.50E+06 | | 880000 | | 1.00E+06 | | 1.30E+06 | | 1.40E+06 | |

# Table H-4
# Pore Water Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | | Location ID | ELF-03 | | ISA-02 | | NOD-01 | | NOD-02 | | NOD-03 | | NOD-04 | | NOD-05 | | SCL-02 | | SOD-01 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | ELF-WP-03 | | ISA-WP-02 | | NOD-WP-0m | | NOD-WP-25m | | NOD-WP-50m | | NOD-WP-100m | | NOD-WP-125m | | SCL-WP-02 | | SOD-WP-0m | |
| | | | | Matrix | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | |
| | | | | Sample Date | 24 Jan 2023 | | 24 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 | | 31 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 | | 23 Jan 2023 | | 26 Jan 2023 | |
| Chemical | CAS No. | Fraction | Aqueous 95% Marine Screening Criteria | Unit | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual |
| Manganese | 7439-96-5 | D | | ug/L | < 5 | U | < 5 | U | 5 | | 48 | | 100 | | < 5 | U | 11 | | < 5 | U | 7 | |
| Manganese | 7439-96-5 | T | 1900 | ug/L | < 5 | U | < 5 | U | 18 | | 85 | | 100 | | < 5 | U | 11 | | < 5 | U | 8 | |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Nickel | 7440-02-0 | D | 70 | ug/L | < 1 | U | < 1 | U | 5 | | 7 | | 3 | | < 1 | U | < 1 | U | 1 | | 3 | |
| Nickel | 7440-02-0 | T | | ug/L | < 1 | U | < 1 | U | 34 | | 35 | | 3 | | 2 | | 3 | | 1 | | 4 | |
| Titanium | 7440-32-6 | D | | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | 6 | |
| Titanium | 7440-32-6 | T | | ug/L | < 5 | U | < 5 | U | 57 | | 140 | | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 | U | < 5 | U | 6 | | 19 | | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Zinc | 7440-66-6 | D | **8** | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | 7 | | 5 | | < 5 | U | < 5 | U | **110** | |
| Zinc | 7440-66-6 | T | | ug/L | < 5 | U | < 5 | U | 95 | | 100 | | 9 | | < 5 | U | 12 | | 13 | | 130 | |
| **SVOC** | | | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]anthracene | 56-55-3 | T | 0.018 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Phenanthrene | 85-01-8 | T | 0.6 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |

## Table H-4
## Pore Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | SOD-02 | | SOD-03 | | SOD-04 | | WLF-01 | | WLF-02 | | WLF-03 | | WOD-01 | | WOD-02 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | SOD-WP-25m | | SOD-WP-50m | | SOD-WP-100m | | WLF-WP-01 | | WLF-WP-02 | | WLF-WP-03 | | WOD-WP-0m | | WOD-WP-25m | |
| | | | | Matrix | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | |
| | | | | Sample Date | 26 Jan 2023 | | 25 Jan 2023 | | 25 Jan 2023 | | 26 Jan 2023 | | 31 Jan 2023 | | 31 Jan 2023 | | 26 Jan 2023 | | 27 Jan 2023 | |
| Chemical | CAS No. | Fraction | Aqueous 95% Marine Screening Criteria | Unit | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual | Result | Qual |
| **GENERAL CHEMISTRY** | | | | | | | | | | | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 510000 | | 290000 | | 250000 | | 560000 | | 170000 | | 130000 | | 130000 | | 150000 | |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 2.00E+07 | | 1.90E+07 | | 1.90E+07 | | 1.80E+07 | | 1.80E+07 | | 2.00E+07 | | 1.20E+07 | | 1.90E+07 | |
| Conductivity | COND | T | | us/cm | 63000 | | 63000 | | 62000 | | 59000 | | | | | | 37000 | | 49000 | |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Cyanide (Free) | FREE CN | T | **4** | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | | | | | | | | | 57000 | | 59000 | | | | | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | 1420 | | 890 | | 920 | | 950 | | 1450 | | 920 | | 700 | | 1370 | |
| pH Value | pH_Lab | T | | SU | 7.9 | | 7.9 | | 8 | | 7.9 | | 7.5 | | 7.7 | | 7.7 | | 7.6 | |
| Total Organic Carbon | TOC | T | | ug/L | 12000 | | 8000 | | 5500 | | 9400 | | 8100 | | < 5000 | U | 11000 | | < 5000 | U |
| Total Suspended Solids | TSS | T | | ug/L | 19000 | | 20000 | | 29000 | | 13000 | | 19000 | | 17000 | | 33000 | | 210000 | |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | **70** | | < 50 | U | < 50 | U | < 50 | U | < 50 | U | < 50 | U | < 50 | U | < 50 | U |
| Aluminum | 7429-90-5 | T | | ug/L | 190 | | 70 | | < 50 | U | < 50 | U | < 50 | U | < 50 | U | 210 | | 510 | |
| Arsenic | 7440-38-2 | D | **12** | ug/L | 4 | | 3 | | 4 | | 7 | | 5 | | 2 | | 2 | | 2 | |
| Arsenic | 7440-38-2 | T | | ug/L | 5 | | 3 | | 4 | | 9 | | 5 | | 2 | | 3 | | 5 | |
| Barium | 7440-39-3 | D | | ug/L | < 20 | U | < 20 | U | < 20 | U | < 20 | U | < 20 | U | < 20 | U | 30 | | < 20 | U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 | U | < 20 | U | < 20 | U | < 20 | U | < 20 | U | < 20 | U | 30 | | < 20 | U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Boron | 7440-42-8 | D | **940** | ug/L | **5400** | | **7800** | | **7000** | | **5900** | | < 50 | U | < 50 | U | **2400** | | **5100** | |
| Boron | 7440-42-8 | T | | ug/L | 5800 | | 8200 | | 7300 | | 7300 | | < 50 | U | < 50 | U | 2500 | | 5200 | |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U | < 0.2 | U |
| Calcium | 7440-70-2 | T | | ug/L | 440000 | | 470000 | | 410000 | | 410000 | | 400000 | | 420000 | | 250000 | | 350000 | |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | 1 | |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | **7** | | **6** | |
| Copper | 7440-50-8 | T | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | 5 | | 7 | |
| Hardness (As CaCO3) | HARD | T | | ug/L | 6.60E+06 | | 6.50E+06 | | 6.20E+06 | | 5.90E+06 | | 6.60E+06 | | 6.90E+06 | | 3.80E+06 | | 5.70E+06 | |
| Iron | 7439-89-6 | D | | ug/L | < 50 | U | < 50 | U | < 50 | U | < 50 | U | < 50 | U | < 50 | U | | | < 50 | U |
| Iron | 7439-89-6 | T | **300** | ug/L | 130 | | 100 | | < 50 | U | < 50 | U | 50 | | < 50 | U | **350** | | **900** | |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Lead | 7439-92-1 | T | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Lithium | 7439-93-2 | D | | ug/L | 130 | | 150 | | 140 | | 140 | | 180 | | 160 | | 68 | | 130 | |
| Lithium | 7439-93-2 | T | | ug/L | 140 | | 150 | | 140 | | 140 | | 160 | | 160 | | 70 | | 140 | |
| Magnesium | 7439-95-4 | T | | ug/L | 1.30E+06 | | 1.30E+06 | | 1.30E+06 | | 1.20E+06 | | 1.40E+06 | | 1.40E+06 | | 780000 | | 1.20E+06 | |

## Table H-4
## Pore Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | SOD-02 | | SOD-03 | | SOD-04 | | WLF-01 | | WLF-02 | | WLF-03 | | WOD-01 | | WOD-02 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | SOD-WP-25m | | SOD-WP-50m | | SOD-WP-100m | | WLF-WP-01 | | WLF-WP-02 | | WLF-WP-03 | | WOD-WP-0m | | WOD-WP-25m | |
| | | | | Matrix | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | | WPO | |
| | | | | Sample Date | 26 Jan 2023 | | 25 Jan 2023 | | 25 Jan 2023 | | 26 Jan 2023 | | 31 Jan 2023 | | 31 Jan 2023 | | 26 Jan 2023 | | 27 Jan 2023 | |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| Manganese | 7439-96-5 | D | | ug/L | < 5 | U | < 5 | U | < 5 | U | 6 | | 36 | | < 5 | U | 380 | | < 5 | U |
| Manganese | 7439-96-5 | T | 1900 | ug/L | < 5 | U | < 5 | U | < 5 | U | 7 | | 36 | | < 5 | U | 390 | | 28 | |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Nickel | 7440-02-0 | D | 70 | ug/L | < 1 | U | 2 | | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Nickel | 7440-02-0 | T | | ug/L | < 1 | U | 2 | | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | 2 | |
| Titanium | 7440-32-6 | D | | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Titanium | 7440-32-6 | T | | ug/L | 6 | | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | 6 | | 30 | |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U | < 5 | U |
| Zinc | 7440-66-6 | D | **8** | ug/L | < 5 | U | **22** | | < 5 | U | < 5 | U | < 5 | U | < 5 | U | **11** | | **12** | |
| Zinc | 7440-66-6 | T | | ug/L | 10 | | 29 | | 6 | | < 5 | U | 8 | | < 5 | U | 16 | | 29 | |
| **SVOC** | | | | | | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]anthracene | 56-55-3 | T | 0.018 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Phenanthrene | 85-01-8 | T | 0.6 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U | < 1 | U |

## Table H-4
## Pore Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | WOD-03 | | WOD-05 | |
|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | WOD-WP-50m | | WOD-WP-100m | |
| | | | | Matrix | WPO | | WPO | |
| | | | | Sample Date | 27 Jan 2023 | | 27 Jan 2023 | |
| Chemical | CAS No. | Fraction | Aqueous 95% Marine Screening Criteria | Unit | Result | Qual | Result | Qual |
| **GENERAL CHEMISTRY** | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 150000 | | 110000 | |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 1.10E+07 | | 1.80E+07 | |
| Conductivity | COND | T | | us/cm | 31000 | | 47000 | |
| Cyanide | 57-12-5 | T | **4** | ug/L | **5** | | < 5 | U |
| Cyanide (Free) | FREE CN | T | **4** | ug/L | < 5 | U | < 5 | U |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | | | | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | 780 | | 900 | |
| pH Value | pH_Lab | T | | SU | 7.1 | | 6.9 | |
| Total Organic Carbon | TOC | T | | ug/L | 7000 | | < 5000 | U |
| Total Suspended Solids | TSS | T | | ug/L | 130000 | | 240000 | |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 | U | < 5 | U |
| **METALS** | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | < 50 | U | < 50 | U |
| Aluminum | 7429-90-5 | T | | ug/L | 150 | | 310 | |
| Arsenic | 7440-38-2 | D | **12** | ug/L | 2 | | 4 | |
| Arsenic | 7440-38-2 | T | | ug/L | 4 | | 5 | |
| Barium | 7440-39-3 | D | | ug/L | 20 | | < 20 | U |
| Barium | 7440-39-3 | T | 1000 | ug/L | 20 | | < 20 | U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 | U | < 1 | U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 | U | < 1 | U |
| Boron | 7440-42-8 | D | **940** | ug/L | **2600** | | < 50 | U |
| Boron | 7440-42-8 | T | | ug/L | 2500 | | < 50 | U |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 | U | < 0.2 | U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 | U | < 0.2 | U |
| Calcium | 7440-70-2 | T | | ug/L | 230000 | | 330000 | |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 | U | < 1 | U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 | U | < 1 | U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 | U | < 1 | U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | < 1 | U | **8** | |
| Copper | 7440-50-8 | T | | ug/L | < 1 | U | 9 | |
| Hardness (As CaCO3) | HARD | T | | ug/L | 3.70E+06 | | 5.50E+06 | |
| Iron | 7439-89-6 | D | | ug/L | < 50 | U | < 50 | U |
| Iron | 7439-89-6 | T | **300** | ug/L | **380** | | **720** | |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 | U | < 1 | U |
| Lead | 7439-92-1 | T | | ug/L | < 1 | U | < 1 | U |
| Lithium | 7439-93-2 | D | | ug/L | 65 | | 120 | |
| Lithium | 7439-93-2 | T | | ug/L | 67 | | 140 | |
| Magnesium | 7439-95-4 | T | | ug/L | 750000 | | 1.10E+06 | |

**Table H-4**
**Pore Water Sampling Results**
**Coastal Marine Area Report**
**Environment Southland**
**Tiwai, NZ**

|  |  |  |  | Location ID | WOD-03 |  | WOD-05 |  |
|---|---|---|---|---|---|---|---|---|
|  |  |  |  | Sample ID | WOD-WP-50m |  | WOD-WP-100m |  |
|  |  |  |  | Matrix | WPO |  | WPO |  |
|  |  |  |  | Sample Date | 27 Jan 2023 |  | 27 Jan 2023 |  |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result** | **Qual** | **Result** | **Qual** |
| Manganese | 7439-96-5 | D |  | ug/L | 28 |  | 6 |  |
| Manganese | 7439-96-5 | T | 1900 | ug/L | 28 |  | 13 |  |
| Mercury | 7439-97-6 | D |  | ug/L | < 0.1 | U | < 0.1 | U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 | U | < 0.1 | U |
| Nickel | 7440-02-0 | D | 70 | ug/L | 2 |  | < 1 | U |
| Nickel | 7440-02-0 | T |  | ug/L | < 1 | U | < 1 | U |
| Titanium | 7440-32-6 | D |  | ug/L | < 5 | U | < 5 | U |
| Titanium | 7440-32-6 | T |  | ug/L | 9 |  | 24 |  |
| Vanadium | 7440-62-2 | D |  | ug/L | < 5 | U | < 5 | U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 | U | < 5 | U |
| Zinc | 7440-66-6 | D | **8** | ug/L | **13** |  | < 5 | U |
| Zinc | 7440-66-6 | T |  | ug/L | 14 |  | < 5 | U |
| **SVOC** |  |  |  |  |  |  |  |  |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 | U | < 1 | U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 | U | < 1 | U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 | U | < 1 | U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 | U | < 1 | U |
| Benzo[a]anthracene | 56-55-3 | T | 0.018 | ug/L | < 1 | U | < 1 | U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 | U | < 1 | U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 | U | < 1 | U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 | U | < 1 | U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 | U | < 1 | U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 | U | < 1 | U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 | U | < 1 | U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 | U | < 1 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 | U | < 1 | U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 | U | < 1 | U |
| Phenanthrene | 85-01-8 | T | 0.6 | ug/L | < 1 | U | < 1 | U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 | U | < 1 | U |
| Sum of PAHs | TOTALPAH | T |  | ug/L | < 1 | U | < 1 | U |

**Notes**
µg/L = Micro-Siemens per Centimeter
µS/cm = Micro-Siemens per Centimeter
˚C = Celsius
CaCO3 = Calcium Carbonate
Cl = Chloride
D = Dissolved
N = No Fraction
PAH = Polycyclic Aromatic Hydrocarbon
SU = Standard Units
SVOC = Semi-Volatile Organic Compound
T = Total
U = Result Not Detected
WPO = Pore Water

# Table H-5
# Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | **Location ID** | **BAB-01** | **BAB-01** | **BAB-02** | **BAB-02** | **BAB-03** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample ID** | **BAB-WS-01-BWC** | **BAB-WS-01-TWC** | **BAB-WS-02-BWC** | **BAB-WS-02-TWC** | **BAB-WS-03-BWC** |
| | | | | **Matrix** | **WS** | **WS** | **WS** | **WS** | **WS** |
| | | | | **Sample Date** | **23 Jan 2023** | **23 Jan 2023** | **23 Jan 2023** | **23 Jan 2023** | **23 Jan 2023** |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 100000 | 95000 | 110000 | 120000 | 98000 |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 2.20E+07 | 2.10E+07 | 2.20E+07 | 2.20E+07 | 2.10E+07 |
| Conductivity | COND | N | | us/cm | | | | | |
| Conductivity | COND | T | | us/cm | | | | | |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | T | 4 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Dissolved Organic Carbon | DOC | D | | ug/L | | | | | |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | 61000 | 60000 | 60000 | 60000 | 61000 |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | 950 | 960 | 960 | 950 | 950 |
| pH Value | pH_Lab | T | | SU | 8 | 8 | 8 | 7.9 | 8 |
| Total Organic Carbon | TOC | T | | ug/L | 12000 | 6100 | 9200 | 9600 | 9300 |
| Total Suspended Solids | TSS | T | | ug/L | 22000 | 25000 | 10000 | 43000 | 14000 |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Aluminum | 7429-90-5 | T | | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Arsenic | 7440-38-2 | D | 12 | ug/L | 2 | 2 | 2 | 2 | 2 |
| Arsenic | 7440-38-2 | T | | ug/L | 3 | 2 | 2 | 2 | 2 |
| Barium | 7440-39-3 | D | | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Boron | 7440-42-8 | D | **5100** | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Boron | 7440-42-8 | T | **5100** | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Calcium | 7440-70-2 | T | | ug/L | 530000 | 520000 | 540000 | 500000 | 570000 |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | **4** | 1 | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | T | | ug/L | 6 | 1 | < 1 U | < 1 U | < 1 U |
| Hardness (As CaCO3) | HARD | T | | ug/L | 8.10E+06 | 7.80E+06 | 8.00E+06 | 7.50E+06 | 8.60E+06 |
| Iron | 7439-89-6 | D | | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Iron | 7439-89-6 | T | **300** | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
# Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | BAB-01 | BAB-01 | BAB-02 | BAB-02 | BAB-03 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | BAB-WS-01-BWC | BAB-WS-01-TWC | BAB-WS-02-BWC | BAB-WS-02-TWC | BAB-WS-03-BWC |
| | | | | Matrix | WS | WS | WS | WS | WS |
| | | | | Sample Date | 23 Jan 2023 | 23 Jan 2023 | 23 Jan 2023 | 23 Jan 2023 | 23 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| Lead | 7439-92-1 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Lithium | 7439-93-2 | D | | ug/L | 170 | 180 | 160 | 140 | 140 |
| Lithium | 7439-93-2 | T | | ug/L | 170 | 180 | 160 | 140 | 140 |
| Magnesium | 7439-95-4 | T | | ug/L | 1.60E+06 | 1.60E+06 | 1.60E+06 | 1.50E+06 | 1.70E+06 |
| Manganese | 7439-96-5 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Manganese | 7439-96-5 | T | 1900 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Nickel | 7440-02-0 | D | **70** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Nickel | 7440-02-0 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Titanium | 7440-32-6 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Titanium | 7440-32-6 | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Zinc | 7440-66-6 | D | **8** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Zinc | 7440-66-6 | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **SVOC** | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]anthracene | 56-55-3 | T | **0.018** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Phenanthrene | 85-01-8 | T | 2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
## Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | **Location ID** | **BAB-03** | **BFS-01** | **BFS-02** | **BFS-03** | **ELF-01** | **ELF-02** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample ID** | **BAB-WS-03-TWC** | **BFS-WS-01** | **BFS02-WS** | **BFS-WS-03** | **ELF-WS-01** | **ELF-WS-02** |
| | | | | **Matrix** | **WS** | **WS** | **WS** | **WS** | **WS** | **WS** |
| | | | | **Sample Date** | **23 Jan 2023** | **22 Jan 2023** | **17 Jan 2023** | **22 Jan 2023** | **24 Jan 2023** | **24 Jan 2023** |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 110000 | 130000 | 140000 | 120000 | 120000 | 110000 |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 2.10E+07 | 1.80E+07 | 1.90E+07 | 2.00E+07 | 2.00E+07 | 2.00E+07 |
| Conductivity | COND | N | | us/cm | | | | | | |
| Conductivity | COND | T | | us/cm | | 33000 | 36000 | 39000 | | |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | T | 4 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Dissolved Organic Carbon | DOC | D | | ug/L | | | | | | |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | 61000 | | | | 57000 | 57000 |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | 950 | 910 | 870 | 910 | 880 | 890 |
| pH Value | pH_Lab | T | | SU | 1.4 | 7.5 | 8.2 | 7.8 | 7.9 | 8 |
| Total Organic Carbon | TOC | T | | ug/L | 10000 | 6900 | < 5000 U | < 5000 U | < 5000 U | 9700 |
| Total Suspended Solids | TSS | T | | ug/L | 17000 | 21000 | 16000 | 17000 | 30000 | 22000 |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | < 50 U | **380** | **210** | **1100** | < 50 U | < 50 U |
| Aluminum | 7429-90-5 | T | | ug/L | < 50 U | 510 | 260 | 2000 | < 50 U | < 50 U |
| Arsenic | 7440-38-2 | D | 12 | ug/L | 2 | 4 | 4 | 5 | 1 | 1 |
| Arsenic | 7440-38-2 | T | | ug/L | 2 | 5 | 5 | 3 | 2 | 2 |
| Barium | 7440-39-3 | D | | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Boron | 7440-42-8 | D | **5100** | ug/L | < 50 U | 2700 | 2700 | 2800 | < 50 U | < 50 U |
| Boron | 7440-42-8 | T | **5100** | ug/L | < 50 U | 3300 | 3200 | 8300 | < 50 U | < 50 U |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Calcium | 7440-70-2 | T | | ug/L | 550000 | 410000 | 440000 | 420000 | 480000 | 460000 |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 U | < 1 U | < 1 U | 2 | < 1 U | < 1 U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 U | 1 | < 1 U | 3 | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 U | < 1 U | < 1 U | 1 | < 1 U | < 1 U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | < 1 U | 1 | 1 | 1 | < 1 U | < 1 U |
| Copper | 7440-50-8 | T | | ug/L | < 1 U | 3 | 3 | 3 | < 1 U | < 1 U |
| Hardness (As CaCO3) | HARD | T | | ug/L | 8.40E+06 | 6.40E+06 | 6.70E+06 | 6.40E+06 | 7.20E+06 | 7.20E+06 |
| Iron | 7439-89-6 | D | | ug/L | < 50 U | 580 | 250 | 1900 | < 50 U | < 50 U |
| Iron | 7439-89-6 | T | **300** | ug/L | < 50 U | **840** | **420** | **2800** | < 50 U | < 50 U |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
# Surface Water Sampling Results
Coastal Marine Area Report
Environment Southland
Tiwai, NZ

| | | | | Location ID | BAB-03 | BFS-01 | BFS-02 | BFS-03 | ELF-01 | ELF-02 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | BAB-WS-03-TWC | BFS-WS-01 | BFS02-WS | BFS-WS-03 | ELF-WS-01 | ELF-WS-02 |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 23 Jan 2023 | 22 Jan 2023 | 17 Jan 2023 | 22 Jan 2023 | 24 Jan 2023 | 24 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| Lead | 7439-92-1 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Lithium | 7439-93-2 | D | | ug/L | 130 | 300 | 300 | 320 | 150 | 150 |
| Lithium | 7439-93-2 | T | | ug/L | 130 | 320 | 300 | 330 | 150 | 150 |
| Magnesium | 7439-95-4 | T | | ug/L | 1.70E+06 | 1.30E+06 | 1.40E+06 | 1.30E+06 | 1.50E+06 | 1.50E+06 |
| Manganese | 7439-96-5 | D | | ug/L | < 5 U | 11 | 8 | 31 | < 5 U | < 5 U |
| Manganese | 7439-96-5 | T | 1900 | ug/L | < 5 U | 13 | 9 | 41 | < 5 U | < 5 U |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Nickel | 7440-02-0 | D | **70** | ug/L | < 1 U | < 1 U | < 1 U | 1 | < 1 U | < 1 U |
| Nickel | 7440-02-0 | T | | ug/L | < 1 U | 1 | < 1 U | 2 | < 1 U | < 1 U |
| Titanium | 7440-32-6 | D | | ug/L | < 5 U | 17 | 6 | 53 | < 5 U | < 5 U |
| Titanium | 7440-32-6 | T | | ug/L | < 5 U | 25 | 12 | 81 | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 U | < 5 U | < 5 U | 6 | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 U | < 5 U | < 5 U | 8 | < 5 U | < 5 U |
| Zinc | 7440-66-6 | D | **8** | ug/L | < 5 U | < 5 U | < 5 U | 5 | < 5 U | < 5 U |
| Zinc | 7440-66-6 | T | | ug/L | < 5 U | < 5 U | < 5 U | 11 | < 5 U | < 5 U |
| **SVOC** | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]anthracene | 56-55-3 | T | **0.018** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Phenanthrene | 85-01-8 | T | 2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
# Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | ELF-03 | ISA-02 | NOD-00 | NOD-01 | NOD-01 | NOD-02 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | ELF-WS-03 | ISA-WS-02 | North Drain SW | NOD-WS-0m-BWC | NOD-WS-0m-TWC | NOD-WS-25m-BWC |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 24 Jan 2023 | 24 Jan 2023 | 02 Feb 2023 | 29 Jan 2023 | 29 Jan 2023 | 29 Jan 2023 |
| Chemical | CAS No. | Fraction | Aqueous 95% Marine Screening Criteria | Unit | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual | Result Qual |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 110000 | 130000 | 74000 | 130000 | 140000 | 110000 |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 2.00E+07 | 2.00E+07 | 36000 | 1.90E+07 | 1.90E+07 | 1.90E+07 |
| Conductivity | COND | N | | us/cm | | | 65 | | | |
| Conductivity | COND | T | | us/cm | | | | 54000 | 50000 | 51000 |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | **12** | < 5 U |
| Cyanide (Free) | FREE CN | T | 4 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Dissolved Organic Carbon | DOC | D | | ug/L | | | < 5000 U | | | |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | 57000 | 56000 | | | | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | 870 | 880 | **66300** | **2040** | **1620** | 330 |
| pH Value | pH_Lab | T | | SU | 8.1 | 8 | 6.4 | 8.1 | 7.7 | 7.6 |
| Total Organic Carbon | TOC | T | | ug/L | < 5000 U | 8300 | 5100 | 5900 | < 5000 U | < 5000 U |
| Total Suspended Solids | TSS | T | | ug/L | 18000 | 19000 | 15000 | 18000 | 240000 | 30000 |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | < 50 U | < 50 U | **46000** | **200** | **210** | **200** |
| Aluminum | 7429-90-5 | T | | ug/L | < 50 U | < 50 U | 46000 | 250 | 210 | 230 |
| Arsenic | 7440-38-2 | D | 12 | ug/L | 1 | 1 | 7 | 3 | 3 | 3 |
| Arsenic | 7440-38-2 | T | | ug/L | 2 | 1 | 8 | 4 | 4 | 4 |
| Barium | 7440-39-3 | D | | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Boron | 7440-42-8 | D | **5100** | ug/L | < 50 U | < 50 U | < 50 U | **8300** | **8000** | **6200** |
| Boron | 7440-42-8 | T | **5100** | ug/L | < 50 U | < 50 U | < 50 U | **9100** | **8600** | **7600** |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 U | < 0.2 U | 0.4 | < 0.2 U | < 0.2 U | < 0.2 U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 U | < 0.2 U | 0.4 | < 0.2 U | < 0.2 U | < 0.2 U |
| Calcium | 7440-70-2 | T | | ug/L | 460000 | 440000 | 3600 | 390000 | 340000 | 360000 |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 U | < 1 U | 2 | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 U | < 1 U | **2** | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | < 1 U | < 1 U | **5** | **8** | **7** | **5** |
| Copper | 7440-50-8 | T | | ug/L | < 1 U | 1 | 6 | 8 | 8 | 7 |
| Hardness (As CaCO3) | HARD | T | | ug/L | 7.00E+06 | 6.90E+06 | 28000 | 5.40E+06 | 5.90E+06 | 5.90E+06 |
| Iron | 7439-89-6 | D | | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Iron | 7439-89-6 | T | **300** | ug/L | < 50 U | < 50 U | 90 | < 50 U | < 50 U | < 50 U |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
# Surface Water Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | | Location ID | ELF-03 | ISA-02 | NOD-00 | NOD-01 | NOD-01 | NOD-02 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | ELF-WS-03 | ISA-WS-02 | North Drain SW | NOD-WS-0m-BWC | NOD-WS-0m-TWC | NOD-WS-25m-BWC |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 24 Jan 2023 | 24 Jan 2023 | 02 Feb 2023 | 29 Jan 2023 | 29 Jan 2023 | 29 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| Lead | 7439-92-1 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Lithium | 7439-93-2 | D | | ug/L | 140 | 140 | < 5 U | 140 | 130 | 140 |
| Lithium | 7439-93-2 | T | | ug/L | 140 | 140 | < 5 U | 140 | 150 | 140 |
| Magnesium | 7439-95-4 | T | | ug/L | 1.40E+06 | 1.40E+06 | 4700 | 1.10E+06 | 1.20E+06 | 1.20E+06 |
| Manganese | 7439-96-5 | D | | ug/L | < 5 U | < 5 U | 63 | 6 | 6 | 7 |
| Manganese | 7439-96-5 | T | 1900 | ug/L | < 5 U | < 5 U | 63 | 6 | 6 | 7 |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Nickel | 7440-02-0 | D | **70** | ug/L | < 1 U | < 1 U | **370** | 2 | 2 | 3 |
| Nickel | 7440-02-0 | T | | ug/L | < 1 U | < 1 U | 370 | 3 | 2 | 3 |
| Titanium | 7440-32-6 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Titanium | 7440-32-6 | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 U | < 5 U | 31 | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 U | < 5 U | 35 | < 5 U | < 5 U | < 5 U |
| Zinc | 7440-66-6 | D | **8** | ug/L | < 5 U | < 5 U | **1000** | 7 | 6 | **9** |
| Zinc | 7440-66-6 | T | | ug/L | < 5 U | < 5 U | 1000 | 14 | 7 | 10 |
| **SVOC** | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]anthracene | 56-55-3 | T | **0.018** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Phenanthrene | 85-01-8 | T | 2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

## Table H-5
## Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | NOD-02 | NOD-03 | NOD-03 | NOD-04 | NOD-04 | NOD-04 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | NOD-WS-25m-TWC | NOD-WS-50m-BWC | NOD-WS-50m-TWC | NOD SW 100m BWC | NOD-WS-100m-BWC | NOD-WS-100m-TWC |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 29 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 02 Feb 2023 | 29 Jan 2023 | 29 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 240000 | 110000 | 110000 | 130000 | 150000 | 69000 |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 1.90E+07 | 2.00E+07 | 1.90E+07 | 2.00E+07 | 1.90E+07 | 1.90E+07 |
| Conductivity | COND | N | | us/cm | | | | 6200 | | |
| Conductivity | COND | T | | us/cm | 49000 | | | | 50000 | 55000 |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | T | 4 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Dissolved Organic Carbon | DOC | D | | ug/L | | | | 5900 | | |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | | 59000 | 58000 | | | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | 550 | 950 | 1000 | **4210** | 1320 | 950 |
| pH Value | pH_Lab | T | | SU | 7.5 | 8 | 8 | 7 | 7.8 | 8.5 |
| Total Organic Carbon | TOC | T | | ug/L | 5900 | < 5000 U | 11000 | 7800 | 9100 | 7300 |
| Total Suspended Solids | TSS | T | | ug/L | 850000 | 11000 | 46000 | 17000 | 300000 | 29000 |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | **260** | < 50 U | **80** | **270** | **90** | < 50 U |
| Aluminum | 7429-90-5 | T | | ug/L | 360 | < 50 U | 90 | 400 | 90 | < 50 U |
| Arsenic | 7440-38-2 | D | 12 | ug/L | 3 | 2 | 2 | 2 | 3 | 3 |
| Arsenic | 7440-38-2 | T | | ug/L | 4 | 2 | 2 | 2 | 3 | 3 |
| Barium | 7440-39-3 | D | | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Boron | 7440-42-8 | D | **5100** | ug/L | **6200** | < 50 U | < 50 U | < 50 U | **6900** | **6700** |
| Boron | 7440-42-8 | T | **5100** | ug/L | **6800** | < 50 U | < 50 U | < 50 U | **7600** | **6800** |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Calcium | 7440-70-2 | T | | ug/L | 410000 | 410000 | 370000 | 380000 | 420000 | 330000 |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | **6** | < 1 U | < 1 U | < 1 U | **5** | **5** |
| Copper | 7440-50-8 | T | | ug/L | 6 | < 1 U | < 1 U | < 1 U | 6 | 6 |
| Hardness (As CaCO3) | HARD | T | | ug/L | 5.80E+06 | 6.70E+06 | 6.10E+06 | 6.30E+06 | 6.00E+06 | 5.30E+06 |
| Iron | 7439-89-6 | D | | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Iron | 7439-89-6 | T | **300** | ug/L | 60 | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
# Surface Water Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

|  |  |  |  | Location ID | NOD-02 | NOD-03 | NOD-03 | NOD-04 | NOD-04 | NOD-04 |
|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  | Sample ID | NOD-WS-25m-TWC | NOD-WS-50m-BWC | NOD-WS-50m-TWC | NOD SW 100m BWC | NOD-WS-100m-BWC | NOD-WS-100m-TWC |
|  |  |  |  | Matrix | WS | WS | WS | WS | WS | WS |
|  |  |  |  | Sample Date | 29 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 02 Feb 2023 | 29 Jan 2023 | 29 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| Lead | 7439-92-1 | T |  | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Lithium | 7439-93-2 | D |  | ug/L | 120 | 160 | 150 | 130 | 130 | 140 |
| Lithium | 7439-93-2 | T |  | ug/L | 140 | 160 | 150 | 130 | 140 | 140 |
| Magnesium | 7439-95-4 | T |  | ug/L | 1.10E+06 | 1.40E+06 | 1.30E+06 | 1.30E+06 | 1.20E+06 | 1.10E+06 |
| Manganese | 7439-96-5 | D |  | ug/L | 9 | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Manganese | 7439-96-5 | T | 1900 | ug/L | 10 | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Mercury | 7439-97-6 | D |  | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Nickel | 7440-02-0 | D | **70** | ug/L | 3 | < 1 U | < 1 U | 16 | < 1 U | < 1 U |
| Nickel | 7440-02-0 | T |  | ug/L | 4 | < 1 U | < 1 U | 16 | < 1 U | < 1 U |
| Titanium | 7440-32-6 | D |  | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Titanium | 7440-32-6 | T |  | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | D |  | ug/L | < 5 U | < 5 U | < 5 U | < 5 U |  | < 5 U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Zinc | 7440-66-6 | D | **8** | ug/L | **16** | < 5 U | < 5 U | 8 | < 5 U | < 5 U |
| Zinc | 7440-66-6 | T |  | ug/L | 21 | < 5 U | 5 | 10 | < 5 U | < 5 U |
| **SVOC** |  |  |  |  |  |  |  |  |  |  |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]anthracene | 56-55-3 | T | **0.018** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Phenanthrene | 85-01-8 | T | 2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Sum of PAHs | TOTALPAH | T |  | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
# Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | NOD-04 | NOD-05 | NOD-05 | SCL-02 | SOD-01 | SOD-02 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | North Drain SW 100m TWC | NOD-WS-125m-BWC | NOD-WS-125m-TWC | SCL-WS-02 | SOD-WS-0m-TWC | SOD-WS-25m-BWC |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 02 Feb 2023 | 29 Jan 2023 | 29 Jan 2023 | 23 Jan 2023 | 26 Jan 2023 | 26 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | < 20000 U | 220000 | 130000 | 110000 | 130000 | 150000 |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 3.60E+06 | 2.00E+07 | 1.90E+07 | 1.90E+07 | 1.90E+07 | 1.90E+07 |
| Conductivity | COND | N | | us/cm | 11000 | | | | | |
| Conductivity | COND | T | | us/cm | | 50000 | 51000 | 34000 | 62000 | 61000 |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | T | 4 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Dissolved Organic Carbon | DOC | D | | ug/L | < 5000 U | | | | | |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | | | | | | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | **23400** | 950 | 990 | 870 | 890 | 890 |
| pH Value | pH_Lab | T | | SU | 6.1 | 7.6 | 7.7 | 8 | 7.9 | 8 |
| Total Organic Carbon | TOC | T | | ug/L | < 5000 U | < 5000 U | < 5000 U | < 5000 U | < 5000 U | < 5000 U |
| Total Suspended Solids | TSS | T | | ug/L | 15000 | 190000 | 190000 | 10000 | 42000 | 23000 |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | **19000** | < 50 U | < 50 U | **70** | < 50 U | < 50 U |
| Aluminum | 7429-90-5 | T | | ug/L | 19000 | < 50 U | 60 | 100 | < 50 U | < 50 U |
| Arsenic | 7440-38-2 | D | 12 | ug/L | 2 | 3 | 3 | 4 | 3 | 2 |
| Arsenic | 7440-38-2 | T | | ug/L | 3 | 3 | 3 | 2 | 3 | 2 |
| Barium | 7440-39-3 | D | | ug/L | 30 | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Barium | 7440-39-3 | T | 1000 | ug/L | 30 | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Boron | 7440-42-8 | D | **5100** | ug/L | < 50 U | **6500** | **8900** | 2700 | **7300** | **5900** |
| Boron | 7440-42-8 | T | **5100** | ug/L | < 50 U | **7200** | **9200** | **8200** | **7500** | **6100** |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | 0.4 | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Cadmium | 7440-43-9 | T | | ug/L | 0.4 | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Calcium | 7440-70-2 | T | | ug/L | 68000 | 400000 | 410000 | 430000 | 360000 | 400000 |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | D | | ug/L | 1 | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | 1 | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | **6** | **2** | **5** | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | T | | ug/L | 6 | 3 | 7 | 2 | < 1 U | < 1 U |
| Hardness (As CaCO3) | HARD | T | | ug/L | 1.10E+06 | 5.90E+06 | 5.90E+06 | 6.00E+06 | 5.80E+06 | 5.90E+06 |
| Iron | 7439-89-6 | D | | ug/L | < 50 U | < 50 U | < 50 U | 60 | < 50 U | < 50 U |
| Iron | 7439-89-6 | T | **300** | ug/L | < 50 U | < 50 U | < 50 U | 130 | < 50 U | < 50 U |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

## Table H-5
## Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | NOD-04 | NOD-05 | NOD-05 | SCL-02 | SOD-01 | SOD-02 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | North Drain SW 100m TWC | NOD-WS-125m-BWC | NOD-WS-125m-TWC | SCL-WS-02 | SOD-WS-0m-TWC | SOD-WS-25m-BWC |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 02 Feb 2023 | 29 Jan 2023 | 29 Jan 2023 | 23 Jan 2023 | 26 Jan 2023 | 26 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| Lead | 7439-92-1 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Lithium | 7439-93-2 | D | | ug/L | 26 | 140 | 120 | 300 | 120 | 120 |
| Lithium | 7439-93-2 | T | | ug/L | 26 | 150 | 140 | 330 | 130 | 130 |
| Magnesium | 7439-95-4 | T | | ug/L | 240000 | 1.20E+06 | 1.20E+06 | 1.20E+06 | 1.20E+06 | 1.20E+06 |
| Manganese | 7439-96-5 | D | | ug/L | 49 | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Manganese | 7439-96-5 | T | 1900 | ug/L | 49 | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Nickel | 7440-02-0 | D | **70** | ug/L | **210** | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Nickel | 7440-02-0 | T | | ug/L | 210 | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Titanium | 7440-32-6 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Titanium | 7440-32-6 | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | D | | ug/L | 10 | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | 13 | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Zinc | 7440-66-6 | D | **8** | ug/L | **1200** | < 5 U | < 5 U | 8 | < 5 U | < 5 U |
| Zinc | 7440-66-6 | T | | ug/L | 1200 | < 5 U | < 5 U | 20 | < 5 U | < 5 U |
| **SVOC** | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]anthracene | 56-55-3 | T | **0.018** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Phenanthrene | 85-01-8 | T | 2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

## Table H-5
## Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | SOD-02 | SOD-03 | SOD-03 | SOD-04 | SOD-04 | WLF-01 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | SOD-WS-25m-TWC | SOD-WS-50m-BWC | SOD-WS-50-TWC | SOD-WS-100m-BWC | SOD-WS-100m-TWC | WLF-SW-01-BTW |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 26 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 26 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 180000 | 150000 | 330000 | 98000 | 130000 | 110000 |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 1.90E+07 | 1.90E+07 | 1.80E+07 | 1.80E+07 | 1.90E+07 | 1.80E+07 |
| Conductivity | COND | N | | us/cm | | | | | | |
| Conductivity | COND | T | | us/cm | 62000 | 61000 | 61000 | 61000 | 61000 | 62000 |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 U | < 5 U | **20** | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | T | 4 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Dissolved Organic Carbon | DOC | D | | ug/L | | | | | | |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | | | | | | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | | 920 | 940 | 860 | 890 | 900 |
| pH Value | pH_Lab | T | | SU | 8 | 7.9 | 7.9 | | 7.9 | |
| Total Organic Carbon | TOC | T | | ug/L | < 5000 U | < 5000 U | < 5000 U | < 5000 U | < 5000 U | 5300 |
| Total Suspended Solids | TSS | T | | ug/L | 18000 | 19000 | 17000 | 96000 | 13000 | 18000 |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Aluminum | 7429-90-5 | T | | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Arsenic | 7440-38-2 | D | 12 | ug/L | 4 | 2 | 2 | 2 | 3 | 2 |
| Arsenic | 7440-38-2 | T | | ug/L | 4 | 2 | 2 | 3 | 3 | 2 |
| Barium | 7440-39-3 | D | | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Boron | 7440-42-8 | D | **5100** | ug/L | **5500** | **7600** | **6900** | **6000** | **7400** | **7100** |
| Boron | 7440-42-8 | T | **5100** | ug/L | **6000** | **7800** | **7100** | **6800** | **8000** | **7700** |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Calcium | 7440-70-2 | T | | ug/L | 440000 | 430000 | 500000 | 430000 | 430000 | 440000 |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chromium, total | 7440-47-3 | T | | ug/L | < 1 U | < 1 U | < 1 U | 1 | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | **16** | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | T | | ug/L | 20 | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Hardness (As CaCO3) | HARD | T | | ug/L | 6.40E+06 | 6.20E+06 | 7.00E+06 | 6.20E+06 | 6.30E+06 | 6.60E+06 |
| Iron | 7439-89-6 | D | | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Iron | 7439-89-6 | T | **300** | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
# Surface Water Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | | Location ID | SOD-02 | SOD-03 | SOD-03 | SOD-04 | SOD-04 | WLF-01 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | SOD-WS-25m-TWC | SOD-WS-50m-BWC | SOD-WS-50-TWC | SOD-WS-100m-BWC | SOD-WS-100m-TWC | WLF-SW-01-BTW |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 26 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 25 Jan 2023 | 26 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| Lead | 7439-92-1 | T | | ug/L | < 1 U | 2 | < 1 U | < 1 U | < 1 U | < 1 U |
| Lithium | 7439-93-2 | D | | ug/L | 150 | 110 | 130 | 120 | 140 | 120 |
| Lithium | 7439-93-2 | T | | ug/L | 140 | 130 | 130 | 120 | 140 | 130 |
| Magnesium | 7439-95-4 | T | | ug/L | 1.30E+06 | 1.30E+06 | 1.20E+06 | 1.30E+06 | 1.30E+06 | 1.30E+06 |
| Manganese | 7439-96-5 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Manganese | 7439-96-5 | T | 1900 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Nickel | 7440-02-0 | D | **70** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Nickel | 7440-02-0 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Titanium | 7440-32-6 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Titanium | 7440-32-6 | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Zinc | 7440-66-6 | D | **8** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Zinc | 7440-66-6 | T | | ug/L | < 5 U | < 5 U | < 5 U | 6 | < 5 U | < 5 U |
| **SVOC** | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]anthracene | 56-55-3 | T | **0.018** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Phenanthrene | 85-01-8 | T | 2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

## Table H-5
## Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | WLF-01 | WLF-02 | WLF-02 | WLF-03 | WLF-03 | WOD-01 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | WLF-WS-01-TWC | WLF-WS-02-BWC | WLF-WS-02-TWC | WLF-WS-03-BWC | WLF-WS-03-TWC | WOD-WS-0m-BWC |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 26 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 27 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 1.40E+06 | 120000 | 120000 | 130000 | 120000 | 130000 |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 1.90E+07 | 1.90E+07 | 1.90E+07 | 2.00E+07 | 1.90E+07 | 1.30E+07 |
| Conductivity | COND | N | | us/cm | | | | | | |
| Conductivity | COND | T | | us/cm | 62000 | | | | | 36000 |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | T | 4 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Dissolved Organic Carbon | DOC | D | | ug/L | | | | | | |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | | 58000 | 59000 | 59000 | 58000 | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | | 880 | 880 | 890 | 890 | **2770** |
| pH Value | pH_Lab | T | | SU | 8 | 8.1 | 8 | 8.1 | 8 | 7.7 |
| Total Organic Carbon | TOC | T | | ug/L | 5700 | 5300 | < 5000 U | < 5000 U | < 5000 U | < 5000 U |
| Total Suspended Solids | TSS | T | | ug/L | 46000 | 13000 | 17000 | 10000 | 13000 | 190000 |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | **240** |
| Aluminum | 7429-90-5 | T | | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | 1300 |
| Arsenic | 7440-38-2 | D | 12 | ug/L | 2 | 2 | 2 | 2 | 2 | 2 |
| Arsenic | 7440-38-2 | T | | ug/L | 3 | 2 | 2 | 2 | 2 | 3 |
| Barium | 7440-39-3 | D | | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Boron | 7440-42-8 | D | **5100** | ug/L | **5600** | < 50 U | < 50 U | < 50 U | < 50 U | 3900 |
| Boron | 7440-42-8 | T | **5100** | ug/L | **6600** | < 50 U | < 50 U | < 50 U | < 50 U | 4000 |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Calcium | 7440-70-2 | T | | ug/L | 410000 | 420000 | 420000 | 410000 | 360000 | 250000 |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chromium, total | 7440-47-3 | T | | ug/L | 1 | < 1 U | < 1 U | < 1 U | < 1 U | 1 |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | **8** |
| Copper | 7440-50-8 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | 10 |
| Hardness (As CaCO3) | HARD | T | | ug/L | 6.20E+06 | 7.00E+06 | 7.00E+06 | 6.90E+06 | 5.80E+06 | 4.00E+06 |
| Iron | 7439-89-6 | D | | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Iron | 7439-89-6 | T | **300** | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U | **910** |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
# Surface Water Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | | Location ID | WLF-01 | WLF-02 | WLF-02 | WLF-03 | WLF-03 | WOD-01 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | WLF-WS-01-TWC | WLF-WS-02-BWC | WLF-WS-02-TWC | WLF-WS-03-BWC | WLF-WS-03-TWC | WOD-WS-0m-BWC |
| | | | | Matrix | WS | WS | WS | WS | WS | WS |
| | | | | Sample Date | 26 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 31 Jan 2023 | 27 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| Lead | 7439-92-1 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | 2 |
| Lithium | 7439-93-2 | D | | ug/L | 140 | 160 | 160 | 160 | 160 | 97 |
| Lithium | 7439-93-2 | T | | ug/L | 140 | 160 | 160 | 160 | 160 | 98 |
| Magnesium | 7439-95-4 | T | | ug/L | 1.20E+06 | 1.40E+06 | 1.40E+06 | 1.40E+06 | 1.20E+06 | 820000 |
| Manganese | 7439-96-5 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | 11 |
| Manganese | 7439-96-5 | T | 1900 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | 23 |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Nickel | 7440-02-0 | D | **70** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | 3 |
| Nickel | 7440-02-0 | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | 7 |
| Titanium | 7440-32-6 | D | | ug/L | 8 | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Titanium | 7440-32-6 | T | | ug/L | 8 | < 5 U | < 5 U | < 5 U | < 5 U | 14 |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Zinc | 7440-66-6 | D | **8** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | **240** |
| Zinc | 7440-66-6 | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U | 350 |
| **SVOC** | | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]anthracene | 56-55-3 | T | **0.018** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Phenanthrene | 85-01-8 | T | 2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

# Table H-5
# Surface Water Sampling Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | | **Location ID** | **WOD-01** | **WOD-02** | **WOD-02** | **WOD-03** | **WOD-03** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | **Sample ID** | **WOD-WS-0m-TWC** | **WOD-WS-25m-BWC** | **WOD-WS-25m-TWC** | **WOD-WS-50m-BWC** | **WOD-WS-50m-TWC** |
| | | | | **Matrix** | **WS** | **WS** | **WS** | **WS** | **WS** |
| | | | | **Sample Date** | **27 Jan 2023** | **27 Jan 2023** | **27 Jan 2023** | **27 Jan 2023** | **27 Jan 2023** |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** | | | | | | | | | |
| Alkalinity, Total (As CaCO3) | ALK | T | | ug/L | 80000 | 85000 | 81000 | 130000 | 140000 |
| Chloride (As Cl) | 16887-00-6 | T | | ug/L | 1.20E+07 | 1.70E+07 | 1.60E+07 | 1.90E+07 | 2.00E+07 |
| Conductivity | COND | N | | us/cm | | | | | |
| Conductivity | COND | T | | us/cm | 37000 | 51000 | 45000 | 51000 | 55000 |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | T | 4 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Dissolved Organic Carbon | DOC | D | | ug/L | | | | | |
| Electrical Conductivity @ 25°C | EC_Lab | T | | us/cm | | | | | |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | **2870** | 1440 | **1920** | 1400 | 1430 |
| pH Value | pH_Lab | T | | SU | 7.9 | 7.8 | 7.7 | 7.4 | 8.2 |
| Total Organic Carbon | TOC | T | | ug/L | < 5000 U | 5700 | < 5000 U | < 5000 U | < 5000 U |
| Total Suspended Solids | TSS | T | | ug/L | 14000 | 240000 | 140000 | 200000 | 14000 |
| Weak Acid Dissociable Cyanide | WDCN | T | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| **METALS** | | | | | | | | | |
| Aluminum | 7429-90-5 | D | **56** | ug/L | **210** | **210** | **240** | **70** | **180** |
| Aluminum | 7429-90-5 | T | | ug/L | 2000 | 270 | 250 | 110 | 200 |
| Arsenic | 7440-38-2 | D | 12 | ug/L | 2 | 3 | 2 | 3 | 3 |
| Arsenic | 7440-38-2 | T | | ug/L | 4 | 3 | 3 | 3 | 3 |
| Barium | 7440-39-3 | D | | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 U | < 20 U | < 20 U | < 20 U | < 20 U |
| Beryllium | 7440-41-7 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Boron | 7440-42-8 | D | **5100** | ug/L | 3700 | **5400** | 4200 | **5400** | 4600 |
| Boron | 7440-42-8 | T | **5100** | ug/L | 3600 | **5700** | 4400 | **6100** | 4700 |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | 0.2 | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Cadmium | 7440-43-9 | T | | ug/L | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U | < 0.2 U |
| Calcium | 7440-70-2 | T | | ug/L | 240000 | 300000 | 270000 | 340000 | 370000 |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chromium, total | 7440-47-3 | T | | ug/L | 2 | < 1 U | 1 | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | D | | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | **10** | **2** | < 1 U | **8** | < 1 U |
| Copper | 7440-50-8 | T | | ug/L | 13 | 3 | < 1 U | 11 | < 1 U |
| Hardness (As CaCO3) | HARD | T | | ug/L | 4.10E+06 | 5.00E+06 | 4.50E+06 | 5.80E+06 | 6.10E+06 |
| Iron | 7439-89-6 | D | | ug/L | < 50 U | < 50 U | < 50 U | < 50 U | < 50 U |
| Iron | 7439-89-6 | T | **300** | ug/L | **1400** | 90 | < 50 U | 70 | < 50 U |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |

EHS Support

## Table H-5
## Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | Location ID | WOD-01 | WOD-02 | WOD-02 | WOD-03 | WOD-03 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sample ID | WOD-WS-0m-TWC | WOD-WS-25m-BWC | WOD-WS-25m-TWC | WOD-WS-50m-BWC | WOD-WS-50m-TWC |
| | | | | Matrix | WS | WS | WS | WS | WS |
| | | | | Sample Date | 27 Jan 2023 | 27 Jan 2023 | 27 Jan 2023 | 27 Jan 2023 | 27 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** | **Result Qual** |
| Lead | 7439-92-1 | T | | ug/L | 2 | < 1 U | < 1 U | < 1 U | < 1 U |
| Lithium | 7439-93-2 | D | | ug/L | 86 | 120 | 100 | 140 | 140 |
| Lithium | 7439-93-2 | T | | ug/L | 90 | 130 | 120 | 150 | 150 |
| Magnesium | 7439-95-4 | T | | ug/L | 840000 | 1.00E+06 | 920000 | 1.20E+06 | 1.20E+06 |
| Manganese | 7439-96-5 | D | | ug/L | 14 | < 5 U | 5 | < 5 U | < 5 U |
| Manganese | 7439-96-5 | T | 1900 | ug/L | 29 | < 5 U | 6 | < 5 U | < 5 U |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U | < 0.1 U |
| Nickel | 7440-02-0 | D | **70** | ug/L | 4 | 1 | 2 | < 1 U | < 1 U |
| Nickel | 7440-02-0 | T | | ug/L | 10 | 1 | 2 | < 1 U | 1 |
| Titanium | 7440-32-6 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Titanium | 7440-32-6 | T | | ug/L | 17 | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 U | < 5 U | < 5 U | < 5 U | < 5 U |
| Zinc | 7440-66-6 | D | **8** | ug/L | **270** | **88** | **130** | 5 | 7 |
| Zinc | 7440-66-6 | T | | ug/L | 430 | 95 | 130 | 6 | 9 |
| **SVOC** | | | | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]anthracene | 56-55-3 | T | **0.018** | ug/L | **4** | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Phenanthrene | 85-01-8 | T | 2 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 U | < 1 U | < 1 U | < 1 U | < 1 U |
| Sum of PAHs | TOTALPAH | T | | ug/L | 4 | < 1 U | < 1 U | < 1 U | < 1 U |

## Table H-5
## Surface Water Sampling Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

|  |  |  |  | **Location ID** | **WOD-05** | **WOD-05** |
|---|---|---|---|---|---|---|
|  |  |  |  | **Sample ID** | **WOD-WS-100m-BWS** | **WOD-WS-100m-TWS** |
|  |  |  |  | **Matrix** | **WS** | **WS** |
|  |  |  |  | **Sample Date** | **27 Jan 2023** | **27 Jan 2023** |
| **Chemical** | **CAS No.** | **Fraction** | **Aqueous 95% Marine Screening Criteria** | **Unit** | **Result Qual** | **Result Qual** |
| **GENERAL CHEMISTRY** |  |  |  |  |  |  |
| Alkalinity, Total (As CaCO3) | ALK | T |  | ug/L | 140000 | 120000 |
| Chloride (As Cl) | 16887-00-6 | T |  | ug/L | 1.90E+07 | 1.90E+07 |
| Conductivity | COND | N |  | us/cm |  |  |
| Conductivity | COND | T |  | us/cm | 51000 | 55000 |
| Cyanide | 57-12-5 | T | **4** | ug/L | < 5 U | < 5 U |
| Cyanide (Free) | FREE CN | T | 4 | ug/L | < 5 U | < 5 U |
| Dissolved Organic Carbon | DOC | D |  | ug/L |  |  |
| Electrical Conductivity @ 25°C | EC_Lab | T |  | us/cm |  |  |
| Fluoride | 16984-48-8 | D | **1500** | ug/L | **1720** | **1740** |
| pH Value | pH_Lab | T |  | SU | 7.7 | 8.2 |
| Total Organic Carbon | TOC | T |  | ug/L | < 5000 U | < 5000 U |
| Total Suspended Solids | TSS | T |  | ug/L | 26000 | 22000 |
| Weak Acid Dissociable Cyanide | WDCN | T |  | ug/L | < 5 U | < 5 U |
| **METALS** |  |  |  |  |  |  |
| Aluminum | 7429-90-5 | D | **56** | ug/L | **760** | **270** |
| Aluminum | 7429-90-5 | T |  | ug/L | 1300 | 290 |
| Arsenic | 7440-38-2 | D | 12 | ug/L | 3 | 3 |
| Arsenic | 7440-38-2 | T |  | ug/L | 4 | 3 |
| Barium | 7440-39-3 | D |  | ug/L | < 20 U | < 20 U |
| Barium | 7440-39-3 | T | 1000 | ug/L | < 20 U | < 20 U |
| Beryllium | 7440-41-7 | D |  | ug/L | < 1 U | < 1 U |
| Beryllium | 7440-41-7 | T | 100 | ug/L | < 1 U | < 1 U |
| Boron | 7440-42-8 | D | **5100** | ug/L | 5100 | **6000** |
| Boron | 7440-42-8 | T | **5100** | ug/L | **6300** | **6900** |
| Cadmium | 7440-43-9 | D | 5.5 | ug/L | < 0.2 U | < 0.2 U |
| Cadmium | 7440-43-9 | T |  | ug/L | < 0.2 U | < 0.2 U |
| Calcium | 7440-70-2 | T |  | ug/L | 350000 | 360000 |
| Chromium, total | 7440-47-3 | D | 27 | ug/L | 5 | < 1 U |
| Chromium, total | 7440-47-3 | T |  | ug/L | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | D |  | ug/L | < 1 U | < 1 U |
| Cobalt | 7440-48-4 | T | **1** | ug/L | < 1 U | < 1 U |
| Copper | 7440-50-8 | D | **1.3** | ug/L | **7** | **10** |
| Copper | 7440-50-8 | T |  | ug/L | 8 | 10 |
| Hardness (As CaCO3) | HARD | T |  | ug/L | 6.00E+06 | 6.10E+06 |
| Iron | 7439-89-6 | D |  | ug/L | 420 | < 50 U |
| Iron | 7439-89-6 | T | **300** | ug/L | **1100** | < 50 U |
| Lead | 7439-92-1 | D | 4.4 | ug/L | < 1 U | < 1 U |

**Table H-5**
**Surface Water Sampling Results**
**Coastal Marine Area Report**
**Environment Southland**
**Tiwai, NZ**

| | | | | Location ID | WOD-05 | WOD-05 |
|---|---|---|---|---|---|---|
| | | | | Sample ID | WOD-WS-100m-BWS | WOD-WS-100m-TWS |
| | | | | Matrix | WS | WS |
| | | | | Sample Date | 27 Jan 2023 | 27 Jan 2023 |
| Chemical | CAS No. | Fraction | Aqueous 95% Marine Screening Criteria | Unit | Result Qual | Result Qual |
| Lead | 7439-92-1 | T | | ug/L | < 1 U | < 1 U |
| Lithium | 7439-93-2 | D | | ug/L | 120 | 120 |
| Lithium | 7439-93-2 | T | | ug/L | 140 | 130 |
| Magnesium | 7439-95-4 | T | | ug/L | 1.20E+06 | 1.30E+06 |
| Manganese | 7439-96-5 | D | | ug/L | 28 | < 5 U |
| Manganese | 7439-96-5 | T | 1900 | ug/L | 28 | < 5 U |
| Mercury | 7439-97-6 | D | | ug/L | < 0.1 U | < 0.1 U |
| Mercury | 7439-97-6 | T | 0.1 | ug/L | < 0.1 U | < 0.1 U |
| Nickel | 7440-02-0 | D | **70** | ug/L | 1 | 1 |
| Nickel | 7440-02-0 | T | | ug/L | 1 | 1 |
| Titanium | 7440-32-6 | D | | ug/L | < 5 U | < 5 U |
| Titanium | 7440-32-6 | T | | ug/L | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | D | | ug/L | < 5 U | < 5 U |
| Vanadium | 7440-62-2 | T | 100 | ug/L | < 5 U | < 5 U |
| Zinc | 7440-66-6 | D | **8** | ug/L | **14** | **12** |
| Zinc | 7440-66-6 | T | | ug/L | 15 | 16 |
| **SVOC** | | | | | | |
| Acenaphthene | 83-32-9 | T | 5.8 | ug/L | < 1 U | < 1 U |
| Acenaphthylene | 208-96-8 | T | 28 | ug/L | < 1 U | < 1 U |
| Anthracene | 120-12-7 | T | 0.4 | ug/L | < 1 U | < 1 U |
| Benzo(b+j)fluoranthene | edms_0016 | T | 0.06 | ug/L | < 1 U | < 1 U |
| Benzo[a]anthracene | 56-55-3 | T | **0.018** | ug/L | < 1 U | < 1 U |
| Benzo[a]pyrene | 50-32-8 | T | 0.2 | ug/L | < 1 U | < 1 U |
| Benzo[g,h,i]perylene | 191-24-2 | T | 0.012 | ug/L | < 1 U | < 1 U |
| Benzo[k]fluoranthene | 207-08-9 | T | 0.06 | ug/L | < 1 U | < 1 U |
| Chrysene | 218-01-9 | T | 0.1 | ug/L | < 1 U | < 1 U |
| Dibenz(A,H)Anthracene | 53-70-3 | T | 0.01 | ug/L | < 1 U | < 1 U |
| Fluoranthene | 206-44-0 | T | 1.4 | ug/L | < 1 U | < 1 U |
| Fluorene | 86-73-7 | T | 3 | ug/L | < 1 U | < 1 U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | T | 0.012 | ug/L | < 1 U | < 1 U |
| Naphthalene | 91-20-3 | T | 70 | ug/L | < 1 U | < 1 U |
| Phenanthrene | 85-01-8 | T | 2 | ug/L | < 1 U | < 1 U |
| Pyrene | 129-00-0 | T | 0.025 | ug/L | < 1 U | < 1 U |
| Sum of PAHs | TOTALPAH | T | | ug/L | < 1 U | < 1 U |

**Notes**
µg/L = Micrograms per Liter
µs/cm = Micro-Siemens per Centimeter ˚C = Celsius
CaCO3 = Calcium Carbonate
Cl = Chlorine
D = Dissolved
PAH = Polycyclic Aromatic Hydrocarbon SU = Standard Units
T = Total
U = Result Not Detected
WS = Surface Water

# Table H-6
# Dioxin PCB Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | Location ID | BAB-01 | | BAB-03 | | NOD-01 | | NOD-01 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample ID | BAB-SE-01_0-10cm | | BAB-SE-03_0-10cm | | NOD-SE-01_0-10cm | | NOD-SE-01_50-100cm | |
| | | Matrix | SE | | SE | | SE | | SE | |
| | | Sample Date | 27-Jan-23 | | 27-Jan-23 | | 03 Feb 2023 | | 03 Feb 2023 | |
| | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 50-100cm | |
| **Chemical** | **CAS No.** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **DIOXIN/FURAN** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | pg/g | 2.1 | | 1.6 | | 11 | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | pg/g | 3.3 | | 2.4 | | 55 | | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | pg/g | < 0.5 | U | < 0.6 | U | < 1.1 | U | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | pg/g | < 0.5 | U | < 0.6 | U | 3.3 | | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | pg/g | < 0.5 | U | < 0.6 | U | < 1.1 | U | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | pg/g | < 0.5 | U | < 0.6 | U | 8.5 | | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | pg/g | < 0.5 | U | < 0.6 | U | < 1.1 | U | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | pg/g | < 0.5 | U | < 0.6 | U | < 1.1 | U | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | pg/g | < 0.5 | U | < 0.6 | U | < 1.1 | U | | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | pg/g | < 0.5 | U | < 0.6 | U | < 1.1 | U | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | pg/g | < 0.5 | U | < 0.6 | U | < 1.1 | U | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | pg/g | < 0.5 | U | < 0.6 | U | < 1.1 | U | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | pg/g | < 0.5 | U | < 0.6 | U | < 1.1 | U | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | pg/g | < 0.1 | U | < 0.1 | U | < 0.2 | U | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | pg/g | < 0.1 | U | < 0.1 | U | < 0.2 | U | | |
| Heptachlorodibenzofurans | 38998-75-3 | pg/g | < 1.1 | U | < 1.1 | U | 13 | | | |
| Heptachlorodibenzo-p-dioxins (HpCDD), Total | 37871-00-4 | pg/g | 54 | | 61 | | 91 | | | |
| Hexachlorodibenzofuran | 55684-94-1 | pg/g | < 2.2 | U | < 2.3 | U | 14 | | | |
| Hexachlorodibenzo-p-dioxin | 34465-46-8 | pg/g | < 1.6 | U | < 1.7 | U | 130 | | | |
| Octachlorodibenzofuran | 39001-02-0 | pg/g | < 1.1 | U | < 1.1 | U | 16 | | | |
| Octachlorodibenzo-p-dioxin | 3268-87-9 | pg/g | 4.7 | | 4.9 | | 150 | | | |
| PCDDs and PCDFs TEQ Kutz 1990 ND at 0 | PCDDF_Kz90_0.0 | pg/g | 0.1 | | 0 | | 2 | | | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx0.5 | PCDDF_Kz90_0.5R | pg/g | 0.6 | | 0.6 | | 3 | | | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx1.0 | PCDDF_Kz90_1xR | pg/g | 1.1 | | 1.2 | | 3.9 | | | |
| PCDDs and PCDFs TEQ WHO 2005 ND at 0 | PCDDF_WHO5_0.0 | pg/g | 0.1 | | 0 | | 1.9 | | | |
| PCDDs and PCDFs TEQ WHO 2005 RLx0.5 | PCDDF_WHO5_0.5R | pg/g | 0.7 | | 0.7 | | 3 | | | |
| PCDDs and PCDFs TEQ WHO 2005 RLx1.0 | PCDDF_WHO5_1xR | pg/g | 1.3 | | 1.3 | | 4.2 | | | |
| Pentachlorodibenzofuran | 30402-15-4 | pg/g | 65 | | 31 | | 53 | | | |
| Pentachlorodibenzo-p-dioxin (PeCDD), (Total) | 36088-22-9 | pg/g | < 0.5 | U | < 0.6 | U | 45 | | | |
| Tetrachlordibenzofuran, Total (TCDF) | 55722-27-5 | pg/g | 280 | | 180 | | 66 | | | |
| Tetrachlorodibenzo-p-dioxin | 41903-57-5 | pg/g | < 0.1 | U | < 0.1 | U | 21 | | | |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | % | 18 | | 19 | | | | 17 | |
| **GEOPHYSICAL** | | | | | | | | | | |
| <63 Microns | <63µm | %w/w | | | | | | | 0.8 | |
| >2000 Microns | >2000µm | %w/w | | | | | | | 64 | |
| 1-2 mm | 1-2mm | %w/w | | | | | | | 8.1 | |
| 125-250 Microns | 125-250µm | %w/w | | | | | | | 15 | |
| 250-500 Microns | 250-500µm | %w/w | | | | | | | 5.6 | |
| 500-1000 Microns | 500-1000µm | %w/w | | | | | | | 3 | |

## Table H-6
## Dioxin PCB Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | Location ID | BAB-01 | | BAB-03 | | NOD-01 | | NOD-01 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample ID | BAB-SE-01_0-10cm | | BAB-SE-03_0-10cm | | NOD-SE-01_0-10cm | | NOD-SE-01_50-100cm | |
| | | Matrix | SE | | SE | | SE | | SE | |
| | | Sample Date | 27-Jan-23 | | 27-Jan-23 | | 03 Feb 2023 | | 03 Feb 2023 | |
| | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 50-100cm | |
| **Chemical** | **CAS No.** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| 63-125 Microns | 63-125µm | %w/w | | | | | | | 2.8 | |
| **PCB** | | | | | | | | | | |
| DL-polychlorinated biphenyls TEQ WHO 2005 ND at 0 | DLPCB_WHO5_0.0 | pg/g | 0 | | 0 | | 0.09 | | | |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx0.5 | DLPCB_WHO5_0.5R | pg/g | 0.007 | | 0.007 | | 0.1 | | | |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx1.0 | DLPCBs_WHO5_1xR | pg/g | 0.01 | | 0.02 | | 0.12 | | | |
| Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189) | 39635-31-9 | pg/g | < 0.1 | U | < 0.1 | U | 27 | | | |
| Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156) | 38380-08-4 | pg/g | < 0.1 | U | < 0.1 | U | 350 | | | |
| Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157) | 69782-90-7 | pg/g | < 0.1 | U | < 0.1 | U | 63 | | | |
| Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167) | 52663-72-6 | pg/g | < 0.1 | U | < 0.1 | U | 380 | | | |
| Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169) | 32774-16-6 | pg/g | < 0.1 | U | < 0.1 | U | < 0.2 | U | | |
| Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105) | 32598-14-4 | pg/g | < 0.1 | U | < 0.1 | U | 550 | | | |
| Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114) | 74472-37-0 | pg/g | < 0.1 | U | < 0.1 | U | 67 | | | |
| Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118) | 31508-00-6 | pg/g | < 0.1 | U | < 0.1 | U | 1600 | | | |
| Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123) | 65510-44-3 | pg/g | < 0.1 | U | < 0.1 | U | < 0.2 | U | | |
| Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126) | 57465-28-8 | pg/g | < 0.1 | U | < 0.1 | U | < 0.2 | U | | |
| Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77) | 32598-13-3 | pg/g | < 0.1 | U | < 0.1 | U | < 0.2 | U | | |
| Tetrachlorobiphenyl, 3,4,4',5- (PCB 81) | 70362-50-4 | pg/g | < 0.1 | U | < 0.1 | U | < 0.2 | U | | |
| PCB-1016 (Aroclor 1016) | 12674-11-2 | mg/kg | | | | | < 0.1 | U | | |
| PCB-1221 (Aroclor 1221) | 11104-28-2 | mg/kg | | | | | < 0.1 | U | | |
| PCB-1232 (Aroclor 1232) | 11141-16-5 | mg/kg | | | | | < 0.1 | U | | |
| PCB-1242 (Aroclor 1242) | 53469-21-9 | mg/kg | | | | | < 0.1 | U | | |
| PCB-1248 (Aroclor 1248) | 12672-29-6 | mg/kg | | | | | < 0.1 | U | | |
| PCB-1254 (Aroclor 1254) | 11097-69-1 | mg/kg | | | | | < 0.1 | U | | |
| PCB-1260 (Aroclor 1260) | 11096-82-5 | mg/kg | | | | | < 0.1 | U | | |
| Polychlorinated Biphenyl (PCBs) | 1336-36-3 | mg/kg | | | | | < 0.1 | U | | |
| **TPH** | | | | | | | | | | |
| C10 - C14 Fraction (SG) | C10-C14SG | mg/kg | | | | | < 10 | U | | |
| C15-C36 Silica Gel | C15-C36 SG | mg/kg | | | | | < 20 | U | | |
| C7-C36 Silica Gel | C7-C36 SG | mg/kg | | | | | < 35 | U | | |
| C7-C9 Silica Gel | C7-C9 SG | mg/kg | | | | | < 5 | U | | |

## Table H-6
## Dioxin PCB Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | Location ID | NOD-02 | | NOD-03 | | NOD-04 | | NOD-04 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample ID | NOD-SE-02_0-10cm | | NOD-SE-03_0-10cm | | NOD-SE-04_0-10cm | | NOD-SE-04_50-100cm | |
| | | Matrix | SE | | SE | | SE | | SE | |
| | | Sample Date | 01 Feb 2023 | | 01 Feb 2023 | | 03 Feb 2023 | | 03 Feb 2023 | |
| | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 50-100cm | |
| **Chemical** | **CAS No.** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **DIOXIN/FURAN** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | pg/g | 1.9 | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | pg/g | 8.3 | | | | | | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | pg/g | < 0.5 | U | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | pg/g | 0.7 | | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | pg/g | < 0.5 | U | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | pg/g | 1.3 | | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | pg/g | 1.7 | | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | pg/g | < 0.5 | U | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | pg/g | < 0.5 | U | | | | | | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | pg/g | < 0.5 | U | | | | | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | pg/g | < 0.5 | U | | | | | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | pg/g | < 0.5 | U | | | | | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | pg/g | < 0.5 | U | | | | | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | pg/g | < 0.1 | U | | | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | pg/g | < 0.1 | U | | | | | | |
| Heptachlorodibenzofurans | 38998-75-3 | pg/g | 2.8 | | | | | | | |
| Heptachlorodibenzo-p-dioxins (HpCDD), Total | 37871-00-4 | pg/g | 13 | | | | | | | |
| Hexachlorodibenzofuran | 55684-94-1 | pg/g | < 2.1 | U | | | | | | |
| Hexachlorodibenzo-p-dioxin | 34465-46-8 | pg/g | 10 | | | | | | | |
| Octachlorodibenzofuran | 39001-02-0 | pg/g | 1.4 | | | | | | | |
| Octachlorodibenzo-p-dioxin | 3268-87-9 | pg/g | 14 | | | | | | | |
| PCDDs and PCDFs TEQ Kutz 1990 ND at 0 | PCDDF_Kz90_0.0 | pg/g | 0.5 | | | | | | | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx0.5 | PCDDF_Kz90_0.5R | pg/g | 0.9 | | | | | | | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx1.0 | PCDDF_Kz90_1xR | pg/g | 1.4 | | | | | | | |
| PCDDs and PCDFs TEQ WHO 2005 ND at 0 | PCDDF_WHO5_0.0 | pg/g | 0.5 | | | | | | | |
| PCDDs and PCDFs TEQ WHO 2005 RLx0.5 | PCDDF_WHO5_0.5R | pg/g | 1 | | | | | | | |
| PCDDs and PCDFs TEQ WHO 2005 RLx1.0 | PCDDF_WHO5_1xR | pg/g | 1.5 | | | | | | | |
| Pentachlorodibenzofuran | 30402-15-4 | pg/g | < 1.1 | U | | | | | | |
| Pentachlorodibenzo-p-dioxin (PeCDD), (Total) | 36088-22-9 | pg/g | 12 | | | | | | | |
| Tetrachlordibenzofuran, Total (TCDF) | 55722-27-5 | pg/g | 31 | | | | | | | |
| Tetrachlorodibenzo-p-dioxin | 41903-57-5 | pg/g | 18 | | | | | | | |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | % | 9.7 | | 5.5 | | 10 | | 13 | |
| **GEOPHYSICAL** | | | | | | | | | | |
| <63 Microns | <63µm | %w/w | < 0.1 | U | < 0.1 | U | 1.1 | | < 0.1 | U |
| >2000 Microns | >2000µm | %w/w | 57 | | 66 | | 35 | | 49 | |
| 1-2 mm | 1-2mm | %w/w | 2.9 | | 4.4 | | 3.8 | | 1.4 | |
| 125-250 Microns | 125-250µm | %w/w | 21 | | 17 | | 6.8 | | 31 | |
| 250-500 Microns | 250-500µm | %w/w | 15 | | 8 | | 22 | | 14 | |
| 500-1000 Microns | 500-1000µm | %w/w | 2.8 | | 2.1 | | 6.9 | | 2.4 | |

## Table H-6
## Dioxin PCB Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Location ID | NOD-02 | | NOD-03 | | NOD-04 | | NOD-04 | |
| | | Sample ID | NOD-SE-02_0-10cm | | NOD-SE-03_0-10cm | | NOD-SE-04_0-10cm | | NOD-SE-04_50-100cm | |
| | | Matrix | SE | | SE | | SE | | SE | |
| | | Sample Date | 01 Feb 2023 | | 01 Feb 2023 | | 03 Feb 2023 | | 03 Feb 2023 | |
| | | Sample Depth | 0-10cm | | 0-10cm | | 0-10cm | | 50-100cm | |
| **Chemical** | **CAS No.** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| 63-125 Microns | 63-125µm | %w/w | 1.1 | | 1.8 | | 24 | | 2.1 | |
| **PCB** | | | | | | | | | | |
| DL-polychlorinated biphenyls TEQ WHO 2005 ND at 0 | DLPCB_WHO5_0.0 | pg/g | 0.0022 | | 0.00053 | | 0.0022 | | 0.00041 | |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx0.5 | DLPCB_WHO5_0.5R | pg/g | 0.0092 | | 0.0074 | | 0.009 | | 0.0077 | |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx1.0 | DLPCBs_WHO5_1xR | pg/g | 0.016 | | 0.014 | | 0.016 | | 0.015 | |
| Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189) | 39635-31-9 | pg/g | 1.1 | | < 0.1 | U | 0.7 | | < 0.1 | U |
| Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156) | 38380-08-4 | pg/g | 12 | | 1.9 | | 9 | | 0.9 | |
| Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157) | 69782-90-7 | pg/g | 2.5 | | 0.3 | | 2.2 | | < 0.1 | U |
| Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167) | 52663-72-6 | pg/g | 10 | | 2.1 | | 10 | | 0.9 | |
| Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169) | 32774-16-6 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105) | 32598-14-4 | pg/g | 19 | | 4.2 | | 7 | | 3.1 | |
| Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114) | 74472-37-0 | pg/g | 0.9 | | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118) | 31508-00-6 | pg/g | 36 | | 10 | | 42 | | 11 | |
| Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123) | 65510-44-3 | pg/g | < 0.1 | U | < 0.1 | U | 9.2 | | < 0.1 | U |
| Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126) | 57465-28-8 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77) | 32598-13-3 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Tetrachlorobiphenyl, 3,4,4',5- (PCB 81) | 70362-50-4 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1016 (Aroclor 1016) | 12674-11-2 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1221 (Aroclor 1221) | 11104-28-2 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1232 (Aroclor 1232) | 11141-16-5 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1242 (Aroclor 1242) | 53469-21-9 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1248 (Aroclor 1248) | 12672-29-6 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1254 (Aroclor 1254) | 11097-69-1 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1260 (Aroclor 1260) | 11096-82-5 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Polychlorinated Biphenyl (PCBs) | 1336-36-3 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| **TPH** | | | | | | | | | | |
| C10 - C14 Fraction (SG) | C10-C14SG | mg/kg | < 10 | U | | | | | | |
| C15-C36 Silica Gel | C15-C36 SG | mg/kg | < 20 | U | | | | | | |
| C7-C36 Silica Gel | C7-C36 SG | mg/kg | < 35 | U | | | | | | |
| C7-C9 Silica Gel | C7-C9 SG | mg/kg | < 5 | U | | | | | | |

## Table H-6
## Dioxin PCB Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | Location ID | NOD-05 | | SOD-01 | | SOD-03 | | SOD-04 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample ID | NOD-SE-05_0-10cm | | SOD-SE-01_10-50cm | | SOD-SE-03_0-10cm | | SOD-SE-04_0-10cm | |
| | | Matrix | SE | | SE | | SE | | SE | |
| | | Sample Date | 03 Feb 2023 | | 26 Jan 2023 | | 25 Jan 2023 | | 25 Jan 2023 | |
| | | Sample Depth | 0-10cm | | 10-50cm | | 0-10cm | | 0-10cm | |
| Chemical | CAS No. | Unit | Result | Qual | Result | Qual | Result | Qual | Result | Qual |
| **DIOXIN/FURAN** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | pg/g | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | pg/g | | | | | | | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | pg/g | | | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | pg/g | | | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | pg/g | | | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | pg/g | | | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | pg/g | | | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | pg/g | | | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | pg/g | | | | | | | | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | pg/g | | | | | | | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | pg/g | | | | | | | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | pg/g | | | | | | | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | pg/g | | | | | | | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | pg/g | | | | | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | pg/g | | | | | | | | |
| Heptachlorodibenzofurans | 38998-75-3 | pg/g | | | | | | | | |
| Heptachlorodibenzo-p-dioxins (HpCDD), Total | 37871-00-4 | pg/g | | | | | | | | |
| Hexachlorodibenzofuran | 55684-94-1 | pg/g | | | | | | | | |
| Hexachlorodibenzo-p-dioxin | 34465-46-8 | pg/g | | | | | | | | |
| Octachlorodibenzofuran | 39001-02-0 | pg/g | | | | | | | | |
| Octachlorodibenzo-p-dioxin | 3268-87-9 | pg/g | | | | | | | | |
| PCDDs and PCDFs TEQ Kutz 1990 ND at 0 | PCDDF_Kz90_0.0 | pg/g | | | | | | | | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx0.5 | PCDDF_Kz90_0.5R | pg/g | | | | | | | | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx1.0 | PCDDF_Kz90_1xR | pg/g | | | | | | | | |
| PCDDs and PCDFs TEQ WHO 2005 ND at 0 | PCDDF_WHO5_0.0 | pg/g | | | | | | | | |
| PCDDs and PCDFs TEQ WHO 2005 RLx0.5 | PCDDF_WHO5_0.5R | pg/g | | | | | | | | |
| PCDDs and PCDFs TEQ WHO 2005 RLx1.0 | PCDDF_WHO5_1xR | pg/g | | | | | | | | |
| Pentachlorodibenzofuran | 30402-15-4 | pg/g | | | | | | | | |
| Pentachlorodibenzo-p-dioxin (PeCDD), (Total) | 36088-22-9 | pg/g | | | | | | | | |
| Tetrachlordibenzofuran, Total (TCDF) | 55722-27-5 | pg/g | | | | | | | | |
| Tetrachlorodibenzo-p-dioxin | 41903-57-5 | pg/g | | | | | | | | |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | % | 9.6 | | | | | | | |
| **GEOPHYSICAL** | | | | | | | | | | |
| <63 Microns | <63µm | %w/w | 1.7 | | | | | | | |
| >2000 Microns | >2000µm | %w/w | 50 | | | | | | | |
| 1-2 mm | 1-2mm | %w/w | 1.7 | | | | | | | |
| 125-250 Microns | 125-250µm | %w/w | 39 | | | | | | | |
| 250-500 Microns | 250-500µm | %w/w | 5.8 | | | | | | | |
| 500-1000 Microns | 500-1000µm | %w/w | 1.1 | | | | | | | |

# Table H-6
# Dioxin PCB Results
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | Location ID | NOD-05 | | SOD-01 | | SOD-03 | | SOD-04 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample ID | NOD-SE-05_0-10cm | | SOD-SE-01_10-50cm | | SOD-SE-03_0-10cm | | SOD-SE-04_0-10cm | |
| | | Matrix | SE | | SE | | SE | | SE | |
| | | Sample Date | 03 Feb 2023 | | 26 Jan 2023 | | 25 Jan 2023 | | 25 Jan 2023 | |
| | | Sample Depth | 0-10cm | | 10-50cm | | 0-10cm | | 0-10cm | |
| **Chemical** | **CAS No.** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| 63-125 Microns | 63-125µm | %w/w | 0.7 | | | | | | | |
| **PCB** | | | | | | | | | | |
| DL-polychlorinated biphenyls TEQ WHO 2005 ND at 0 | DLPCB_WHO5_0.0 | pg/g | 0.0015 | | 0.0015 | | 0.00028 | | 0.00016 | |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx0.5 | DLPCB_WHO5_0.5R | pg/g | 0.0082 | | 0.01 | | 0.0093 | | 0.0069 | |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx1.0 | DLPCBs_WHO5_1xR | pg/g | 0.015 | | 0.019 | | 0.018 | | 0.014 | |
| Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189) | 39635-31-9 | pg/g | 0.8 | | 0.5 | | < 0.1 | U | < 0.1 | U |
| Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156) | 38380-08-4 | pg/g | 6.8 | | 1.3 | | 1.1 | | 0.6 | |
| Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157) | 69782-90-7 | pg/g | 1.6 | | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167) | 52663-72-6 | pg/g | 6.9 | | 1.9 | | 1.2 | | 0.5 | |
| Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169) | 32774-16-6 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105) | 32598-14-4 | pg/g | 5.7 | | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114) | 74472-37-0 | pg/g | 3.1 | | 3.8 | | < 0.1 | U | < 0.1 | U |
| Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118) | 31508-00-6 | pg/g | 30 | | 8.8 | | 6.9 | | 4.4 | |
| Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123) | 65510-44-3 | pg/g | < 0.1 | U | 33 | | < 0.1 | U | < 0.1 | U |
| Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126) | 57465-28-8 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77) | 32598-13-3 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Tetrachlorobiphenyl, 3,4,4',5- (PCB 81) | 70362-50-4 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1016 (Aroclor 1016) | 12674-11-2 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1221 (Aroclor 1221) | 11104-28-2 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1232 (Aroclor 1232) | 11141-16-5 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1242 (Aroclor 1242) | 53469-21-9 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1248 (Aroclor 1248) | 12672-29-6 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1254 (Aroclor 1254) | 11097-69-1 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1260 (Aroclor 1260) | 11096-82-5 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Polychlorinated Biphenyl (PCBs) | 1336-36-3 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| **TPH** | | | | | | | | | | |
| C10 - C14 Fraction (SG) | C10-C14SG | mg/kg | | | | | | | | |
| C15-C36 Silica Gel | C15-C36 SG | mg/kg | | | | | | | | |
| C7-C36 Silica Gel | C7-C36 SG | mg/kg | | | | | | | | |
| C7-C9 Silica Gel | C7-C9 SG | mg/kg | | | | | | | | |

# Table H-6
## Dioxin PCB Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | Location ID | WLF-02 | | WLF-02 | | WLF-03 | |
|---|---|---|---|---|---|---|---|---|
| | | Sample ID | WLF-SE-02_0-10cm | | WLF-SE-02_10-50cm | | WLF-SE-03_0-10cm | |
| | | Matrix | SE | | SE | | SE | |
| | | Sample Date | 31 Jan 2023 | | 31 Jan 2023 | | 31 Jan 2023 | |
| | | Sample Depth | 0-10cm | | 10-50cm | | 0-10cm | |
| **Chemical** | **CAS No.** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **DIOXIN/FURAN** | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | pg/g | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | pg/g | | | | | | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | pg/g | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | pg/g | | | | | | |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | pg/g | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | pg/g | | | | | | |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | pg/g | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | pg/g | | | | | | |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | pg/g | | | | | | |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | pg/g | | | | | | |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | pg/g | | | | | | |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | pg/g | | | | | | |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | pg/g | | | | | | |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | pg/g | | | | | | |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | pg/g | | | | | | |
| Heptachlorodibenzofurans | 38998-75-3 | pg/g | | | | | | |
| Heptachlorodibenzo-p-dioxins (HpCDD), Total | 37871-00-4 | pg/g | | | | | | |
| Hexachlorodibenzofuran | 55684-94-1 | pg/g | | | | | | |
| Hexachlorodibenzo-p-dioxin | 34465-46-8 | pg/g | | | | | | |
| Octachlorodibenzofuran | 39001-02-0 | pg/g | | | | | | |
| Octachlorodibenzo-p-dioxin | 3268-87-9 | pg/g | | | | | | |
| PCDDs and PCDFs TEQ Kutz 1990 ND at 0 | PCDDF_Kz90_0.0 | pg/g | | | | | | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx0.5 | PCDDF_Kz90_0.5R | pg/g | | | | | | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx1.0 | PCDDF_Kz90_1xR | pg/g | | | | | | |
| PCDDs and PCDFs TEQ WHO 2005 ND at 0 | PCDDF_WHO5_0.0 | pg/g | | | | | | |
| PCDDs and PCDFs TEQ WHO 2005 RLx0.5 | PCDDF_WHO5_0.5R | pg/g | | | | | | |
| PCDDs and PCDFs TEQ WHO 2005 RLx1.0 | PCDDF_WHO5_1xR | pg/g | | | | | | |
| Pentachlorodibenzofuran | 30402-15-4 | pg/g | | | | | | |
| Pentachlorodibenzo-p-dioxin (PeCDD), (Total) | 36088-22-9 | pg/g | | | | | | |
| Tetrachlordibenzofuran, Total (TCDF) | 55722-27-5 | pg/g | | | | | | |
| Tetrachlorodibenzo-p-dioxin | 41903-57-5 | pg/g | | | | | | |
| **GENERAL CHEMISTRY** | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | % | | | 40 | | 9.2 | |
| **GEOPHYSICAL** | | | | | | | | |
| <63 Microns | <63µm | %w/w | | | 21 | | 0.4 | |
| >2000 Microns | >2000µm | %w/w | | | 5.9 | | < 0.1 | U |
| 1-2 mm | 1-2mm | %w/w | | | 0.4 | | 0.6 | |
| 125-250 Microns | 125-250µm | %w/w | | | 17 | | 10 | |
| 250-500 Microns | 250-500µm | %w/w | | | 48 | | 49 | |
| 500-1000 Microns | 500-1000µm | %w/w | | | 4.8 | | 14 | |

## Table H-6
## Dioxin PCB Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | Location ID | WLF-02 | | WLF-02 | | WLF-03 | |
|---|---|---|---|---|---|---|---|---|
| | | Sample ID | WLF-SE-02_0-10cm | | WLF-SE-02_10-50cm | | WLF-SE-03_0-10cm | |
| | | Matrix | SE | | SE | | SE | |
| | | Sample Date | 31 Jan 2023 | | 31 Jan 2023 | | 31 Jan 2023 | |
| | | Sample Depth | 0-10cm | | 10-50cm | | 0-10cm | |
| **Chemical** | **CAS No.** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| 63-125 Microns | 63-125µm | %w/w | | | 4.4 | | 26 | |
| **PCB** | | | | | | | | |
| DL-polychlorinated biphenyls TEQ WHO 2005 ND at 0 | DLPCB_WHO5_0.0 | pg/g | 0.00032 | | 0.00034 | | | |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx0.5 | DLPCB_WHO5_0.5R | pg/g | 0.007 | | 0.013 | | | |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx1.0 | DLPCBs_WHO5_1xR | pg/g | 0.014 | | 0.026 | | | |
| Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189) | 39635-31-9 | pg/g | < 0.1 | U | < 0.2 | U | | |
| Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156) | 38380-08-4 | pg/g | 0.8 | | 1.5 | | | |
| Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157) | 69782-90-7 | pg/g | < 0.1 | U | < 0.2 | U | | |
| Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167) | 52663-72-6 | pg/g | 1.1 | | 1 | | | |
| Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169) | 32774-16-6 | pg/g | < 0.1 | U | < 0.2 | U | | |
| Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105) | 32598-14-4 | pg/g | 2.1 | | 3.9 | | | |
| Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114) | 74472-37-0 | pg/g | < 0.1 | U | < 0.2 | U | | |
| Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118) | 31508-00-6 | pg/g | 6.7 | | 12 | | | |
| Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123) | 65510-44-3 | pg/g | < 0.1 | U | < 0.2 | U | | |
| Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126) | 57465-28-8 | pg/g | < 0.1 | U | < 0.2 | U | | |
| Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77) | 32598-13-3 | pg/g | < 0.1 | U | < 0.2 | U | | |
| Tetrachlorobiphenyl, 3,4,4',5- (PCB 81) | 70362-50-4 | pg/g | < 0.1 | U | < 0.2 | U | | |
| PCB-1016 (Aroclor 1016) | 12674-11-2 | mg/kg | < 0.1 | U | < 0.1 | U | | |
| PCB-1221 (Aroclor 1221) | 11104-28-2 | mg/kg | < 0.1 | U | < 0.1 | U | | |
| PCB-1232 (Aroclor 1232) | 11141-16-5 | mg/kg | < 0.1 | U | < 0.1 | U | | |
| PCB-1242 (Aroclor 1242) | 53469-21-9 | mg/kg | < 0.1 | U | < 0.1 | U | | |
| PCB-1248 (Aroclor 1248) | 12672-29-6 | mg/kg | < 0.1 | U | < 0.1 | U | | |
| PCB-1254 (Aroclor 1254) | 11097-69-1 | mg/kg | < 0.1 | U | < 0.1 | U | | |
| PCB-1260 (Aroclor 1260) | 11096-82-5 | mg/kg | < 0.1 | U | < 0.1 | U | | |
| Polychlorinated Biphenyl (PCBs) | 1336-36-3 | mg/kg | < 0.1 | U | < 0.1 | U | | |
| **TPH** | | | | | | | | |
| C10 - C14 Fraction (SG) | C10-C14SG | mg/kg | | | | | | |
| C15-C36 Silica Gel | C15-C36 SG | mg/kg | | | | | | |
| C7-C36 Silica Gel | C7-C36 SG | mg/kg | | | | | | |
| C7-C9 Silica Gel | C7-C9 SG | mg/kg | | | | | | |

**Table H-6**

**Dioxin PCB Results**

**Coastal Marine Area Report**

**Environment Southland**

**Tiwai, NZ**

| | | Location ID | WLF-03 | | WOD-01 | | WOD-02 | | WOD-03 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample ID | WLF-SE-03_50-100cm | | WOD-SE-01_0-10cm | | WOD-SE-02_0-10cm | | WOD-SE-03_10-50cm | |
| | | Matrix | SE | | SE | | SE | | SE | |
| | | Sample Date | 31 Jan 2023 | | 30 Jan 2023 | | 30 Jan 2023 | | 30 Jan 2023 | |
| | | Sample Depth | 50-100cm | | 0-10cm | | 0-10cm | | 10-50cm | |
| **Chemical** | **CAS No.** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| **DIOXIN/FURAN** | | | | | | | | | | |
| 1,2,3,4,6,7,8-Heptachlorodibenzofuran | 67562-39-4 | pg/g | | | < 0.5 | U | 1.1 | | 1.8 | |
| 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin | 35822-46-9 | pg/g | | | 4.3 | | 3.9 | | 10 | |
| 1,2,3,4,7,8,9-Heptachlorodibenzofuran | 55673-89-7 | pg/g | | | < 0.5 | U | < 0.5 | U | < 0.5 | U |
| 1,2,3,4,7,8-Hexachlorodibenzofuran | 70648-26-9 | pg/g | | | < 0.5 | U | < 0.5 | U | < 0.5 | U |
| 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin | 39227-28-6 | pg/g | | | < 0.5 | U | < 0.5 | U | < 0.5 | U |
| 1,2,3,6,7,8-Hexachlorodibenzofuran | 57117-44-9 | pg/g | | | < 0.5 | U | < 0.5 | U | < 0.5 | U |
| 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin | 57653-85-7 | pg/g | | | 1.7 | | < 0.5 | U | < 0.5 | U |
| 1,2,3,7,8,9-Hexachlorodibenzofuran | 72918-21-9 | pg/g | | | < 0.5 | U | < 0.5 | U | < 0.5 | U |
| 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin | 19408-74-3 | pg/g | | | < 0.5 | U | < 0.5 | U | < 0.5 | U |
| 1,2,3,7,8-Pentachlorodibenzofuran | 57117-41-6 | pg/g | | | 3.2 | | < 0.5 | U | < 0.5 | U |
| 1,2,3,7,8-Pentachlorodibenzo-p-dioxin | 40321-76-4 | pg/g | | | < 0.5 | U | < 0.5 | U | < 0.5 | U |
| 2,3,4,6,7,8-Hexachlorodibenzofuran | 60851-34-5 | pg/g | | | < 0.5 | U | < 0.5 | U | < 0.5 | U |
| 2,3,4,7,8-Pentachlorodibenzofuran | 57117-31-4 | pg/g | | | 12 | | < 0.5 | U | < 0.5 | U |
| 2,3,7,8-Tetrachlorodibenzofuran | 51207-31-9 | pg/g | | | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| 2,3,7,8-Tetrachlorodibenzo-p-dioxin | 1746-01-6 | pg/g | | | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Heptachlorodibenzofurans | 38998-75-3 | pg/g | | | 1.1 | | < 1 | U | < 1.1 | U |
| Heptachlorodibenzo-p-dioxins (HpCDD), Total | 37871-00-4 | pg/g | | | 7.4 | | 88 | | 36 | |
| Hexachlorodibenzofuran | 55684-94-1 | pg/g | | | < 2.2 | U | < 2 | U | 4.6 | |
| Hexachlorodibenzo-p-dioxin | 34465-46-8 | pg/g | | | 7 | | < 1.5 | U | 60 | |
| Octachlorodibenzofuran | 39001-02-0 | pg/g | | | < 1.1 | U | < 1 | U | < 1.1 | U |
| Octachlorodibenzo-p-dioxin | 3268-87-9 | pg/g | | | 5.5 | | 3.8 | | 9.9 | |
| PCDDs and PCDFs TEQ Kutz 1990 ND at 0 | PCDDF_Kz90_0.0 | pg/g | | | 6.4 | | 0.1 | | 0.1 | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx0.5 | PCDDF_Kz90_0.5R | pg/g | | | 6.7 | | 0.5 | | 0.7 | |
| PCDDs and PCDFs TEQ Kutz 1990 RLx1.0 | PCDDF_Kz90_1xR | pg/g | | | 7.1 | | 1 | | 1.2 | |
| PCDDs and PCDFs TEQ WHO 2005 ND at 0 | PCDDF_WHO5_0.0 | pg/g | | | 3.9 | | 0.1 | | 0.1 | |
| PCDDs and PCDFs TEQ WHO 2005 RLx0.5 | PCDDF_WHO5_0.5R | pg/g | | | 4.4 | | 0.6 | | 0.7 | |
| PCDDs and PCDFs TEQ WHO 2005 RLx1.0 | PCDDF_WHO5_1xR | pg/g | | | 4.9 | | 1.2 | | 1.3 | |
| Pentachlorodibenzofuran | 30402-15-4 | pg/g | | | < 1.1 | U | < 1 | U | 28 | |
| Pentachlorodibenzo-p-dioxin (PeCDD), (Total) | 36088-22-9 | pg/g | | | 7.7 | | 63 | | 28 | |
| Tetrachlordibenzofuran, Total (TCDF) | 55722-27-5 | pg/g | | | 56 | | 300 | | 74 | |
| Tetrachlorodibenzo-p-dioxin | 41903-57-5 | pg/g | | | 11 | | 30 | | 16 | |
| **GENERAL CHEMISTRY** | | | | | | | | | | |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | % | | | | | | | | |
| **GEOPHYSICAL** | | | | | | | | | | |
| <63 Microns | <63µm | %w/w | | | | | | | | |
| >2000 Microns | >2000µm | %w/w | | | | | | | | |
| 1-2 mm | 1-2mm | %w/w | | | | | | | | |
| 125-250 Microns | 125-250µm | %w/w | | | | | | | | |
| 250-500 Microns | 250-500µm | %w/w | | | | | | | | |
| 500-1000 Microns | 500-1000µm | %w/w | | | | | | | | |

## Table H-6
## Dioxin PCB Results
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

|  |  | Location ID | WLF-03 |  | WOD-01 |  | WOD-02 |  | WOD-03 |  |
|---|---|---|---|---|---|---|---|---|---|---|
|  |  | Sample ID | WLF-SE-03_50-100cm |  | WOD-SE-01_0-10cm |  | WOD-SE-02_0-10cm |  | WOD-SE-03_10-50cm |  |
|  |  | Matrix | SE |  | SE |  | SE |  | SE |  |
|  |  | Sample Date | 31 Jan 2023 |  | 30 Jan 2023 |  | 30 Jan 2023 |  | 30 Jan 2023 |  |
|  |  | Sample Depth | 50-100cm |  | 0-10cm |  | 0-10cm |  | 10-50cm |  |
| **Chemical** | **CAS No.** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| 63-125 Microns | 63-125µm | %w/w |  |  |  |  |  |  |  |  |
| **PCB** |  |  |  |  |  |  |  |  |  |  |
| DL-polychlorinated biphenyls TEQ WHO 2005 ND at 0 | DLPCB_WHO5_0.0 | pg/g | 0.00019 |  | 0.00041 |  | 0.00025 |  | 0.0007 |  |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx0.5 | DLPCB_WHO5_0.5R | pg/g | 0.0075 |  | 0.0075 |  | 0.0068 |  | 0.0076 |  |
| DL-polychlorinated biphenyls TEQ WHO 2005 RLx1.0 | DLPCBs_WHO5_1xR | pg/g | 0.015 |  | 0.015 |  | 0.013 |  | 0.015 |  |
| Heptachlorobiphenyl, 2,3,3',4,4',5,5'- (PCB 189) | 39635-31-9 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | 1.4 |  |
| Hexachlorobiphenyl, 2,3,3',4,4',5- (PCB 156) | 38380-08-4 | pg/g | 0.6 |  | 1.5 |  | 1.1 |  | 5.2 |  |
| Hexachlorobiphenyl, 2,3,3',4,4',5'- (PCB 157) | 69782-90-7 | pg/g | < 0.1 | U | < 0.1 | U | 0.3 |  | < 0.1 | U |
| Hexachlorobiphenyl, 2,3',4,4',5,5'- (PCB 167) | 52663-72-6 | pg/g | 0.3 |  | 1.5 |  | 1.9 |  | 4.1 |  |
| Hexachlorobiphenyl, 3,3',4,4',5,5'- (PCB 169) | 32774-16-6 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Pentachlorobiphenyl, 2,3,3',4,4'- (PCB 105) | 32598-14-4 | pg/g | 1.6 |  | 3 |  | < 0.1 | U | 2.7 |  |
| Pentachlorobiphenyl, 2,3,4,4',5- (PCB 114) | 74472-37-0 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Pentachlorobiphenyl, 2,3',4,4',5- (PCB 118) | 31508-00-6 | pg/g | 4 |  | 7.8 |  | 5 |  | 10 |  |
| Pentachlorobiphenyl, 2',3,4,4',5- (PCB 123) | 65510-44-3 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Pentachlorobiphenyl, 3,3',4,4',5- (PCB 126) | 57465-28-8 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Tetrachlorobiphenyl, 3,3',4,4'- (PCB 77) | 32598-13-3 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Tetrachlorobiphenyl, 3,4,4',5- (PCB 81) | 70362-50-4 | pg/g | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1016 (Aroclor 1016) | 12674-11-2 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1221 (Aroclor 1221) | 11104-28-2 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1232 (Aroclor 1232) | 11141-16-5 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1242 (Aroclor 1242) | 53469-21-9 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1248 (Aroclor 1248) | 12672-29-6 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1254 (Aroclor 1254) | 11097-69-1 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| PCB-1260 (Aroclor 1260) | 11096-82-5 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| Polychlorinated Biphenyl (PCBs) | 1336-36-3 | mg/kg | < 0.1 | U | < 0.1 | U | < 0.1 | U | < 0.1 | U |
| **TPH** |  |  |  |  |  |  |  |  |  |  |
| C10 - C14 Fraction (SG) | C10-C14SG | mg/kg |  |  | < 10 | U | < 10 | U |  |  |
| C15-C36 Silica Gel | C15-C36 SG | mg/kg |  |  | < 20 | U | < 20 | U |  |  |
| C7-C36 Silica Gel | C7-C36 SG | mg/kg |  |  | < 35 | U | < 35 | U |  |  |
| C7-C9 Silica Gel | C7-C9 SG | mg/kg |  |  | < 5 | U | < 5 | U |  |  |

**Notes**

µm = Micron
˚C = Celsius
%w/w = Weight by Weight Percentage
mg/kg = Milligrams per Kilogram
mm = Millmetres
N = No Fraction
PCB = Polychlorinated Biphenyls
PCDD = Polychlorinated Dibenzodioxins
PCDF = Polychlorinated Dibenzofurans
pg/g = Picogram per Gram
TEQ = Toxic Equivalency
T = Total
TPH = Total Petroleum Hydrocarbons
U = Result Not Detected

# Appendix I QA/QC Tables

## Table I-1
## QA/QC Tables
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | NOD-SO-01 | | NOD-SO-01 | | NOD-SO-01 | WLF-SO-04 | | WLF-SO-04 | | WLF-SO-04 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | NOD-SO-01 | | DUP-SO-01 | | RPD | WLF-SO-03 | | DUP-SO-02 | | RPD |
| | | | **Matrix** | SO | | SO | | | SO | | SO | | |
| | | | **Sample Type** | N | | FD | | | N | | FD | | |
| | | | **Parent Sample** | | | NOD-SO-01_20230129 | | | | | WLF-SO-03_20230131 | | |
| | | | **Sample Date** | 29 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 | 31 Jan 2023 | | 31 Jan 2023 | | 31 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| Cyanide (Free) | FREE CN | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| Fluoride | 16984-48-8 | T | mg/kg | < 100 | U | 100 | | 0.0 | 210 | | < 100 | U | 71.0 |
| Fluoride Soluble | 16984-48-8_Sol | N | mg/kg | < 0.1 | U | 0.6 | | 142.9 | 2.9 | | 5.2 | | 56.8 |
| Moisture Content (dried @ 103°C) | MOISTCONTENT | N | % | 1.9 | | 1.3 | | 37.5 | 3.9 | | 4.1 | | 5.0 |
| Total Organic Carbon | TOC | T | % | 0.3 | | 0.4 | | 28.6 | 1.2 | | 0.8 | | 40.0 |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| METALS | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | T | mg/kg | 3600 | | 3700 | | 2.7 | 3700 | | 3500 | | 5.6 |
| Arsenic | 7440-38-2 | T | mg/kg | 3.1 | | 3 | | 3.3 | 3.3 | | 3.2 | | 3.1 |
| Barium | 7440-39-3 | T | mg/kg | < 10 | U | < 10 | U | -- | < 10 | U | < 10 | U | -- |
| Beryllium | 7440-41-7 | T | mg/kg | < 2 | U | < 2 | U | -- | < 2 | U | < 2 | U | -- |
| Boron | 7440-42-8 | T | mg/kg | < 10 | U | < 10 | U | -- | < 10 | U | < 10 | U | -- |
| Cadmium | 7440-43-9 | T | mg/kg | 0.05 | | 0.04 | | 22.2 | 0.03 | | 0.03 | | 0.0 |
| Chromium, total | 7440-47-3 | T | mg/kg | 4.2 | | 4.2 | | 0.0 | 5.5 | | 5.3 | | 3.7 |
| Cobalt | 7440-48-4 | T | mg/kg | 1.7 | | 1.6 | | 6.1 | 1.9 | | 1.8 | | 5.4 |
| Copper | 7440-50-8 | T | mg/kg | 2.2 | | 2.2 | | 0.0 | 2.4 | | 2.4 | | 0.0 |
| Iron | 7439-89-6 | T | mg/kg | 4700 | | 4500 | | 4.3 | 5100 | | 4900 | | 4.0 |
| Lead | 7439-92-1 | T | mg/kg | 2 | | 2 | | 0.0 | 2.4 | | 2.4 | | 0.0 |
| Lithium | 7439-93-2 | T | mg/kg | 8.1 | | 7.8 | | 3.8 | 6.4 | | 6 | | 6.5 |
| Manganese | 7439-96-5 | T | mg/kg | 62 | | 58 | | 6.7 | 83 | | 74 | | 11.5 |
| Mercury | 7439-97-6 | T | mg/kg | 0.03 | | 0.04 | | 28.6 | < 0.01 | U | < 0.01 | U | -- |
| Nickel | 7440-02-0 | T | mg/kg | 5.5 | | 5.3 | | 3.7 | 3.7 | | 3.4 | | 8.5 |
| Titanium | 7440-32-6 | T | mg/kg | 280 | | 290 | | 3.5 | 370 | | 360 | | 2.7 |
| Vanadium | 7440-62-2 | T | mg/kg | 15 | | 14 | | 6.9 | 19 | | 17 | | 11.1 |
| Zinc | 7440-66-6 | T | mg/kg | 26 | | 25 | | 3.9 | 14 | | 13 | | 7.4 |
| SVOC | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Anthracene | 120-12-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/kg | 0.22 | | 0.21 | | 4.7 | 0.05 | | 0.04 | | 22.2 |
| Benzo[a]anthracene | 56-55-3 | N | mg/kg | 0.03 | | 0.03 | | 0.0 | 0.05 | | 0.04 | | 22.2 |
| Benzo[a]pyrene | 50-32-8 | N | mg/kg | 0.03 | | 0.03 | | 0.0 | < 0.03 | U | < 0.03 | U | -- |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | N | mg/kg | 0.09 | | 0.09 | | 0.0 | 0.05 | | 0.04 | | 22.2 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | N | mg/kg | 0.1 | | 0.1 | | 0.0 | 0.08 | | 0.08 | | 0.0 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | N | mg/kg | 0.07 | | 0.07 | | 0.0 | < 0.03 | U | < 0.03 | U | -- |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/kg | 0.03 | | < 0.03 | U | 0.0 | < 0.03 | U | < 0.03 | U | -- |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/kg | 0.12 | | 0.11 | | 8.7 | 0.04 | | 0.03 | | 28.6 |
| Chrysene | 218-01-9 | N | mg/kg | 0.06 | | 0.06 | | 0.0 | 0.03 | | 0.03 | | 0.0 |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/kg | 0.03 | | < 0.03 | U | 0.0 | < 0.03 | U | < 0.03 | U | -- |
| Fluorene | 86-73-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/kg | 0.03 | | 0.03 | | 0.0 | < 0.03 | U | < 0.03 | U | -- |
| Naphthalene | 91-20-3 | N | mg/kg | < 0.1 | U | < 0.1 | U | -- | < 0.1 | U | < 0.1 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Pyrene | 129-00-0 | N | mg/kg | 0.03 | | < 0.03 | U | 0.0 | < 0.03 | U | < 0.03 | U | -- |
| High Molecular Weight PAHs | PAHs_highMW | T | mg/kg | 0.58 | | 0.47 | | 21.0 | 0.17 | | 0.14 | | 19.4 |
| Low Molecular Weight PAHs | PAHS_lowMW | T | mg/kg | < 0.1 | U | < 0.1 | U | -- | < 0.1 | U | < 0.1 | U | -- |
| Sum of PAHs | TOTALPAH | N | mg/kg | 0.6 | | 0.5 | | 18.2 | 0.2 | | 0.1 | | 66.7 |

**Table I-2**
**QA/QC Tables**
**Coastal Marine Area Report**
**Environment Southland**
**Tiwai, NZ**

| | | | **Location ID** | NOD-02 | | NOD-02 | | NOD-02 | NOD-03 | | NOD-03 | | NOD-03 | WOD-01 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | NOD-SE-02_10-50cm | | DUP-SE-04 | | RPD | NOD-SE-03_0-10cm | | DUP-SE-03 | | RPD | WOD-SE-01_0-10cm | |
| | | | **Matrix** | SE | | SE | | | SE | | SE | | | SE | |
| | | | **Sample Type** | N | | FD | | | N | | FD | | | N | |
| | | | **Parent Sample** | | | NOD-SE-02_10-50CM_2023020 | | | | | NOD-SE-03_0-10CM_20230201 | | | | |
| | | | **Sample Date** | 01 Feb 2023 | | 01 Feb 2023 | | 01 Feb 2023 | 01 Feb 2023 | | 01 Feb 2023 | | 01 Feb 2023 | 30 Jan 2023 | |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** |
| GENERAL CHEMISTRY | | | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- | < 5 | U |
| Cyanide (Free) | FREE CN | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- | < 5 | U |
| Fluoride | 16984-48-8 | T | mg/kg | 110 | | 240 | | 74.3 | 310 | | 380 | | 20.3 | < 100 | U |
| Fluoride Soluble | 16984-48-8_Sol | N | mg/kg | 40 | | < 0.1 | U | 199.0 | 50 | | < 0.1 | U | 199.2 | 0.5 | |
| Total Organic Carbon | TOC | T | % | 0.2 | | 0.5 | | 85.7 | 0.3 | | 0.1 | | 100.0 | 0.2 | |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- | < 5 | U |
| METALS | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | T | mg/kg | 5600 | | 5100 | | 9.3 | 2800 | | 3400 | | 19.4 | 2900 | |
| Arsenic | 7440-38-2 | T | mg/kg | 2.6 | | 2.9 | | 10.9 | 1.8 | | 2.2 | | 20.0 | 2.5 | |
| Barium | 7440-39-3 | T | mg/kg | < 10 | U | < 10 | U | -- | < 10 | U | < 10 | U | -- | < 10 | U |
| Beryllium | 7440-41-7 | T | mg/kg | < 2 | U | < 2 | U | -- | < 2 | U | < 2 | U | -- | < 2 | U |
| Boron | 7440-42-8 | T | mg/kg | < 10 | U | < 10 | U | -- | < 10 | U | < 10 | U | -- | < 10 | U |
| Cadmium | 7440-43-9 | T | mg/kg | 0.07 | | 0.08 | | 13.3 | 0.06 | | 0.06 | | 0.0 | 0.03 | |
| Calcium | 7440-70-2 | T | mg/kg | 4000 | | 2300 | | 54.0 | 1700 | | 1700 | | 0.0 | | |
| Chromium, total | 7440-47-3 | T | mg/kg | 6.5 | | 4.7 | | 32.1 | 3.7 | | 4.1 | | 10.3 | 3 | |
| Cobalt | 7440-48-4 | T | mg/kg | 2.4 | | 2.3 | | 4.3 | 1.2 | | 1.4 | | 15.4 | 1.8 | |
| Copper | 7440-50-8 | T | mg/kg | 5.2 | | 6.5 | | 22.2 | 2 | | 2.1 | | 4.9 | 2.6 | |
| Iron | 7439-89-6 | T | mg/kg | 5400 | | 5900 | | 8.8 | 3100 | | 4000 | | 25.4 | 6000 | |
| Lead | 7439-92-1 | T | mg/kg | 3 | | 2.7 | | 10.5 | 1.6 | | 1.9 | | 17.1 | 1.8 | |
| Lithium | 7439-93-2 | T | mg/kg | 6.4 | | 5.7 | | 11.6 | < 5 | U | 5.6 | | 11.3 | 5.3 | |
| Magnesium | 7439-95-4 | T | mg/kg | 960 | | 940 | | 2.1 | 660 | | 860 | | 26.3 | | |
| Manganese | 7439-96-5 | T | mg/kg | 94 | | 86 | | 8.9 | 45 | | 60 | | 28.6 | 87 | |
| Mercury | 7439-97-6 | T | mg/kg | < 0.01 | U | 0.01 | | 0.0 | < 0.01 | U | < 0.01 | U | -- | < 0.01 | U |
| Nickel | 7440-02-0 | T | mg/kg | 11 | | 9.9 | | 10.5 | 5.4 | | 4.4 | | 20.4 | 3.4 | |
| Titanium | 7440-32-6 | T | mg/kg | 380 | | 340 | | 11.1 | 200 | | 290 | | 36.7 | 310 | |
| Vanadium | 7440-62-2 | T | mg/kg | 22 | | 21 | | 4.7 | 13 | | 15 | | 14.3 | 17 | |
| Zinc | 7440-66-6 | T | mg/kg | 42 | | 36 | | 15.4 | 26 | | 22 | | 16.7 | 35 | |
| SVOC | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U |
| Acenaphthylene | 208-96-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U |
| Anthracene | 120-12-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/kg | 0.12 | | 0.12 | | 0.0 | < 0.03 | U | 0.05 | | 50.0 | 0.16 | |
| Benzo[a]anthracene | 56-55-3 | N | mg/kg | 0.12 | | 0.14 | | 15.4 | < 0.03 | U | 0.05 | | 50.0 | 0.26 | |
| Benzo[a]pyrene | 50-32-8 | N | mg/kg | 0.04 | | 0.05 | | 22.2 | < 0.03 | U | 0.03 | | 0.0 | 0.09 | |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | N | mg/kg | 0.09 | | 0.11 | | 20.0 | 0.04 | | 0.06 | | 40.0 | 0.16 | |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | N | mg/kg | 0.11 | | 0.12 | | 8.7 | 0.08 | | 0.08 | | 0.0 | 0.18 | |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | N | mg/kg | 0.08 | | 0.09 | | 11.8 | < 0.03 | U | 0.05 | | 50.0 | 0.14 | |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- | 0.03 | |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/kg | 0.11 | | 0.13 | | 16.7 | < 0.03 | U | 0.07 | | 80.0 | 0.1 | |
| Chrysene | 218-01-9 | N | mg/kg | 0.09 | | 0.1 | | 10.5 | < 0.03 | U | 0.03 | | 0.0 | 0.06 | |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U |
| Fluoranthene | 206-44-0 | N | mg/kg | 0.04 | | 0.05 | | 22.2 | < 0.03 | U | < 0.03 | U | -- | 0.12 | |
| Fluorene | 86-73-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U |
| Naphthalene | 91-20-3 | N | mg/kg | < 0.1 | U | < 0.1 | U | -- | < 0.1 | U | < 0.1 | U | -- | < 0.1 | U |
| Phenanthrene | 85-01-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U |
| Pyrene | 129-00-0 | N | mg/kg | 0.03 | | 0.03 | | 0.0 | < 0.03 | U | < 0.03 | U | -- | 0.11 | |
| Sum of PAHs | TOTALPAH | N | mg/kg | 0.6 | | 0.6 | | 0.0 | < 0.1 | U | 0.2 | | 66.7 | 0.9 | |

# Table I-2
## QA/QC Tables
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | WOD-01 | | WOD-01 | WOD-02 | | WOD-02 | WOD-02 | WOD-02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | DUP-SE-01 | | RPD | WOD-SE-02_0-10cm | | DUP-SE-02 | | RPD |
| | | | **Matrix** | SE | | | SE | | SE | | |
| | | | **Sample Type** | FD | | | N | | FD | | |
| | | | **Parent Sample** | WOD-SE-01_0-10CM_2023013 | | | | | WOD-SE-02_0-10CM_2023013 | | |
| | | | **Sample Date** | 30 Jan 2023 | | 30 Jan 2023 | 30 Jan 2023 | | 30 Jan 2023 | | 30 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | | | | |
| Cyanide | 57-12-5 | T | mg/kg | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| Cyanide (Free) | FREE CN | T | mg/kg | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| Fluoride | 16984-48-8 | T | mg/kg | < 100 | U | -- | < 100 | U | < 100 | U | -- |
| Fluoride Soluble | 16984-48-8_Sol | N | mg/kg | 2.3 | | 128.6 | < 0.1 | U | 3.8 | | 189.7 |
| Total Organic Carbon | TOC | T | % | 0.3 | | 40.0 | < 0.1 | U | 0.2 | | 66.7 |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/kg | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| METALS | | | | | | | | | | | |
| Aluminum | 7429-90-5 | T | mg/kg | 2100 | | 32.0 | 2500 | | 3500 | | 33.3 |
| Arsenic | 7440-38-2 | T | mg/kg | 2.3 | | 8.3 | 1.9 | | 42 | | 182.7 |
| Barium | 7440-39-3 | T | mg/kg | < 10 | U | -- | < 10 | U | < 10 | U | -- |
| Beryllium | 7440-41-7 | T | mg/kg | < 2 | U | -- | < 2 | U | 46 | | 183.3 |
| Boron | 7440-42-8 | T | mg/kg | < 10 | U | -- | < 10 | U | 69 | | 149.4 |
| Cadmium | 7440-43-9 | T | mg/kg | 0.06 | | 66.7 | 0.04 | | 5.3 | | 197.0 |
| Calcium | 7440-70-2 | T | mg/kg | | | -- | | | | | -- |
| Chromium, total | 7440-47-3 | T | mg/kg | 3.5 | | 15.4 | 5.6 | | 61 | | 166.4 |
| Cobalt | 7440-48-4 | T | mg/kg | 0.9 | | 66.7 | 1.6 | | 71 | | 191.2 |
| Copper | 7440-50-8 | T | mg/kg | 1 | | 88.9 | 1.8 | | 79 | | 191.1 |
| Iron | 7439-89-6 | T | mg/kg | 3200 | | 60.9 | 4100 | | 4900 | | 17.8 |
| Lead | 7439-92-1 | T | mg/kg | 1.1 | | 48.3 | 3.4 | | 83 | | 184.3 |
| Lithium | 7439-93-2 | T | mg/kg | 5.5 | | 3.7 | < 5 | U | < 5 | U | -- |
| Magnesium | 7439-95-4 | T | mg/kg | | | -- | | | | | -- |
| Manganese | 7439-96-5 | T | mg/kg | 41 | | 71.9 | 64 | | 140 | | 74.5 |
| Mercury | 7439-97-6 | T | mg/kg | < 0.01 | U | -- | < 0.01 | U | 1.7 | | 197.7 |
| Nickel | 7440-02-0 | T | mg/kg | 2 | | 51.9 | 5.9 | | 74 | | 170.5 |
| Titanium | 7440-32-6 | T | mg/kg | 220 | | 34.0 | 310 | | 350 | | 12.1 |
| Vanadium | 7440-62-2 | T | mg/kg | 10 | | 51.9 | 16 | | 91 | | 140.2 |
| Zinc | 7440-66-6 | T | mg/kg | 29 | | 18.8 | 32 | | 94 | | 98.4 |
| SVOC | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/kg | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/kg | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Anthracene | 120-12-7 | N | mg/kg | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/kg | 0.22 | | 31.6 | 0.08 | | 0.1 | | 22.2 |
| Benzo[a]anthracene | 56-55-3 | N | mg/kg | 0.13 | | 66.7 | 0.04 | | 0.08 | | 66.7 |
| Benzo[a]pyrene | 50-32-8 | N | mg/kg | 0.05 | | 57.1 | < 0.03 | U | < 0.03 | U | -- |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | N | mg/kg | 0.12 | | 28.6 | 0.05 | | 0.06 | | 18.2 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | N | mg/kg | 0.14 | | 25.0 | 0.09 | | 0.09 | | 0.0 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | N | mg/kg | 0.11 | | 24.0 | < 0.03 | U | < 0.03 | U | -- |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/kg | 0.04 | | 28.6 | < 0.03 | U | < 0.03 | U | -- |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/kg | 0.19 | | 62.1 | 0.08 | | 0.09 | | 11.8 |
| Chrysene | 218-01-9 | N | mg/kg | 0.08 | | 28.6 | 0.04 | | 0.07 | | 54.5 |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/kg | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/kg | 0.05 | | 82.4 | < 0.03 | U | < 0.03 | U | -- |
| Fluorene | 86-73-7 | N | mg/kg | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/kg | 0.04 | | 28.6 | < 0.03 | U | < 0.03 | U | -- |
| Naphthalene | 91-20-3 | N | mg/kg | < 0.1 | U | -- | < 0.1 | U | < 0.1 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/kg | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Pyrene | 129-00-0 | N | mg/kg | 0.04 | | 93.3 | < 0.03 | U | < 0.03 | U | -- |
| Sum of PAHs | TOTALPAH | N | mg/kg | 0.8 | | 11.8 | 0.2 | | 0.3 | | 40.0 |

## Table I-3
## QA/QC Tables
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | A51 | | A51 | | A51 |
|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | A51 | | DUP-01-WG | | RPD |
| | | | **Matrix** | WG | | WG | | |
| | | | **Sample Type** | N | | FD | | |
| | | | **Parent Sample** | | | A51_20230119 | | |
| | | | **Sample Date** | 19 Jan 2023 | | 23 Jan 2023 | | 23 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | T | mg/L | 89 | | 88 | | 1.1 |
| Conductivity | COND | N | us/cm | | | | | -- |
| Conductivity | COND | T | us/cm | 640 | | 640 | | 0.0 |
| Cyanide | 57-12-5 | T | mg/L | < 0.005 | U | < 0.005 | U | -- |
| Cyanide (Free) | FREE CN | T | mg/L | < 0.005 | U | < 0.005 | U | -- |
| Fluoride | 16984-48-8 | D | mg/L | 0.09 | | 0.12 | | 28.6 |
| Total Suspended Solids | TSS | T | mg/L | < 5 | U | < 5 | U | -- |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/L | < 0.005 | U | < 0.005 | U | -- |
| METALS | | | | | | | | |
| Aluminum | 7429-90-5 | D | mg/L | 2.7 | | 2.5 | | 7.7 |
| Aluminum | 7429-90-5 | T | mg/L | 2.7 | | 2.7 | | 0.0 |
| Arsenic | 7440-38-2 | D | mg/L | 0.002 | | 0.002 | | 0.0 |
| Arsenic | 7440-38-2 | T | mg/L | 0.002 | | 0.002 | | 0.0 |
| Barium | 7440-39-3 | D | mg/L | < 0.02 | U | < 0.02 | U | -- |
| Barium | 7440-39-3 | T | mg/L | < 0.02 | U | < 0.02 | U | -- |
| Beryllium | 7440-41-7 | D | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Beryllium | 7440-41-7 | T | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Boron | 7440-42-8 | D | mg/L | 0.1 | | 0.1 | | 0.0 |
| Boron | 7440-42-8 | T | mg/L | 0.12 | | 0.12 | | 0.0 |
| Cadmium | 7440-43-9 | D | mg/L | < 0.0002 | U | < 0.0002 | U | -- |
| Cadmium | 7440-43-9 | T | mg/L | < 0.0002 | U | < 0.0002 | U | -- |
| Calcium | 7440-70-2 | T | mg/L | 30 | | 31 | | 3.3 |
| Chromium, total | 7440-47-3 | D | mg/L | 0.007 | | 0.007 | | 0.0 |
| Chromium, total | 7440-47-3 | T | mg/L | 0.007 | | 0.008 | | 13.3 |
| Cobalt | 7440-48-4 | D | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Cobalt | 7440-48-4 | T | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Copper | 7440-50-8 | D | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Copper | 7440-50-8 | T | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Iron | 7439-89-6 | D | mg/L | 7.6 | | 7.3 | | 4.0 |
| Iron | 7439-89-6 | T | mg/L | 7.8 | | 8 | | 2.5 |
| Lead | 7439-92-1 | D | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Lead | 7439-92-1 | T | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Lithium | 7439-93-2 | D | mg/L | < 0.005 | U | < 0.005 | U | -- |
| Lithium | 7439-93-2 | T | mg/L | < 0.005 | U | < 0.005 | U | -- |
| Magnesium | 7439-95-4 | T | mg/L | 2.8 | | 2.7 | | 3.6 |
| Manganese | 7439-96-5 | D | mg/L | 0.075 | | 0.075 | | 0.0 |
| Manganese | 7439-96-5 | T | mg/L | 0.073 | | 0.079 | | 7.9 |
| Mercury | 7439-97-6 | D | mg/L | < 0.0001 | U | < 0.0001 | U | -- |
| Mercury | 7439-97-6 | T | mg/L | < 0.0001 | U | < 0.0001 | U | -- |
| Nickel | 7440-02-0 | D | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Nickel | 7440-02-0 | T | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Titanium | 7440-32-6 | D | mg/L | 0.036 | | 0.033 | | 8.7 |
| Titanium | 7440-32-6 | T | mg/L | 0.036 | | 0.038 | | 5.4 |
| Vanadium | 7440-62-2 | D | mg/L | 0.058 | | 0.056 | | 3.5 |
| Vanadium | 7440-62-2 | T | mg/L | 0.056 | | 0.059 | | 5.2 |
| Zinc | 7440-66-6 | D | mg/L | 0.005 | | < 0.005 | U | 0.0 |
| Zinc | 7440-66-6 | T | mg/L | 0.007 | | < 0.005 | U | 33.3 |

# Table I-3
QA/QC Tables
Coastal Marine Area Report
Environment Southland
Tiwai, NZ

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Location ID** | | | | A51 | | A51 | | A51 |
| **Sample Name** | | | | A51 | | DUP-01-WG | | RPD |
| **Matrix** | | | | WG | | WG | | |
| **Sample Type** | | | | N | | FD | | |
| **Parent Sample** | | | | | | A51_20230119 | | |
| **Sample Date** | | | | 19 Jan 2023 | | 23 Jan 2023 | | 23 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| SVOC | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Anthracene | 120-12-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]anthracene | 56-55-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]pyrene | 50-32-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Chrysene | 218-01-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Fluorene | 86-73-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Naphthalene | 91-20-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Pyrene | 129-00-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- |
| Sum of PAHs | TOTALPAH | N | mg/L | < 0.001 | U | < 0.001 | U | -- |

## Table I-4
## QA/QC Tables
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | NOD-01 | | NOD-01 | | NOD-01 | WOD-03 | | WOD-03 | | WOD-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | NOD-WP-0m | | DUP-WP-02 | | RPD | WOD-WP-50m | | DUP-WP-01 | | RPD |
| | | | **Matrix** | WPO | | WPO | | | WPO | | WPO | | |
| | | | **Sample Type** | N | | FD | | | N | | FD | | |
| | | | **Parent Sample** | | | NOD-WP-0M_20230129 | | | | | WOD-WP-50M_20230127 | | |
| | | | **Sample Date** | 29 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | T | mg/L | 17000 | | 16000 | | 6.1 | 11000 | | 12000 | | 8.7 |
| Cyanide | 57-12-5 | T | mg/L | < 0.005 | U | < 0.005 | U | -- | 0.005 | | < 0.005 | U | 0.0 |
| Cyanide (Free) | FREE CN | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Fluoride | 16984-48-8 | D | mg/L | 14.8 | | 14.9 | | 0.7 | 0.78 | | 0.72 | | 8.0 |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| METALS | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | mg/L | 0.18 | | 0.42 | | 80.0 | < 0.05 | U | < 0.05 | U | -- |
| Aluminum | 7429-90-5 | T | mg/L | 9.1 | | 14 | | 42.4 | 0.15 | | 0.91 | | 143.4 |
| Arsenic | 7440-38-2 | D | mg/L | 0.017 | | 0.006 | | 95.7 | 0.002 | | 0.002 | | 0.0 |
| Arsenic | 7440-38-2 | T | mg/L | 0.027 | | 0.02 | | 29.8 | 0.004 | | 0.014 | | 111.1 |
| Barium | 7440-39-3 | D | mg/L | 0.02 | | 0.02 | | 0.0 | 0.02 | | 0.02 | | 0.0 |
| Barium | 7440-39-3 | T | mg/L | 0.05 | | 0.07 | | 33.3 | 0.02 | | 0.02 | | 0.0 |
| Beryllium | 7440-41-7 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Beryllium | 7440-41-7 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Boron | 7440-42-8 | D | mg/L | 7.8 | | 8.3 | | 6.2 | 2.6 | | 2.7 | | 3.8 |
| Boron | 7440-42-8 | T | mg/L | 8.2 | | 8.7 | | 5.9 | 2.5 | | 2.8 | | 11.3 |
| Cadmium | 7440-43-9 | D | mg/L | < 0.0002 | U | 0.0003 | | 40.0 | < 0.0002 | U | < 0.0002 | U | -- |
| Cadmium | 7440-43-9 | T | mg/L | 0.0002 | | 0.0004 | | 66.7 | < 0.0002 | U | < 0.0002 | U | -- |
| Calcium | 7440-70-2 | T | mg/L | 320 | | 370 | | 14.5 | 230 | | 220 | | 4.4 |
| Chromium, total | 7440-47-3 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Chromium, total | 7440-47-3 | T | mg/L | 0.004 | | 0.005 | | 22.2 | < 0.001 | U | 0.002 | | 66.7 |
| Cobalt | 7440-48-4 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Cobalt | 7440-48-4 | T | mg/L | < 0.001 | U | 0.001 | | 0.0 | < 0.001 | U | < 0.001 | U | -- |
| Copper | 7440-50-8 | D | mg/L | 0.006 | | 0.009 | | 40.0 | < 0.001 | U | < 0.001 | U | -- |
| Copper | 7440-50-8 | T | mg/L | 0.016 | | 0.017 | | 6.1 | < 0.001 | U | < 0.001 | U | -- |
| Iron | 7439-89-6 | D | mg/L | < 0.05 | U | < 0.05 | U | -- | < 0.05 | U | < 0.05 | U | -- |
| Iron | 7439-89-6 | T | mg/L | 1.8 | | 2.2 | | 20.0 | 0.38 | | 2.7 | | 150.6 |
| Lead | 7439-92-1 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Lead | 7439-92-1 | T | mg/L | 0.007 | | 0.009 | | 25.0 | < 0.001 | U | < 0.001 | U | -- |
| Lithium | 7439-93-2 | D | mg/L | 0.13 | | 0.12 | | 8.0 | 0.065 | | 0.073 | | 11.6 |
| Lithium | 7439-93-2 | T | mg/L | 0.13 | | 0.12 | | 8.0 | 0.067 | | 0.073 | | 8.6 |
| Magnesium | 7439-95-4 | T | mg/L | 1100 | | 1000 | | 9.5 | 750 | | 720 | | 4.1 |
| Manganese | 7439-96-5 | D | mg/L | 0.005 | | 0.005 | | 0.0 | 0.028 | | 0.01 | | 94.7 |
| Manganese | 7439-96-5 | T | mg/L | 0.018 | | 0.023 | | 24.4 | 0.028 | | 0.026 | | 7.4 |
| Mercury | 7439-97-6 | D | mg/L | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- |
| Mercury | 7439-97-6 | T | mg/L | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- |
| Nickel | 7440-02-0 | D | mg/L | 0.005 | | 0.019 | | 116.7 | 0.002 | | < 0.001 | U | 66.7 |
| Nickel | 7440-02-0 | T | mg/L | 0.034 | | 0.05 | | 38.1 | < 0.001 | U | 0.002 | | 66.7 |
| Titanium | 7440-32-6 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Titanium | 7440-32-6 | T | mg/L | 0.057 | | 0.076 | | 28.6 | 0.009 | | 0.055 | | 143.8 |
| Vanadium | 7440-62-2 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Vanadium | 7440-62-2 | T | mg/L | 0.006 | | 0.012 | | 66.7 | < 0.005 | U | 0.01 | | 66.7 |
| Zinc | 7440-66-6 | D | mg/L | < 0.005 | U | 0.09 | | 178.9 | 0.013 | | 0.007 | | 60.0 |
| Zinc | 7440-66-6 | T | mg/L | 0.095 | | 0.16 | | 51.0 | 0.014 | | 0.017 | | 19.4 |

## Table I-4
## QA/QC Tables
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | NOD-01 | | NOD-01 | | NOD-01 | WOD-03 | | WOD-03 | | WOD-03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | NOD-WP-0m | | DUP-WP-02 | | RPD | WOD-WP-50m | | DUP-WP-01 | | RPD |
| | | | **Matrix** | WPO | | WPO | | | WPO | | WPO | | |
| | | | **Sample Type** | N | | FD | | | N | | FD | | |
| | | | **Parent Sample** | | | NOD-WP-0M_20230129 | | | | | WOD-WP-50M_20230127 | | |
| | | | **Sample Date** | 29 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| SVOC | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Anthracene | 120-12-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]anthracene | 56-55-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]pyrene | 50-32-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Chrysene | 218-01-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Fluorene | 86-73-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Naphthalene | 91-20-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Pyrene | 129-00-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Sum of PAHs | TOTALPAH | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |

## Table I-5

## QA/QC Tables

## Coastal Marine Area Report

## Environment Southland

## Tiwai, NZ

| | | | **Location ID** | NOD-01 | | NOD-01 | | NOD-01 | NOD-03 | | NOD-03 | | NOD-03 | WOD-01 | | WOD-01 | | WOD-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | NOD-WS-0m-TWC | | DUP-WS-02 | | RPD | NOD-WS-50m-BWC | | DUP-WS-03 | | RPD | WOD-WS-0m-BWC | | DUP-WS-01 | | RPD |
| | | | **Matrix** | WS | | WS | | | WS | | WS | | | WS | | WS | | |
| | | | **Sample Type** | N | | FD | | | N | | FD | | | N | | FD | | |
| | | | **Parent Sample** | | | NOD-WS-0M-TWC_20230129 | | | | | NOD-WS-50M-BWC_20230131 | | | | | WOD-WS-0M-BWC_20230127 | | |
| | | | **Sample Date** | 29 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 | 31 Jan 2023 | | 31 Jan 2023 | | 31 Jan 2023 | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | | | | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | T | mg/L | 19000 | | 19000 | | 0.0 | 20000 | | 20000 | | 0.0 | 13000 | | 11000 | | 16.7 |
| Cyanide | 57-12-5 | T | mg/L | 0.012 | | < 0.005 | U | 82.4 | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Cyanide (Free) | FREE CN | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Fluoride | 16984-48-8 | D | mg/L | 1.62 | | 1.62 | | 0.0 | 0.95 | | 0.9 | | 5.4 | 2.77 | | 2.49 | | 10.6 |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| METALS | | | | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | mg/L | 0.21 | | 0.23 | | 9.1 | < 0.05 | U | < 0.05 | U | -- | 0.24 | | 0.18 | | 28.6 |
| Aluminum | 7429-90-5 | T | mg/L | 0.21 | | 0.48 | | 78.3 | < 0.05 | U | < 0.05 | U | -- | 1.3 | | 2.1 | | 47.1 |
| Arsenic | 7440-38-2 | D | mg/L | 0.003 | | 0.003 | | 0.0 | 0.002 | | 0.002 | | 0.0 | 0.002 | | 0.002 | | 0.0 |
| Arsenic | 7440-38-2 | T | mg/L | 0.004 | | 0.004 | | 0.0 | 0.002 | | 0.002 | | 0.0 | 0.003 | | 0.004 | | 28.6 |
| Barium | 7440-39-3 | D | mg/L | < 0.02 | U | < 0.02 | U | -- | < 0.02 | U | < 0.02 | U | -- | < 0.02 | U | < 0.02 | U | -- |
| Barium | 7440-39-3 | T | mg/L | < 0.02 | U | < 0.02 | U | -- | < 0.02 | U | < 0.02 | U | -- | < 0.02 | U | < 0.02 | U | -- |
| Beryllium | 7440-41-7 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Beryllium | 7440-41-7 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Boron | 7440-42-8 | D | mg/L | 8 | | 6 | | 28.6 | < 0.05 | U | < 0.05 | U | -- | 3.9 | | 3.2 | | 19.7 |
| Boron | 7440-42-8 | T | mg/L | 8.6 | | 6.4 | | 29.3 | < 0.05 | U | < 0.05 | U | -- | 4 | | 3.3 | | 19.2 |
| Cadmium | 7440-43-9 | D | mg/L | < 0.0002 | U | < 0.0002 | U | -- | < 0.0002 | U | < 0.0002 | U | -- | < 0.0002 | U | 0.0003 | | 40.0 |
| Cadmium | 7440-43-9 | T | mg/L | < 0.0002 | U | < 0.0002 | U | -- | < 0.0002 | U | < 0.0002 | U | -- | < 0.0002 | U | 0.0003 | | 40.0 |
| Calcium | 7440-70-2 | T | mg/L | 340 | | 440 | | 25.6 | 410 | | 390 | | 5.0 | 250 | | 210 | | 17.4 |
| Chromium, total | 7440-47-3 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Chromium, total | 7440-47-3 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | 0.001 | | 0.002 | | 66.7 |
| Cobalt | 7440-48-4 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Cobalt | 7440-48-4 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Copper | 7440-50-8 | D | mg/L | 0.007 | | 0.004 | | 54.5 | < 0.001 | U | < 0.001 | U | -- | 0.008 | | 0.007 | | 13.3 |
| Copper | 7440-50-8 | T | mg/L | 0.008 | | 0.006 | | 28.6 | < 0.001 | U | < 0.001 | U | -- | 0.01 | | 0.008 | | 22.2 |
| Iron | 7439-89-6 | D | mg/L | < 0.05 | U | < 0.05 | U | -- | < 0.05 | U | < 0.05 | U | -- | < 0.05 | U | < 0.05 | U | -- |
| Iron | 7439-89-6 | T | mg/L | < 0.05 | U | 0.1 | | 66.7 | < 0.05 | U | < 0.05 | U | -- | 0.91 | | 1 | | 9.4 |
| Lead | 7439-92-1 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Lead | 7439-92-1 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | 0.002 | | 0.002 | | 0.0 |
| Lithium | 7439-93-2 | D | mg/L | 0.13 | | 0.14 | | 7.4 | 0.16 | | 0.16 | | 0.0 | 0.097 | | 0.08 | | 19.2 |
| Lithium | 7439-93-2 | T | mg/L | 0.15 | | 0.14 | | 6.9 | 0.16 | | 0.16 | | 0.0 | 0.098 | | 0.084 | | 15.4 |
| Magnesium | 7439-95-4 | T | mg/L | 1200 | | 1200 | | 0.0 | 1400 | | 1400 | | 0.0 | 820 | | 710 | | 14.4 |
| Manganese | 7439-96-5 | D | mg/L | 0.006 | | 0.006 | | 0.0 | < 0.005 | U | < 0.005 | U | -- | 0.011 | | 0.017 | | 42.9 |
| Manganese | 7439-96-5 | T | mg/L | 0.006 | | 0.007 | | 15.4 | < 0.005 | U | < 0.005 | U | -- | 0.023 | | 0.027 | | 16.0 |
| Mercury | 7439-97-6 | D | mg/L | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- |
| Mercury | 7439-97-6 | T | mg/L | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- |
| Nickel | 7440-02-0 | D | mg/L | 0.002 | | 0.002 | | 0.0 | < 0.001 | U | < 0.001 | U | -- | 0.003 | | 0.004 | | 28.6 |
| Nickel | 7440-02-0 | T | mg/L | 0.002 | | 0.003 | | 40.0 | < 0.001 | U | < 0.001 | U | -- | 0.007 | | 0.009 | | 25.0 |
| Titanium | 7440-32-6 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Titanium | 7440-32-6 | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- | 0.014 | | 0.014 | | 0.0 |
| Vanadium | 7440-62-2 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Vanadium | 7440-62-2 | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Zinc | 7440-66-6 | D | mg/L | 0.006 | | 0.006 | | 0.0 | < 0.005 | U | < 0.005 | U | -- | 0.24 | | 0.42 | | 54.5 |
| Zinc | 7440-66-6 | T | mg/L | 0.007 | | 0.013 | | 60.0 | < 0.005 | U | < 0.005 | U | -- | 0.35 | | 0.62 | | 55.7 |

## Table I-5
## QA/QC Tables
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | NOD-01 | | NOD-01 | | NOD-01 | NOD-03 | | NOD-03 | | NOD-03 | WOD-01 | | WOD-01 | | WOD-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | NOD-WS-0m-TWC | | DUP-WS-02 | | RPD | NOD-WS-50m-BWC | | DUP-WS-03 | | RPD | WOD-WS-0m-BWC | | DUP-WS-01 | | RPD |
| | | | **Matrix** | WS | | WS | | | WS | | WS | | | WS | | WS | | |
| | | | **Sample Type** | N | | FD | | | N | | FD | | | N | | FD | | |
| | | | **Parent Sample** | | | NOD-WS-0M-TWC_20230129 | | | | | NOD-WS-50M-BWC_20230131 | | | | | WOD-WS-0M-BWC_20230127 | | |
| | | | **Sample Date** | 29 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 | 31 Jan 2023 | | 31 Jan 2023 | | 31 Jan 2023 | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| SVOC | | | | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Anthracene | 120-12-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]anthracene | 56-55-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]pyrene | 50-32-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Chrysene | 218-01-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Fluorene | 86-73-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Naphthalene | 91-20-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Pyrene | 129-00-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Sum of PAHs | TOTALPAH | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |

### Table I-6
### QA/QC Tables
### Coastal Marine Area Report
### Environment Southland
### Tiwai, NZ

| | | | **Location ID** | BAB-SO-03 | | BAB-SO-03 | | BAB-SO-03 | NOD-SO-01 | | NOD-SO-01 | | NOD-SO-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | BAB-SO-03 | | BAB-SO-03 REPLICATE | | RPD | NOD-SO-01 | | NOD-SO-01 REPLICATE | | RPD |
| | | | **Matrix** | SO | | SO | | | SO | | SO | | |
| | | | **Sample Type** | N | | LR | | | N | | LR | | |
| | | | **Parent Sample** | | | BAB-SO-03_20230127 | | | | | NOD-SO-01_20230129 | | |
| | | | **Sample Date** | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 | 29 Jan 2023 | | 29 Jan 2023 | | 29 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| Cyanide (Free) | FREE CN | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| Fluoride | 16984-48-8 | T | mg/kg | < 100 | U | 110 | | 9.5 | < 100 | U | 130 | | 26.1 |
| Fluoride Soluble | 16984-48-8_Sol | N | mg/kg | 3.1 | | 3 | | 3.3 | < 0.1 | U | < 0.1 | U | -- |
| High Molecular Weight PAHs | PAHs_highMW | T | mg/kg | 0.57 | | 0.49 | | 15.1 | 0.58 | | 0.22 | | 90.0 |
| Low Molecular Weight PAHs | PAHS_lowMW | T | mg/kg | < 0.1 | U | < 0.1 | U | -- | < 0.1 | U | < 0.1 | U | -- |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| METALS | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | T | mg/kg | 2700 | | 2800 | | 3.6 | 3600 | | 3300 | | 8.7 |
| Arsenic | 7440-38-2 | T | mg/kg | 2 | | 2.1 | | 4.9 | 3.1 | | 2.8 | | 10.2 |
| Barium | 7440-39-3 | T | mg/kg | 14 | | 14 | | 0.0 | < 10 | U | < 10 | U | -- |
| Beryllium | 7440-41-7 | T | mg/kg | < 2 | U | < 2 | U | -- | < 2 | U | < 2 | U | -- |
| Boron | 7440-42-8 | T | mg/kg | 10 | | 12 | | 18.2 | < 10 | U | < 10 | U | -- |
| Cadmium | 7440-43-9 | T | mg/kg | 0.15 | | 0.16 | | 6.5 | 0.05 | | 0.04 | | 22.2 |
| Chromium, total | 7440-47-3 | T | mg/kg | 2.7 | | 2.7 | | 0.0 | 4.2 | | 4 | | 4.9 |
| Cobalt | 7440-48-4 | T | mg/kg | 1.3 | | 1.5 | | 14.3 | 1.7 | | 1.5 | | 12.5 |
| Copper | 7440-50-8 | T | mg/kg | 4 | | 4.7 | | 16.1 | 2.2 | | 1.9 | | 14.6 |
| Iron | 7439-89-6 | T | mg/kg | 3800 | | 4100 | | 7.6 | 4700 | | 4200 | | 11.2 |
| Lead | 7439-92-1 | T | mg/kg | 6.2 | | 6.7 | | 7.8 | 2 | | 2.3 | | 14.0 |
| Lithium | 7439-93-2 | T | mg/kg | < 5 | U | < 5 | U | -- | 8.1 | | 7.5 | | 7.7 |
| Manganese | 7439-96-5 | T | mg/kg | 530 | | 580 | | 9.0 | 62 | | 55 | | 12.0 |
| Mercury | 7439-97-6 | T | mg/kg | 0.08 | | 0.09 | | 11.8 | 0.03 | | 0.02 | | 40.0 |
| Nickel | 7440-02-0 | T | mg/kg | 2.5 | | 2.7 | | 7.7 | 5.5 | | 5.1 | | 7.5 |
| Titanium | 7440-32-6 | T | mg/kg | 140 | | 150 | | 6.9 | 280 | | 280 | | 0.0 |
| Vanadium | 7440-62-2 | T | mg/kg | 13 | | 13 | | 0.0 | 15 | | 13 | | 14.3 |
| Zinc | 7440-66-6 | T | mg/kg | 28 | | 33 | | 16.4 | 26 | | 24 | | 8.0 |
| SVOC | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Anthracene | 120-12-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/kg | 0.16 | | 0.14 | | 13.3 | 0.22 | | 0.11 | | 66.7 |
| Benzo[a]anthracene | 56-55-3 | N | mg/kg | 0.03 | | 0.04 | | 28.6 | 0.03 | | < 0.03 | U | 0.0 |
| Benzo[a]pyrene | 50-32-8 | N | mg/kg | 0.05 | | 0.04 | | 22.2 | 0.03 | | < 0.03 | U | 0.0 |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | N | mg/kg | 0.11 | | 0.1 | | 9.5 | 0.09 | | 0.05 | | 57.1 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | N | mg/kg | 0.13 | | 0.12 | | 8.0 | 0.1 | | 0.09 | | 10.5 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | N | mg/kg | 0.1 | | 0.08 | | 22.2 | 0.07 | | < 0.03 | U | 80.0 |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/kg | 0.03 | | < 0.03 | U | 0.0 | 0.03 | | < 0.03 | U | 0.0 |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/kg | 0.08 | | 0.07 | | 13.3 | 0.12 | | 0.07 | | 52.6 |
| Chrysene | 218-01-9 | N | mg/kg | 0.06 | | 0.06 | | 0.0 | 0.06 | | 0.04 | | 40.0 |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/kg | 0.06 | | 0.05 | | 18.2 | 0.03 | | < 0.03 | U | 0.0 |
| Fluorene | 86-73-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/kg | 0.05 | | 0.04 | | 22.2 | 0.03 | | < 0.03 | U | 0.0 |
| Naphthalene | 91-20-3 | N | mg/kg | < 0.1 | U | < 0.1 | U | -- | < 0.1 | U | < 0.1 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Pyrene | 129-00-0 | N | mg/kg | 0.05 | | 0.05 | | 0.0 | 0.03 | | < 0.03 | U | 0.0 |
| Sum of PAHs | TOTALPAH | N | mg/kg | 0.7 | | 0.6 | | 15.4 | 0.6 | | 0.2 | | 100.0 |

# Table I-7
# QA/QC Tables
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | **Location ID** | BAB-01 | | BAB-01 | | BAB-01 | BAB-02 | | BAB-02 | | BAB-02 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | BAB-SE-01_50-100cm | | AB-SE-01_50-100cm REPLICAT | | RPD | BAB-SE-02_10-50cm | | BAB-SE-02_10-50cm REPLICAT | | RPD |
| | | | **Matrix** | SE | | SE | | | SE | | SE | | |
| | | | **Sample Type** | N | | LR | | | N | | LR | | |
| | | | **Parent Sample** | | | AB-SE-01_50-100CM_2023012 | | | | | BAB-SE-02_10-50CM_2023012 | | |
| | | | **Sample Date** | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 | 25 Jan 2023 | | 25 Jan 2023 | | 25 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | T | mg/kg | | | | | -- | | | | | -- |
| Cyanide | 57-12-5 | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| Cyanide (Free) | FREE CN | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| Fluoride | 16984-48-8 | T | mg/kg | < 100 | U | < 100 | U | -- | < 100 | U | < 100 | U | -- |
| Fluoride Soluble | 16984-48-8_Sol | N | mg/kg | < 0.1 | U | < 0.1 | U | -- | < 0.1 | U | < 0.1 | U | -- |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/kg | < 5 | U | < 5 | U | -- | < 5 | U | < 5 | U | -- |
| METALS | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | T | mg/kg | 9000 | | 9900 | | 9.5 | 4700 | | 4500 | | 4.3 |
| Arsenic | 7440-38-2 | T | mg/kg | 8.3 | | 9.3 | | 11.4 | 15 | | 15 | | 0.0 |
| Barium | 7440-39-3 | T | mg/kg | < 10 | U | < 10 | U | -- | < 10 | U | < 10 | U | -- |
| Beryllium | 7440-41-7 | T | mg/kg | < 2 | U | < 2 | U | -- | < 2 | U | < 2 | U | -- |
| Boron | 7440-42-8 | T | mg/kg | < 10 | U | < 10 | U | -- | < 10 | U | < 10 | U | -- |
| Cadmium | 7440-43-9 | T | mg/kg | 0.02 | | 0.02 | | 0.0 | 0.02 | | 0.02 | | 0.0 |
| Calcium | 7440-70-2 | T | mg/kg | | | | | -- | | | | | -- |
| Chromium, total | 7440-47-3 | T | mg/kg | 10 | | 11 | | 9.5 | 6.5 | | 6.6 | | 1.5 |
| Cobalt | 7440-48-4 | T | mg/kg | 6.7 | | 7.3 | | 8.6 | 11 | | 11 | | 0.0 |
| Copper | 7440-50-8 | T | mg/kg | 7.9 | | 9.2 | | 15.2 | 2.8 | | 2.8 | | 0.0 |
| Iron | 7439-89-6 | T | mg/kg | 9000 | | 9900 | | 9.5 | 7800 | | 7500 | | 3.9 |
| Lead | 7439-92-1 | T | mg/kg | 2.1 | | 2.5 | | 17.4 | 1.9 | | 1.9 | | 0.0 |
| Lithium | 7439-93-2 | T | mg/kg | 31 | | 34 | | 9.2 | 16 | | 15 | | 6.5 |
| Magnesium | 7439-95-4 | T | mg/kg | | | | | -- | | | | | -- |
| Manganese | 7439-96-5 | T | mg/kg | 120 | | 120 | | 0.0 | 120 | | 97 | | 21.2 |
| Mercury | 7439-97-6 | T | mg/kg | 0.02 | | 0.05 | | 85.7 | < 0.01 | U | < 0.01 | U | -- |
| Nickel | 7440-02-0 | T | mg/kg | 9.1 | | 9.9 | | 8.4 | 6.7 | | 7 | | 4.4 |
| Titanium | 7440-32-6 | T | mg/kg | 730 | | 830 | | 12.8 | 510 | | 490 | | 4.0 |
| Vanadium | 7440-62-2 | T | mg/kg | 28 | | 31 | | 10.2 | 25 | | 24 | | 4.1 |
| Zinc | 7440-66-6 | T | mg/kg | 24 | | 25 | | 4.1 | 19 | | 17 | | 11.1 |
| SVOC | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Anthracene | 120-12-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Benzo[a]anthracene | 56-55-3 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Benzo[a]pyrene | 50-32-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | N | mg/kg | 0.05 | | 0.05 | | 0.0 | 0.04 | | 0.04 | | 0.0 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | N | mg/kg | 0.11 | | 0.1 | | 9.5 | 0.08 | | 0.08 | | 0.0 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Chrysene | 218-01-9 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Fluorene | 86-73-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Naphthalene | 91-20-3 | N | mg/kg | < 0.1 | U | < 0.1 | U | -- | < 0.1 | U | < 0.1 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Pyrene | 129-00-0 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- | < 0.03 | U | < 0.03 | U | -- |
| Sum of PAHs | TOTALPAH | N | mg/kg | < 0.1 | U | < 0.1 | U | -- | < 0.1 | U | < 0.1 | U | -- |

## Table I-7
## QA/QC Tables
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Location ID** | BAB-03 | | BAB-03 | | BAB-03 |
|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | BAB-SE-03_0-10cm | | B-SE-03_0-10cm REPLICA | | RPD |
| | | | **Matrix** | SE | | SE | | |
| | | | **Sample Type** | N | | LR | | |
| | | | **Parent Sample** | | | B-SE-03_0-10CM_202301 | | |
| | | | **Sample Date** | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | |
| Chloride (As Cl) | 16887-00-6 | T | mg/kg | | | | | -- |
| Cyanide | 57-12-5 | T | mg/kg | < 5 | U | < 5 | U | -- |
| Cyanide (Free) | FREE CN | T | mg/kg | < 5 | U | < 5 | U | -- |
| Fluoride | 16984-48-8 | T | mg/kg | < 100 | U | 260 | | 88.9 |
| Fluoride Soluble | 16984-48-8_Sol | N | mg/kg | < 0.1 | U | < 0.1 | U | -- |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/kg | < 5 | U | < 5 | U | -- |
| METALS | | | | | | | | |
| Aluminum | 7429-90-5 | T | mg/kg | 3700 | | 3300 | | 11.4 |
| Arsenic | 7440-38-2 | T | mg/kg | 2 | | 2.2 | | 9.5 |
| Barium | 7440-39-3 | T | mg/kg | < 10 | U | < 10 | U | -- |
| Beryllium | 7440-41-7 | T | mg/kg | < 2 | U | < 2 | U | -- |
| Boron | 7440-42-8 | T | mg/kg | < 10 | U | < 10 | U | -- |
| Cadmium | 7440-43-9 | T | mg/kg | < 0.01 | U | < 0.01 | U | -- |
| Calcium | 7440-70-2 | T | mg/kg | | | | | -- |
| Chromium, total | 7440-47-3 | T | mg/kg | 5.1 | | 4.6 | | 10.3 |
| Cobalt | 7440-48-4 | T | mg/kg | 1.5 | | 1.5 | | 0.0 |
| Copper | 7440-50-8 | T | mg/kg | 1.4 | | 1.3 | | 7.4 |
| Iron | 7439-89-6 | T | mg/kg | 4500 | | 4200 | | 6.9 |
| Lead | 7439-92-1 | T | mg/kg | 1.2 | | 1.1 | | 8.7 |
| Lithium | 7439-93-2 | T | mg/kg | 8.6 | | 8.7 | | 1.2 |
| Magnesium | 7439-95-4 | T | mg/kg | | | | | -- |
| Manganese | 7439-96-5 | T | mg/kg | 64 | | 60 | | 6.5 |
| Mercury | 7439-97-6 | T | mg/kg | 0.04 | | 0.02 | | 66.7 |
| Nickel | 7440-02-0 | T | mg/kg | 2.7 | | 2.7 | | 0.0 |
| Titanium | 7440-32-6 | T | mg/kg | 370 | | 340 | | 8.5 |
| Vanadium | 7440-62-2 | T | mg/kg | 14 | | 13 | | 7.4 |
| Zinc | 7440-66-6 | T | mg/kg | 8.9 | | 9 | | 1.1 |
| SVOC | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Anthracene | 120-12-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Benzo[a]anthracene | 56-55-3 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Benzo[a]pyrene | 50-32-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Benzo[a]pyrene TEQ (half LOR) | BaP_TEQ_0.5xEQL | N | mg/kg | 0.05 | | 0.05 | | 0.0 |
| Benzo[a]pyrene TEQ (LOR) | BaP_TEQ_1.0xEQL | N | mg/kg | 0.09 | | 0.09 | | 0.0 |
| Benzo[a]pyrene TEQ (zero) | BaP_TEQ_0xEQL | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Chrysene | 218-01-9 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Fluorene | 86-73-7 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Naphthalene | 91-20-3 | N | mg/kg | < 0.1 | U | < 0.1 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Pyrene | 129-00-0 | N | mg/kg | < 0.03 | U | < 0.03 | U | -- |
| Sum of PAHs | TOTALPAH | N | mg/kg | < 0.1 | U | < 0.1 | U | -- |

# Table I-8
# QA/QC Tables
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | **Location ID** | WOD-03 | | WOD-03 | | WOD-03 | SOD-01 | | SOD-01 | | SOD-01 | WOD-01 | | WOD-01 | | WOD-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | DUP-WP-01 | | DUP-WP-01 REPLICATE | | RPD | SOD-WP-0m | | SOD-WP-0m REPLICATE | | RPD | WOD-WP-0m | | WOD-WP-0m REPLICATE | | RPD |
| | | | **Matrix** | WPO | | WPO | | | WPO | | WPO | | | WPO | | WPO | | |
| | | | **Sample Type** | FD | | LR | | | N | | LR | | | N | | LR | | |
| | | | **Parent Sample** | WOD-WP-50M_20230127 | | DUP-WP-01_20230127 | | | | | SOD-WP-0M_20230126 | | | | | WOD-WP-0M_20230126 | | |
| | | | **Sample Date** | 27 Jan 2023 | | 27 Jan 2023 | | 27 Jan 2023 | 26 Jan 2023 | | 26 Jan 2023 | | 26 Jan 2023 | 26 Jan 2023 | | 26 Jan 2023 | | 26 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Fluoride | 16984-48-8 | D | mg/L | 0.72 | | 0.72 | | 0.0 | | | | | -- | 0.7 | | 0.76 | | 8.2 |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| METALS | | | | | | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | mg/L | < 0.05 | U | < 0.05 | U | -- | 0.21 | | < 0.05 | U | 123.1 | < 0.05 | U | < 0.05 | U | -- |
| Aluminum | 7429-90-5 | T | mg/L | 0.91 | | 1.2 | | 27.5 | < 0.05 | U | 0.12 | | 82.4 | 0.21 | | 0.07 | | 100.0 |
| Arsenic | 7440-38-2 | D | mg/L | 0.002 | | 0.002 | | 0.0 | 0.001 | | 0.004 | | 120.0 | 0.002 | | 0.003 | | 40.0 |
| Arsenic | 7440-38-2 | T | mg/L | 0.014 | | 0.018 | | 25.0 | 0.002 | | 0.004 | | 66.7 | 0.003 | | 0.003 | | 0.0 |
| Barium | 7440-39-3 | D | mg/L | 0.02 | | 0.02 | | 0.0 | 0.02 | | 0.02 | | 0.0 | 0.03 | | < 0.02 | U | 40.0 |
| Barium | 7440-39-3 | T | mg/L | 0.02 | | 0.03 | | 40.0 | 0.02 | | 0.03 | | 40.0 | 0.03 | | < 0.02 | U | 40.0 |
| Beryllium | 7440-41-7 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Beryllium | 7440-41-7 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Boron | 7440-42-8 | D | mg/L | 2.7 | | 2.8 | | 3.6 | 4.9 | | 5.3 | | 7.8 | 2.4 | | 5.1 | | 72.0 |
| Boron | 7440-42-8 | T | mg/L | 2.8 | | 2.8 | | 0.0 | 5 | | 5.9 | | 16.5 | 2.5 | | 5.9 | | 81.0 |
| Cadmium | 7440-43-9 | D | mg/L | < 0.0002 | U | < 0.0002 | U | -- | 0.001 | | 0.0011 | | 9.5 | < 0.0002 | U | < 0.0002 | U | -- |
| Cadmium | 7440-43-9 | T | mg/L | < 0.0002 | U | < 0.0002 | U | -- | 0.0011 | | 0.0011 | | 0.0 | < 0.0002 | U | < 0.0002 | U | -- |
| Calcium | 7440-70-2 | T | mg/L | 220 | | 230 | | 4.4 | 480 | | 460 | | 4.3 | 250 | | 240 | | 4.1 |
| Chromium, total | 7440-47-3 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Chromium, total | 7440-47-3 | T | mg/L | 0.002 | | 0.003 | | 40.0 | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Cobalt | 7440-48-4 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Cobalt | 7440-48-4 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Copper | 7440-50-8 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | 0.033 | | 188.2 | 0.007 | | 0.006 | | 15.4 |
| Copper | 7440-50-8 | T | mg/L | < 0.001 | U | 0.005 | | 133.3 | 0.002 | | 0.029 | | 174.2 | 0.005 | | 0.008 | | 46.2 |
| Iron | 7439-89-6 | D | mg/L | < 0.05 | U | < 0.05 | U | -- | < 0.05 | U | < 0.05 | U | -- | | | < 0.05 | U | -- |
| Iron | 7439-89-6 | T | mg/L | 2.7 | | 3.6 | | 28.6 | 0.35 | | 0.21 | | 50.0 | 0.35 | | < 0.05 | U | 150.0 |
| Lead | 7439-92-1 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Lead | 7439-92-1 | T | mg/L | < 0.001 | U | 0.001 | | 0.0 | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Lithium | 7439-93-2 | D | mg/L | 0.073 | | 0.073 | | 0.0 | 0.1 | | 0.11 | | 9.5 | 0.068 | | 0.12 | | 55.3 |
| Lithium | 7439-93-2 | T | mg/L | 0.073 | | 0.074 | | 1.4 | 0.13 | | 0.098 | | 28.1 | 0.07 | | 0.14 | | 66.7 |
| Magnesium | 7439-95-4 | T | mg/L | 720 | | 760 | | 5.4 | 1400 | | 1300 | | 7.4 | 780 | | 760 | | 2.6 |
| Manganese | 7439-96-5 | D | mg/L | 0.01 | | 0.01 | | 0.0 | 0.007 | | < 0.005 | U | 33.3 | 0.38 | | < 0.005 | U | 194.8 |
| Manganese | 7439-96-5 | T | mg/L | 0.026 | | 0.033 | | 23.7 | 0.008 | | 0.009 | | 11.8 | 0.39 | | < 0.005 | U | 194.9 |
| Mercury | 7439-97-6 | D | mg/L | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- |
| Mercury | 7439-97-6 | T | mg/L | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- |
| Nickel | 7440-02-0 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | 0.003 | | 0.004 | | 28.6 | < 0.001 | U | < 0.001 | U | -- |
| Nickel | 7440-02-0 | T | mg/L | 0.002 | | 0.002 | | 0.0 | 0.004 | | 0.004 | | 0.0 | < 0.001 | U | < 0.001 | U | -- |
| Titanium | 7440-32-6 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | 0.006 | | 0.006 | | 0.0 | < 0.005 | U | < 0.005 | U | -- |
| Titanium | 7440-32-6 | T | mg/L | 0.055 | | 0.071 | | 25.4 | < 0.005 | U | 0.006 | | 18.2 | 0.006 | | < 0.005 | U | 18.2 |
| Vanadium | 7440-62-2 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Vanadium | 7440-62-2 | T | mg/L | 0.01 | | 0.013 | | 26.1 | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Zinc | 7440-66-6 | D | mg/L | 0.007 | | 0.007 | | 0.0 | 0.11 | | 0.13 | | 16.7 | 0.011 | | < 0.005 | U | 75.0 |
| Zinc | 7440-66-6 | T | mg/L | 0.017 | | 0.02 | | 16.2 | 0.13 | | 0.14 | | 7.4 | 0.016 | | < 0.005 | U | 104.8 |
| SVOC | | | | | | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Anthracene | 120-12-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]anthracene | 56-55-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]pyrene | 50-32-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Chrysene | 218-01-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Fluorene | 86-73-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Naphthalene | 91-20-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Pyrene | 129-00-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Sum of PAHs | TOTALPAH | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |

# Table I-9
# QA/QC Tables
# Coastal Marine Area Report
# Environment Southland
# Tiwai, NZ

| | | | **Location ID** | SOD-04 | | SOD-04 | | SOD-04 | WLF-01 | | WLF-01 | | WLF-01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Name** | SOD-WS-100m-BWC | | SOD-WS-100m-BWC REPLICAT | | RPD | WLF-WS-01-TWC | | WLF-WS-01-TWC REPLICATE | | RPD |
| | | | **Matrix** | WS | | WS | | | WS | | WS | | |
| | | | **Sample Type** | N | | LR | | | N | | LR | | |
| | | | **Parent Sample** | | | SOD-WS-100M-BWC_20230125 | | | | | WLF-WS-01-TWC_20230126 | | |
| | | | **Sample Date** | 25 Jan 2023 | | 25 Jan 2023 | | 25 Jan 2023 | 26 Jan 2023 | | 26 Jan 2023 | | 26 Jan 2023 |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **RPD** | **Result** | **Qual** | **Result** | **Qual** | **RPD** |
| GENERAL CHEMISTRY | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Cyanide (Free) | FREE CN | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Fluoride | 16984-48-8 | D | mg/L | 0.86 | | -- | -- | -- | -- | -- | -- | -- | -- |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| METALS | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | mg/L | < 0.05 | U | < 0.05 | U | -- | < 0.05 | U | < 0.05 | U | -- |
| Aluminum | 7429-90-5 | T | mg/L | < 0.05 | U | < 0.05 | U | -- | < 0.05 | U | < 0.05 | U | -- |
| Arsenic | 7440-38-2 | D | mg/L | 0.002 | | 0.002 | | 0.0 | 0.002 | | 0.003 | | 40.0 |
| Arsenic | 7440-38-2 | T | mg/L | 0.003 | | 0.002 | | 40.0 | 0.003 | | 0.003 | | 0.0 |
| Barium | 7440-39-3 | D | mg/L | < 0.02 | U | < 0.02 | U | -- | < 0.02 | U | < 0.02 | U | -- |
| Barium | 7440-39-3 | T | mg/L | < 0.02 | U | < 0.02 | U | -- | < 0.02 | U | < 0.02 | U | -- |
| Beryllium | 7440-41-7 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Beryllium | 7440-41-7 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Boron | 7440-42-8 | D | mg/L | 6 | | 8.2 | | 31.0 | 5.6 | | 5.3 | | 5.5 |
| Boron | 7440-42-8 | T | mg/L | 6.8 | | 6.2 | | 9.2 | 6.6 | | 6.3 | | 4.7 |
| Cadmium | 7440-43-9 | D | mg/L | < 0.0002 | U | < 0.0002 | U | -- | < 0.0002 | U | < 0.0002 | U | -- |
| Cadmium | 7440-43-9 | T | mg/L | < 0.0002 | U | < 0.0002 | U | -- | < 0.0002 | U | < 0.0002 | U | -- |
| Calcium | 7440-70-2 | T | mg/L | 430 | | 410 | | 4.8 | 410 | | 420 | | 2.4 |
| Chromium, total | 7440-47-3 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Chromium, total | 7440-47-3 | T | mg/L | 0.001 | | < 0.001 | U | 0.0 | 0.001 | | < 0.001 | U | 0.0 |
| Cobalt | 7440-48-4 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Cobalt | 7440-48-4 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Copper | 7440-50-8 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | 0.002 | | 66.7 |
| Copper | 7440-50-8 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | 0.005 | | 133.3 |
| Iron | 7439-89-6 | D | mg/L | < 0.05 | U | < 0.05 | U | -- | < 0.05 | U | < 0.05 | U | -- |
| Iron | 7439-89-6 | T | mg/L | < 0.05 | U | < 0.05 | U | -- | < 0.05 | U | < 0.05 | U | -- |
| Lead | 7439-92-1 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Lead | 7439-92-1 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Lithium | 7439-93-2 | D | mg/L | 0.12 | | 0.13 | | 8.0 | 0.14 | | 0.14 | | 0.0 |
| Lithium | 7439-93-2 | T | mg/L | 0.12 | | 0.13 | | 8.0 | 0.14 | | 0.15 | | 6.9 |
| Magnesium | 7439-95-4 | T | mg/L | 1300 | | 1200 | | 8.0 | 1200 | | 1300 | | 8.0 |
| Manganese | 7439-96-5 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Manganese | 7439-96-5 | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Mercury | 7439-97-6 | D | mg/L | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- |
| Mercury | 7439-97-6 | T | mg/L | < 0.0001 | U | < 0.0001 | U | -- | < 0.0001 | U | < 0.0001 | U | -- |
| Nickel | 7440-02-0 | D | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Nickel | 7440-02-0 | T | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Titanium | 7440-32-6 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | 0.008 | | < 0.005 | U | 46.2 |
| Titanium | 7440-32-6 | T | mg/L | < 0.005 | U | < 0.005 | U | -- | 0.008 | | < 0.005 | U | 46.2 |
| Vanadium | 7440-62-2 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Vanadium | 7440-62-2 | T | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Zinc | 7440-66-6 | D | mg/L | < 0.005 | U | < 0.005 | U | -- | < 0.005 | U | < 0.005 | U | -- |
| Zinc | 7440-66-6 | T | mg/L | 0.006 | | < 0.005 | U | 18.2 | < 0.005 | U | < 0.005 | U | -- |
| SVOC | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Acenaphthylene | 208-96-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Anthracene | 120-12-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]anthracene | 56-55-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[a]pyrene | 50-32-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Chrysene | 218-01-9 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Fluoranthene | 206-44-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Fluorene | 86-73-7 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Naphthalene | 91-20-3 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Phenanthrene | 85-01-8 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Pyrene | 129-00-0 | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |
| Sum of PAHs | TOTALPAH | N | mg/L | < 0.001 | U | < 0.001 | U | -- | < 0.001 | U | < 0.001 | U | -- |

## Table I-10
## QA/QC Tables
## Coastal Marine Area Report
## Environment Southland
## Tiwai, NZ

| | | | **Sample ID** | EQB-01 | | EQB-02 | | EQB-03 | | EQB-04 | | EQB-05 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sample Type** | EB | | EB | | EB | | EB | | EB | |
| | | | **Sample Date** | 03 Feb 2023 | | 03 Feb 2023 | | 03 Feb 2023 | | 03 Feb 2023 | | 03 Feb 2023 | |
| **Chemical** | **CAS No.** | **Fraction** | **Unit** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** | **Result** | **Qual** |
| GENERAL CHEMISTRY | | | | | | | | | | | | | |
| Cyanide | 57-12-5 | T | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Cyanide (Free) | FREE CN | T | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Fluoride | 16984-48-8 | D | mg/L | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U |
| Weak Acid Dissociable Cyanide | WDCN | T | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| METALS | | | | | | | | | | | | | |
| Aluminum | 7429-90-5 | D | mg/L | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U |
| Aluminum | 7429-90-5 | T | mg/L | **0.1** | | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U |
| Arsenic | 7440-38-2 | D | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Arsenic | 7440-38-2 | T | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Barium | 7440-39-3 | D | mg/L | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U |
| Barium | 7440-39-3 | T | mg/L | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U | < 0.02 | U |
| Beryllium | 7440-41-7 | D | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Beryllium | 7440-41-7 | T | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Boron | 7440-42-8 | D | mg/L | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U |
| Boron | 7440-42-8 | T | mg/L | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U |
| Cadmium | 7440-43-9 | D | mg/L | < 0.0002 | U | < 0.0002 | U | < 0.0002 | U | < 0.0002 | U | < 0.0002 | U |
| Cadmium | 7440-43-9 | T | mg/L | < 0.0002 | U | < 0.0002 | U | < 0.0002 | U | < 0.0002 | U | < 0.0002 | U |
| Chromium, total | 7440-47-3 | D | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Chromium, total | 7440-47-3 | T | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Cobalt | 7440-48-4 | D | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Cobalt | 7440-48-4 | T | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Copper | 7440-50-8 | D | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Copper | 7440-50-8 | T | mg/L | < 0.001 | U | < 0.001 | U | **0.002** | | < 0.001 | U | < 0.001 | U |
| Iron | 7439-89-6 | D | mg/L | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U |
| Iron | 7439-89-6 | T | mg/L | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U | < 0.05 | U |
| Lead | 7439-92-1 | D | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Lead | 7439-92-1 | T | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Lithium | 7439-93-2 | D | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Lithium | 7439-93-2 | T | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Manganese | 7439-96-5 | D | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Manganese | 7439-96-5 | T | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Mercury | 7439-97-6 | D | mg/L | < 0.0001 | U | < 0.0001 | U | < 0.0001 | U | < 0.0001 | U | < 0.0001 | U |
| Mercury | 7439-97-6 | T | mg/L | < 0.0001 | U | < 0.0001 | U | < 0.0001 | U | < 0.0001 | U | < 0.0001 | U |
| Nickel | 7440-02-0 | D | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Nickel | 7440-02-0 | T | mg/L | **0.001** | | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Titanium | 7440-32-6 | D | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Titanium | 7440-32-6 | T | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Vanadium | 7440-62-2 | D | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Vanadium | 7440-62-2 | T | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Zinc | 7440-66-6 | D | mg/L | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| Zinc | 7440-66-6 | T | mg/L | **0.009** | | **0.01** | | < 0.005 | U | < 0.005 | U | < 0.005 | U |
| SVOC | | | | | | | | | | | | | |
| Acenaphthene | 83-32-9 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Acenaphthylene | 208-96-8 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Anthracene | 120-12-7 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Benzo(b+j)fluoranthene | edms_0016 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Benzo[a]anthracene | 56-55-3 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Benzo[a]pyrene | 50-32-8 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Benzo[g,h,i]perylene | 191-24-2 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Benzo[k]fluoranthene | 207-08-9 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Chrysene | 218-01-9 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Dibenz(A,H)Anthracene | 53-70-3 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Fluoranthene | 206-44-0 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Fluorene | 86-73-7 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Indeno(1,2,3-C,D)Pyrene | 193-39-5 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Naphthalene | 91-20-3 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Phenanthrene | 85-01-8 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Pyrene | 129-00-0 | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |
| Sum of PAHs | TOTALPAH | N | mg/L | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U | < 0.001 | U |

# Appendix J Bioaccumulation Technical Note

EHS Support

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# MEMO

To: Simon Hunt, EHS Support

From: Gary Long, Dana McCue

CC: Nigel Goulding, EHS Support
Maxwell Gerjoi, EHS Support

Date: 7 August 2023

Re: *Technical Memorandum: Assessment of Indirect Exposure to Persistent, Bioaccumulative, and Toxic Compounds Analysed in Sediments in the Coastal Marine Area*
Environment Southland Independent Monitoring Programme – Coastal Marine Area Investigation
Tiwai Point, New Zealand

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## Introduction

This technical memorandum describes the approach for assessing potential indirect exposure to primary persistent, bioaccumulative, and toxic (PBT) compounds via bioaccumulation pathways in aquatic and marine environments as part of the Coastal Marine Investigation (CMA) of the New Zealand Aluminium Smelters Ltd (NZAS) Tiwai Point manufacturing facility ("Site"). The purpose of the assessment is to provide a preliminary evaluation of the potential for adverse human health or ecological effects associated with the ingestion of fish or shellfish in aquatic habitats adjacent to the Site, specifically within or adjacent to the drains discharging from the Site (North Drain, West Drain, South Drain) to the surrounding marine environment. Findings from the preliminary assessment will be used to inform the need for further monitoring to address uncertainties in the quantification of exposure to human health and wildlife consumers of fish and shellfish within the CMA.

The assessment was conducted primarily using sediment data collected by EHS Support New Zealand Ltd ("EHS Support") to investigate key areas where discharge(s) from the NZAS Site to the CMA may have occurred historically or could be occurring during current operations. Bioaccumulation relationships were used to estimate the concentrations of primary PBT constituent groups, specifically polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and dioxins/furans in fish and shellfish tissue as a function of sediment concentrations. Estimated concentrations in fish and shellfish tissues were compared to human health benchmark concentrations for the protection of human consumption and ecological benchmark concentrations for the protection of aquatic life and wildlife. Where applicable, site-specific tissue data collected by NZAS and others were used to assess the alignment between tissue concentrations estimated based on bioaccumulation relationships and measured tissue concentrations.

The following sections present the technical approach for estimating primary PBT concentrations in fish and shellfish tissue and the findings of preliminary screening assessments of potential ecological and human health exposure to PBTs in fish and shellfish tissues.

## Primary PBT Compounds in Biological Tissue

The assessment of human health and ecological exposure to PBT compounds in biological tissue focused on PAHs associated with sediment samples collected throughout the CMA and PCBs and dioxins/furans associated in sediment samples collected within the North Drain, West Drain, and South Drain (Figure 2; EHS Support, 2023). Concentrations of PBT compounds in sediment were used to estimate concentrations in fish and shellfish using biota-sediment accumulation factors (BSAF) derived from relevant literature sources. Where applicable, site-specific tissue data collected by NZAS and others were used to assess the alignment between estimated tissue concentrations based on BSAFs and measured tissue concentrations. The following sections present the approach for estimating primary PBT concentrations in fish and shellfish tissue and summarize available site-specific data to evaluate the reliability of estimated concentrations.

### Estimated Tissue Concentrations

The bioaccumulation of primary PBT compounds in the CMA was estimated using relevant literature-based BSAFs for PAHs associated with sediment samples collected throughout the CMA and dioxin/furans associated with sediment samples collected within the North Drain, West Drain, and South Drain.

The bioaccumulation of PCBs was not quantified in fish or shellfish tissue due to the absence of detectable concentrations in PCB Aroclor analyses of sediment samples. PCBs were analyzed as Aroclors and dioxin-like PCB congeners (12 of 209 PCB congeners)[1] in 15 sediment samples collected within the North Drain, West Drain, South Drain, and West Landfill (WLF) areas (Table H-6; EHS Support, 2023). Aroclor concentrations were below the detection limit (<0.1 milligrams per kilogram [mg/kg]) in all 15 sediment samples; however, there were detections of some dioxin-like PCB congeners in each of the samples (Table H-6; EHS Support, 2023). Due to the lack of any detectable Aroclor concentrations in sediment samples, total PCB concentrations were not estimated in fish or shellfish tissue in this assessment. Shellfish samples collected as part of the Landfill Consent Application indicated no detections of PCB congeners in subtidal sampling stations adjacent to the landfill coast (GHD, 2023). However, given the detection of dioxin-like PCB congeners in sediment within the drains and WLF, there is some uncertainty in the potential for PCB bioaccumulation in tissue within the drains and near the points of discharge from the Site that may be addressed through direct analysis of tissue as part of future monitoring efforts.

Concentrations of PAHs and dioxins/furans in fish and shellfish tissue were estimated based on BSAFs and sediment exposure point concentrations from samples collected in the North Drain and West Drain.

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[1] Aroclor is the trade name of PCB congener mixtures sold commercially by Monsanto Company. Congeners are individual chemical compounds within the PCB class of compounds; there are 209 PCB congeners typically included in the PCB class of compounds. Environmental investigations of PCBs are typically initiated with broad analyses of Aroclors and progress to analyses of congeners in subsequent stages of investigation.

Bioaccumulation of PAHs and dioxins/furans into biota within the aquatic environment is influenced by chemical-specific properties, sediment characteristics (e.g., organic carbon content), receptor physiology, and the characteristics of dietary items (e.g., lipid content). The following section discusses the basis for selecting BSAFs to represent uptake into fish and shellfish tissue for each constituent group.

## Polycyclic Aromatic Hydrocarbons

PAH concentrations in fish and shellfish tissue were estimated based on the biota-sediment accumulation relationship described by DiToro and McGrath (2000) in the development of the target lipid model. The application of the BSAF relationship from DiToro and McGrath (2000) conservatively assumes that exposure and uptake to fish and shellfish within the water column does not exceed exposure and uptake in sediment and pore water within the benthic environment. BSAFs for PAH compounds were estimated on an organic carbon and lipid-normalized basis using molar concentrations (µmol/g) as a function of the octanol-water partitioning coefficient ($K_{ow}$):

$$BSAF_{norm} = \frac{C_{lipid}}{C_{oc}} = K_{ow}{}^{-0.038}$$

where:

$BSAF_{norm}$ = BSAF normalized by organism lipid content and sediment organic carbon content (g organic carbon/g lipid)

$C_{lipid}$ = Tissue lipid concentration (µmol PAH/g lipid)

$C_{oc}$ = Sediment organic carbon concentration (µmol PAH/g organic carbon)

$K_{ow}$ = Octanol-water partitioning coefficient

Organic carbon and lipid-normalized BSAFs were estimated on a dry weight basis using assumed lipid and organic carbon content in sediments as follows:

$$BSAF = BSAF_{norm} \times f_{lipid} \times \frac{1}{f_{oc}}$$

where:

$BSAF$ = BSAF specific to prey type and compound (g sediment/g tissue, wet weight)

$BSAF_{norm}$ = Organic carbon and lipid normalized BSAF specific to prey type and compound (g organic carbon/g lipid)

$f_{lipid}$ = Fraction of lipid in dietary items (wet weight)

$f_{oc}$ = Fraction of organic carbon in sediment (dry weight)

For estimating PAH concentrations in fish tissue, a lipid content of 8 percent (wet weight) was assumed based on the upper end of the range of lipid content for fish reported in Sydney Harbour (Manning and Batley, 2023). For shellfish, a lipid content of 2 percent (wet weight) was assumed based on the average lipid concentrations reported for marine crustaceans and mollusks in the U.S. Army Corps of Engineers (USACE) Biota-Sediment Accumulation Factor Database (USACE, 2022).[2] The fraction of organic carbon

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[2] Shellfish lipid content was estimated as the average lipid concentration for marine crustaceans and mollusks reported in wet weight in the USACE Biota-Sediment Accumulation Factor Database. The arithmetic mean of 1.75 percent lipid (wet weight) was rounded to the nearest whole percent for calculations.

in sediment was estimated as the geometric mean of total organic carbon (TOC) concentrations for sediment samples included in the assessment. PAH concentrations below detection were estimated at 50 percent of the reporting limit.

PAH-specific BASF values for fish or shellfish were multiplied by the individual sediment PAH concentration to estimate the individual PAH concentration in each tissue type. Concentrations of individual PAHs that were below detection were estimated at 50 percent of the reporting limit. For human health, exposure was evaluated based on individual PAH concentrations in tissue. For ecological exposure, individual PAH concentrations estimated in tissue were summed by molecular weight group to provide estimated exposure point concentrations for low molecular weight (LMW) PAHs, high molecular weight (HMW) PAHs, and total PAHs. Total PAHs were presented on a molar and lipid normalized basis to facilitate comparisons with a tissue-based benchmark for the protection of aquatic life.

Calculations supporting the estimation of PAHs in fish and shellfish tissue are provided in calculations are provided in **Attachment A, Table A1-1.**

## Dioxins/Furans

The bioaccumulation of dioxins/furans from sediment into fish and shellfish tissue was estimated using BSAFs derived from relevant literature studies. The estimation of dioxins/furans in fish tissue was based on a site-specific BSAF developed to support the derivation of marine sediment quality guidelines in Sydney Harbour (Manning and Batley, 2023). The estimation of dioxins/furans in shellfish tissue were based on congener-specific BSAFs developed by the U.S. Army Corps of Engineers to assess the potential for dioxin/furan bioaccumulation into invertebrates and shellfish (Clarke et al., 2004). The approach used to estimate concentrations in each tissue type is described below.

### *Fish Tissue*

Manning and Batley (2023) derived fish tissue BSAFs for 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) expressed as toxicity equivalents for fish ($TEQ_{fish}$) based on paired fish tissue residues and sediment concentrations measured within Sydney Harbour. Toxicity equivalents for fish were estimated by multiplying the measured concentration of each dioxin/furan congener by the toxicity equivalency factor (TEF) for fish reported by the World Health Organization (WHO; Van den Berg et al., 1998). BSAFs were estimated for 13 fish species based on 15 samples of each species. 95th percentile of BSAFs ranged from 0.02 to 0.1 (lipid and organic carbon normalized) for the 13 species evaluated, with the greatest BSAF estimated for the Dusky Flathead (*Platycephalus fuscus*), a bottom dwelling-species with relatively low lipid content. Consistent with Manning and Bately (2023), a BSAF of 0.1 (lipid and organic carbon normalized) was selected for this assessment to capture the range of potential dioxin/furan bioaccumulation. $TEQ_{fish}$ concentrations were estimated using the normalized BSAF as follows:

$$Tissue\ TEQ \quad = BSAF_{norm} \times \ f_{lipid} \times \frac{1}{f_{oc}} \times Sed\ TEQ$$

where:
*Tissue TEQ* = $TEQ_{fish}$ in fish tissue for the protection of human health or fish (pg/g, wet weight)

$BSAF_{norm}$ = Organic carbon and lipid normalized BSAF specific to prey type and compound (gram [g] organic carbon/gram [g] lipid)
$f_{lipid}$ = Fraction of lipid in target tissue (wet weight)
$f_{oc}$ = Fraction of organic carbon in sediment (dry weight)
*Sed TEQ* = Sediment TEQ based on WHO TEFs for fish (pg/g, dry weight)

Consistent with estimates for PAHs, a lipid content of 8 percent (wet weight) was assumed based on the upper end of the range of lipid content for fish reported in Sydney Harbour (Manning and Batley, 2023). The fraction of organic carbon in sediment was estimated as the geometric mean of TOC concentrations for sediment samples included in the assessment. Dioxin/furan concentrations below detection were estimated at 50 percent of the reporting limit.

Toxicity equivalents for human health ($TEQ_{HH}$) were estimated using the TEFs for mammals (Van den Berg et al., 2006) and the same calculation approach shown above based on the BSAF of 0.1 (lipid and organic carbon normalized) reported by Manning and Bately (2023).

Calculations supporting the estimation of TEQ equivalents in fish tissue are provided in calculations are provided in **Attachment A, Table A1-2.**

### *Shellfish Tissue*

Clarke et al. (2004) derived invertebrate tissue BSAFs for individual dioxin/furan compounds based on a compilation of paired sediment and invertebrate tissue datasets. 95 percent upper confidence limit (UCL) BSAFs (lipid and organic carbon normalized) reported by Clark et al. (2004) were selected for use in the assessment to estimate dioxin/furan concentrations in shellfish tissue at the Site (**Table 1**).

**Table 1 Aquatic Invertebrate BSAFs Derived by Clarke et al. (2005)**

| Dioxin/Furan | 95 Percent Upper Confidence BSAF |
|---|---|
| 2,3,7,8-TCDD | 0.927 |
| 1,2,3,7,8-PeCDD | 1.58 |
| 1,2,3,4,7,8-HxCDD | 1.9 |
| 1,2,3,6,7,8-HxCDD | 0.326 |
| 1,2,3,7,8,9-HxCDD | 0.619 |
| 1,2,3,4,6,7,8-HpCDD | 0.084 |
| OCDD | 0.077 |
| 2,3,7,8-TCDF | 1.68 |
| 1,2,3,7,8-PeCDF | 1.68 |
| 2,3,4,7,8-PeCDF | 0.982 |
| 1,2,3,4,7,8-HxCDF | 0.768 |
| 1,2,3,6,7,8-HxCDF | 1.37 |
| 2,3,4,6,7,8-HxCDF | 0.917 |
| 1,2,3,7,8,9-HxCDF | 0.622 |
| 1,2,3,4,6,7,8-HpCDF | 0.048 |
| 1,2,3,4,7,8,9-HpCDF | 0.333 |
| OCDF | 0.047 |

**Notes:**
TCDD = Tetrachlorodibenzodioxin
TCDF = Tetrachlorodibenzofuran
HpCDD = Heptachlorodibenzodioxin
HxCDD = Hexachlorodibenzodioxin
PeCDD =Pentachlorodibenzodioxin
PeCDF = Pentachlorodibenzofuran

Concentrations of each individual congener were estimated for shellfish tissue using the normalized congener specific BSAF from **Table 1** as follows:

$$C_{invert} = \left( BSAF_{norm} \times f_{lipid} \times \frac{1}{f_{oc}} \times C_{sed} \right)$$

where:

| | |
|---|---|
| $C_{invert}$ | = Concentration in invertebrate (shellfish) tissue (pg/g, wet weight) |
| $BSAF_{norm}$ | = Organic carbon and lipid normalized BSAF specific to prey type and congener (g organic carbon/g lipid) |
| $f_{lipid}$ | = Fraction of lipid in dietary items (wet weight) |
| $f_{oc}$ | = Fraction of organic carbon in sediment (dry weight) |
| $C_{sed}$ | = Concentration in sediment (pg/g, dry weight) |

Consistent with PAHs, a lipid content of 2 percent (wet weight) was assumed based the average lipid concentrations reported for marine crustaceans and mollusks in USACE (2022). The fraction of organic carbon in sediment was estimated as the geometric mean of total organic carbon (TOC) concentrations for sediment samples included in the assessment.

Estimated concentrations in shellfish tissue were expressed as 2,3,7,8-TCDD equivalents for use in the human health assessment by multiplying the concentration by TEFs for mammals (Van den Berg et al., 2006) and summing the products for the 17 congeners to calculate $TEQ_{HH}$. For the ecological assessment, estimated concentrations in shellfish tissue were expressed as 2,3,7,8-TCDD equivalents by multiplying the concentration by TEF for fish (Van den Berg et al., 1998) and summing the products for the 17 congeners to calculate $TEQ_{fish}$.

Calculations supporting the estimation of TEQ equivalents in fish tissue are provided in calculations are provided in **Attachment A, Table A1-3.**

## Site-Specific Tissue Concentrations

Site-specific tissue datasets were evaluated to assess the general alignment of tissue concentrations estimated using BSAFs, as described in the preceding section, with concentrations directly measured in samples collected at the Site. The evaluation of estimated and measured tissue concentrations is not quantitative due to spatial and temporal differences between the estimated and measured datasets. Rather, the evaluation is provided as a qualitative assessment of findings regarding potential human health and ecological exposure via bioaccumulation pathways.

Site-specific data evaluated as part of the assessment was obtained from data reported by GHD on behalf of NZAS in the *NZAS Landfill Resource Consent Application and Assessment of Environmental*

*Effects* (Landfill Consent Application; GHD, 2023). As part of the Landfill Coastal Marine Area Investigation conducted to support the human health and ecological risk assessment (HHERA) presented in the Landfill Consent Application, GHD collected biota samples in the marine environment near the landfill coast, as well as background locations. Samples collected for analysis were invertebrates, including gastropod (*Cookia sulcate*; cook's turban), mussels (*Perna canaliculus*), paua (*Haliotis sp*.), whelk (*Cominella sp.*), and sea urchin (*Evechinus chloroticus*; kina). No fish tissue samples were collected as part of the investigations. Invertebrate samples were analysed for fluoride, metals, PCBs, PAHs and PFAS; however, dioxins/furans were not analysed. In addition to biota samples collected as part of the Landfill Coastal Marine Area Investigation, GHD summarized several historical studies conducted by NZAS and others that included the collection of biota samples within the coastal environment (GHD, 2023).

## Ecological Bioaccumulation Exposure Assessment

Aquatic life and wildlife exposures to PAHs and dioxins/furans through bioaccumulation pathways were assessed by comparing estimated fish and shellfish tissue concentrations to benchmark concentrations for the protection of aquatic life and wildlife. The following sections describe the selection of tissue benchmark concentrations and present comparisons of estimated tissue concentrations to benchmarks and available background concentrations.

### Selection of Benchmark Concentrations

Tissue benchmark concentrations for PAHs were derived for the protection of aquatic life and dietary consumption based on approaches developed by the United States Environmental Protection Agency (USEPA; **Table 2**). USEPA (2003) established a no effect critical body residue for PAHs of 2.24 micromoles per gram lipid wet weight (µmol)/g lipid ww) based on the target lipid model (TLM) developed by DiToro et al. (2000). The TLM-based benchmark is protective of 95 percent of benthic and water column species tested in the model (DiToro et al, 2000; USEPA, 2003).

For the protection of wildlife exposure to PAHs, tissue concentrations were back-calculated from dietary exposure models to estimate the tissue concentration equivalent to a no observed adverse effect level (NOAEL), consistent with the approach used to derive USEPA ecological soil screening levels (Eco-SSLs; USEPA, 2003). The NOAEL dose for LMW PAHs was selected based on the no effect dose reported for mallard by Patton and Dieter (1980); the NOAEL dose for HMW PAHs was selected based on the no effect dose reported for European starling by (Trust et al., 1994). The calculated values represent the concentrations of LMW and HMW PAHs for the most sensitive avian receptor, Double-banded plover (*Charadrius bicinctus*), of the three avian species modeled for Tiwai Point (Caspian tern; *Sterna caspia* and Variable oystercatcher; *Haematopus unicolor*). Further details of the dietary exposure model calculations are provided in **Attachment A, Table A2-1**. In addition to risk-based tissue benchmarks, a background tissue concentration of 0.0093 mg/kg wet weight (ww) was identified for comparison to estimated shellfish concentrations at the Site.

**Table 2 Tissue Benchmarks to Evaluate Bioaccumulation Exposure to PAHs**

| Tissue Type | Aquatic Life Protection | Wildlife Protection | Estimated Background Concentration |
|---|---|---|---|
| Fish | Total PAHs:<br>2.24 µmol/g lipid ww[a] | LMW: 21.6 mg/kg ww[b]<br>HMW: 2.7 mg/kg ww[b] | --- |
| Shellfish | | | 0.0093 mg/kg ww[c] |

**Notes:**

[a] USEPA (2003) based on the TLM developed by DiToro et al. (2000); establishes no effect critical body residue for PAHs of 2.24 µmol/g lipid that is protective of 95 percent of benthic and water column species tested in the model.

[b] Calculated dietary concentration for the most sensitive avian receptor, Double-banded plover (*Charadrius bicinctus*), representative of species on Tiwai Point.

[c] Background total PAH concentration reported by GHD (2023) in the Landfill Consent Application.

--- Benchmark not derived or measured.

Tissue benchmark concentrations for dioxins/furans were derived based on established sources of risk-based tissue benchmarks for the protection of aquatic life and associated wildlife (Manning and Bately, 2023; USEPA, 1993; **Table 3**). For the protection of aquatic life, the 95 percent protection level species sensitivity distribution (SSD) developed for Sydney Harbour by Manning and Batley (2023) of 671 pg $TEQ_{fish}$/g lipid was used as the basis for the tissue benchmark. Assuming 8 percent lipid content (Manning and Bately, 2023), the equivalent wet weight (ww) concentration is 54 pg $TEQ_{fish}$/g tissue ww. For the protection of wildlife, a tissue concentration of 6 pg/g 2,3,7,8-TCDD was selected from USEPA (1993). Given that this benchmark is based on 2,3,7,8-TCDD, it can be compared to $TEQ_{fish}$ equivalents estimated for the Site. No dioxin/furan tissue data were identified for background areas for comparison.

**Table 3 Tissue Benchmarks to Evaluate Bioaccumulation Exposure to Dioxin/Furans**

| Tissue Type | Aquatic Life Protection | Wildlife Protection | Estimated Background Concentration |
|---|---|---|---|
| Fish | 54 pg $TEQ_{fish}$/g, ww[a] | 6 pg/g 2,3,7,8-TCDD, ww[b] | --- |
| Shellfish | | | --- |

**Notes:**

[a] Selected protective concentration in fish based on the 95% protection level species SSD developed for Sydney Harbour by Manning and Bately (2023), assuming 8 percent lipid content.

[b] Calculated dietary concentration for the protection of wildlife derived by the USEPA (USEPA, 1993).

ww, Value is presented on a wet weight basis.

--- Benchmark not derived or measured.

ww = wet weight

## Comparison of Estimated Concentrations to Benchmarks

Estimated tissue concentrations of PAHs and dioxins/furans for fish and shellfish are presented in **Table 4** and **Table 5**, respectively. Comparison to applicable risk-based and background tissue benchmarks are provided for comparison.

The evaluation of estimated PAH concentrations indicates limited bioaccumulation of PAHs into fish and shellfish tissue in the areas represented by sediment samples collected within the CMA and presented in the CMA Investigation Report (Table H-6; EHS Support, 2023). Estimated PAH concentrations in fish and shellfish tissues, based on the geometric mean of concentrations estimated for sediment samples collected within the CMA, were below the aquatic life protection benchmark of 2.24 µmol/g lipid.

Further, the geometric mean of estimated concentrations were wildlife protection benchmarks based on avian dietary ingestion pathways (**Table 4**). Although estimated concentrations were below risk-based tissue benchmarks, the sum of LMW and HMW PAH concentrations exceeded fish and shellfish total PAH concentrations in background samples reported by GHD (2023).

GHD (2023) reported a maximum total PAH concentration of 0.02 mg/kg ww in a snail, whelk, and mussel sample collected along the southern landfill coast. This maximum concentration is lower than the geometric mean concentration estimated based on sediment samples collected throughout the CMA. This difference may reflect elevated concentrations of total PAHs within the North Drain, West Drain, and South Drain relative to nearshore areas within the marine environment. It may also reflect the conservative estimation of total PAH concentrations in invertebrate tissues using the BSAF approach. Fish tissue samples were not collected and analyzed for PAHs by GHD (2023). The Landfill Consent Application and historical fish tissue results reported in Cawthorn et al. (2006) appear to have been collected exclusively in the marine environment and may not reflect exposure closer to the point of discharge from the drains; therefore, site-specific tissue data may be warranted to confirm the limited bioaccumulation potential for PAHs indicated by the BSAF-estimated tissue concentrations.

**Table 4 Summary of Ecological Exposure to PAHs Via Bioaccumulation Pathways**

| Tissue Type | Estimated Tissue Concentration – Geometric Mean | Aquatic Life Protection Benchmark | Wildlife Protection Benchmark | Estimated Background Concentration |
|---|---|---|---|---|
| Fish:<br>Total PAH: | 4.4 mg/kg ww<br>0.29 µmol/g lipid ww | 2.24 µmol/g lipid ww | --- | 0.0093 mg/kg ww |
| LMW PAH | 2.05 mg/kg ww | --- | 21.6 mg/kg ww | --- |
| HMW PAH: | 2.37 mg/kg ww | --- | 2.7 mg/kg ww | |
| Shellfish:<br>Total PAH: | 1.1mg/kg ww<br>0.288 µmol/g lipid | 2.24 µmol/g lipid ww | --- | 0.0093 mg/kg ww |
| LMW PAH: | 0.512 mg/kg ww | --- | 21.6 mg/kg ww | --- |
| HMW PAH: | 0.592 mg/kg ww | --- | 2.7 mg/kg ww | --- |

**Notes:**
µmol/g = micromole per gram
--- Benchmark not derived or measured
HMW = High molecular weight
LMW = Low molecular weight
Mg/kg = milligram per kilogram
PAH = Polycyclic aromatic hydrocarbon
ww = wet weight
ww value is presented on a wet weight basis

The evaluation of estimated dioxin/furan concentrations in fish and shellfish tissue based on sediment samples collected within the North Drain and West Drain indicates the potential for bioaccumulation and exposure through wildlife ingestion pathways (**Table 5**). Estimated TEQ$_{fish}$ equivalents for 2,3,7,8-TCDD in fish tissue were below the aquatic life protection benchmark established for the protection of fish by Manning and Batley (2023); however, the estimated TEQ$_{fish}$ in fish tissue was comparable to the wildlife protection benchmark and the estimated TEQ$_{fish}$ in shellfish tissue exceeded the wildlife protection benchmark; therefore, there is some uncertainty regarding dietary exposure to avian receptors that may forage within the drains. Within the drains, dioxin/furan concentrations in sediment were generally greatest at stations nearest to the drain discharge in the West Drain (WOD-SE 01) and

North Drain (NOD-SE 01), with decreasing concentrations in samples collected from the point of discharge towards the receiving marine environment. The spatial distribution of elevated dioxin/furan concentrations in sediment should be evaluated in the context of the conceptual ecological exposure model to understand if complete exposure pathways are present in areas of greatest exposure.

Dioxins/furans were not analyzed in biota samples by GHD (2023) for the Landfill Consent Application and were not presented in any of the previous studies summarised by GHD (2023); therefore, site-specific data are not available to evaluate the estimated concentrations presented in **Table 5**.

**Table 5 Summary of Ecological Exposure to Dioxin/Furans Via Bioaccumulation Pathways**

| Tissue Type | Estimated Tissue Concentration – Geometric Mean | Aquatic Life Protection Benchmark | Wildlife Protection Benchmark | Estimated Background Concentration |
|---|---|---|---|---|
| Fish | 5.1 pg TEQ$_{fish}$/g, ww | 54 pg TEQ$_{fish}$/g, ww | 6 pg/g 2,3,7,8-TCDD, ww | --- |
| Shellfish | 11.9 pg TEQ$_{fish}$/g, ww | | | --- |

**Notes:**
--- Benchmark not derived or measured
g = gram
pg/g = picogram/gram
TCDD = Tetrachlorodibenzodioxin
ww = wet weight
ww, Value is presented on a wet weight basis

## Discussion of Findings

The evaluation presented in the preceding section presents a preliminary assessment of the potential for primary PBT compounds to bioaccumulate and potentially pose risks to aquatic life and wildlife (avian) receptors. A summary of key findings is provided below by constituent group:

- **PAHs**: The results of the preliminary assessment indicate limited potential for adverse effects to aquatic life and wildlife through exposure to PAHs bioaccumulated in fish and shellfish. This finding was generally supported by relatively low concentrations measured in site-specific shellfish samples, as reported by GHD (2023); however, there are no site-specific fish tissue data for PAHs to support the relatively low estimates of PAH concentrations in fish tissue.
- **Dioxins/furans:** The evaluation of estimated dioxin/furan concentrations in fish and shellfish tissue based on sediment samples collected within the North Drain and West Drain indicates the potential for bioaccumulation and exposure through wildlife ingestion pathways; however, there are no site-specific data available to evaluate estimated concentrations. Further evaluation of dioxin/furan exposure within the drains and surrounding marine receiving environment may be warranted to fully address the uncertainty with the bioaccumulation exposure pathway.
- **PCBs:** As previously stated, PCB bioaccumulation into fish and shellfish was not quantitatively evaluated in this assessment due to the lack of any detectable Aroclor concentrations in sediment samples collected within the North Drain, West Drain, South Drain, or WLF; however, the detection of dioxin-like PCB congeners in sediment indicates some uncertainty regarding the

potential for PCB bioaccumulation in tissue that may be addressed through direct analysis of PCBs in fish tissue as part of future monitoring efforts within the CMA.

## Human Health Bioaccumulation Exposure Assessment

Human health exposures to PAHs and dioxins/furans through bioaccumulation pathways were assessed by comparing estimated fish and shellfish tissue concentrations to risk-based tissue consumption screening levels ($RBSLs_{TC}$). The following sections describe the exposure assumptions and toxicological reference values (TRVs) used in the screening level derivation, and present comparisons of estimated tissue concentrations to the $RBSLs_{TC}$.

### Derivation of Consumption-Based Screening Levels

New Zealand has not developed guideline values for fish or shellfish tissue. As a result, $RBSLs_{TC}$ were derived based on approaches developed by USEPA (USEPA, 1989, 2000 and 2023) utilizing USEPA's Regional Screening Level (RSL) on-line calculator. Screening levels were calculated to be protective of potential non-threshold (carcinogenic) effects and threshold (non-carcinogenic or systemic) effects.

**Attachment A, Tables A3-1 through A3-3** provides the RSL calculator inputs and outputs. As detailed in the attachment, exposure assumptions considered in the derivation were based on a combination of both Ministry for the Environment (MfE)-recommended and USEPA-recommended values. For the fish ingestion rate, an assumption of 8 ounces (227 grams) per week was used to derive the $RBSLs_{TC}$. An 8-ounce per week ingestion rate is equivalent to an average daily fish ingestion rate of 32.4 grams per day (g/day) recommended by MfE (MfE, 1998). This ingestion rate is considered protective of fish consumption by most individuals, including young children, who consume recreationally harvested fish. An ingestion rate of 9.9 g/day (MfE, 1998) was used for shellfish and is consistent with consumption rates reported for adult males and females in the 2016 New Zealand Total Diet Study (MPI, 2016) and is more conservative than rates (4.8 g/day) reported in a 2021 study (Guy et al, 2021) which included New Zealand's indigenous Māori communities that on average consume larger quantities of shellfish.

Chemical-specific TRVs for use in the screening level calculations are also detailed in **Attachment A.** Chemical-specific TRVs were obtained from *Toxicological Intake Values for Priority Contaminants in Soil* (MfE, 2011a). Where a TRV was not recommended in the guidance document, then a TRV has been selected using the most up-to-date/high-quality data subject to internal/external peer review processes and formally adopted by a national or international agency, such as MfE/MoH, WHO, United Nations Environmental Programme (UNEP), Health Canada, or the USEPA.

For 2,3,7,8-TCDD, the TRV consistent with the tolerable monthly intake (TMI) of 70 picograms per kilogram body weight per month (pg/kg bw/month) has been used instead of the TRV recommended in the *Toxicological Intake Values for Priority Contaminants in Soil* (MfE, 2011a). This TRV was developed by the WHO/Food and Agriculture Organization (FAO) Joint Expert Committee for Food Additives (JECFA) and was used by Food Standards Australia New Zealand (FSANZ) in *Dioxins in Food: Dietary Exposure Assessment and Risk Characterisation* (FSANZ, 2004).

The $RBSLs_{TC}$ are based on a cancer risk of one in one hundred thousand ($1x10^{-5}$) and a hazard quotient of one. Oral bioavailability has been assumed to be 100 percent (i.e., 100 percent of the contaminant ingested is absorbed into the body). Both assumptions are consistent with the *Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health* (MfE, 2011b).

## Comparison of Estimated Concentrations to Consumption-Based Screening Levels

Estimated tissue concentrations of PAHs and dioxins/furans for fish and shellfish are presented in **Table 6**, along with a comparison to the $RBSLs_{TC}$. Screening levels were derived for each of the PAHs and dioxins/furans estimated in tissue. Consistent with MfE guidance, dioxin and furan results estimated in tissue were converted to TEQs using the 2005 WHO TEFs. The total TEQs were compared to the $RBSL_{TC}$ for 2,3,7,8-TCDD. Similar to dioxin/furans, carcinogenic PAHs estimated in tissue were also converted to TEQs using MfE recommended relative potency factors (RPFs) (MfE, 2011b). The total TEQs were compared to the $RBSL_{TC}$ derived for benzo(a)pyrene.

As previously discussed, the evaluation of estimated PAH and dioxin/furan concentrations in fish and shellfish tissue based on sediment samples collected within the North Drain and West Drain indicates the potential for bioaccumulation. Consequently, potential human receptors may be exposed to PAHs and dioxins/furans in sediment indirectly via ingestion of fish and shellfish. Based on the comparison to consumption-based screening levels detailed in **Table 6**, the significance of this potentially complete exposure pathway is low for dioxin/furans in fish and shellfish and low for non-carcinogenic PAHs in fish and carcinogenic and non-carcinogenic PAHs in shellfish. Estimated tissue concentrations in fish and shellfish were below the $RBSLs_{TC}$.

However, the total TEQ for benzo(a)pyrene estimated in fish was above the $RBSLs_{TC}$ indicating the potential for exposure. As previously noted, there are no site-specific fish tissue data for PAHs to confirm these estimates.

**Table 6 Summary of Estimated Human Health Exposure to PAHs and Dioxins/Furans in Fish and Shellfish Tissue**

| Analyte | Estimated Fish Tissue Concentration – Geometric Mean (mg/kg ww) | Human Health $RBSL_{TC}$ - Fish (mg/kg ww) | Estimated Shellfish Tissue Concentration – Geometric Mean (mg/kg ww) | Human Health $RBSL_{TC}$ - Shellfish (mg/kg ww) |
|---|---|---|---|---|
| Acenaphthene | 0.210 | 140 | 0.052 | 440 |
| Anthracene | 0.207 | 68 | 0.052 | 220 |
| Benzo(g,h,i)perylene[3] | 0.223 | 68 | 0.056 | 220 |
| Phenanthrene[3] | 0.213 | 680 | 0.053 | 2200 |
| Pyrene | 0.261 | 68 | 0.065 | 220 |
| Benzo(a)pyrene TEQ[1] | **0.585** | 0.059 | 0.15 | 0.19 |
| 2,3,7,8-TCDD TEQ[2] | 4.76 ng/kg ww | 5.25 ng/kg ww | 11.9 ng/kg ww | 17 ng/kg ww |

**Notes:**

[1] The benzo(a)pyrene (BaP) toxicity equivalency quotient (TEQ) concentration is calculated as the sum of each of the detected concentrations of nine carcinogenic PAHs (beno[a]anthracene, benzo[b]fluoranthene, benzo[j]fluoranthene, benzo[k]fluoranthene, BaP, chrysene, dibenz[a,h]anthracene, fluoranthene and indeno[1,2,3-cd]pyrene), multiplied by their respective potency equivalency factors (PEF) from Table 40 in MfE, 2011b.

[2] Dioxin and furan results estimated in fish and shellfish were converted to toxicity equivalencies (TEQs) using the 2005 World Health Organization (WHO) toxicity equivalency factors (TEF). The total TEQ is compared to the RBSL for 2,3,7,8-TCDD.

[3] Toxicity factors were unavailable. Pyrene is used as a surrogate for benzo(g,h,i)perylene and phenanthrene.

**Bold** and *italicized* values exceed corresponding tissue consumption screening level
mg/kg – milligrams per kilogram
ng/kg – nanograms per kilogram
Risk-based tissue screening level (RBSL) derivation is provided in **Attachment A.** Values are rounded to two significant figures
TCDD = 2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ = toxic equivalency quotient
ww = wet weather
ww value is presented on a wet weight basis

Concentrations in **bold** indicate an exceedance of the screening criteria

## Recommendations

This assessment provided a preliminary evaluation of the potential for adverse human health or ecological effects associated with the ingestion of fish or shellfish in aquatic habitats adjacent to the Site, specifically within or adjacent to the drains discharging from the Site (North Drain, West Drain, South Drain) to the surrounding marine environment.

It is important to emphasize that estimated PAHs and dioxins/furans tissue concentrations presented in this preliminary bioaccumulation assessment are a function of the concentrations of these constituents measured in sediment samples collected within the CMA; therefore, the assessment is only as spatially and temporally representative as the available sediment data in adequately characterizing the nature and extent of PBT compounds within the CMA. Further, the estimation of fish and shellfish tissue concentrations based on sediment concentrations and BSAFs has inherent uncertainties given the complex site-specific dynamics that control the bioavailability, bioaccumulation, and biomagnification of PBT compounds in marine and estuarine environments.

Given these uncertainties, the development of spatially adequate and representative datasets for fish and shellfish based on direct analysis of tissue samples is the most accurate and comprehensive approach to evaluating human health and ecological exposure via bioaccumulation and ingestion pathways. As indicated in the Landfill Consent Application, NZAS recognizes that local stakeholder groups have an interest in understanding the suitability of local seafood for human consumption (GHD, 2023); therefore, a full data gap assessment is recommended to support the assessment of current exposure and future monitoring of PBT compounds in fish and shellfish consumed by humans and wildlife from aquatic habitats within and around Tiwai Point. Specific recommendations for consideration in the data gap assessment include:

1. Assessment of the Site conceptual exposure model to determine if exposure pathways to human health or ecological receptors are complete within the North Drain, West Drain, and South Drain.

2. Further evaluate PAH exposure in fish and shellfish tissue through direct analysis of biological samples collected within the drains and surrounding marine receiving environment within the CMA.
3. Further evaluate dioxin/furan exposure in fish and shellfish tissue through direct analysis of biological samples collected within the drains and surrounding marine receiving environment within the CMA.
4. Further evaluate the potential for PCB bioaccumulation in tissue within the drains and near the points of discharge of the drains through direct analysis of tissue as part of future monitoring efforts within the CMA.
5. Assess the potential for other PBT compounds to be associated with Site operations or discharge and include in the analyte list to provide a comprehensive assessment of potential bioaccumulation exposure to human health and ecological receptors within the CMA.

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# Attachment A

## Table A1-1
## Estimated LMW and HMW PAH Concentrations in Shellfish and Fish Tissue Based on Sediment Bioaccumulation
## Environment Southland Independent Monitoring Programme – Coastal Marine Area Investigation
## Tiwai Point, New Zealand

| Polycylic Aromatic Hydrocarbons (PAHs) | Octonal-Water Partitioning Coefficient ($K_{OW}$) | Molecular Weight (g/mol) | Geomean of Detected Sediment Concentrations (mg/kg)[1] | Geomean of Detected Sediment Concentrations (µmol/g)[1] | Normalized Biota-Sediment Accumulation Factor ($BSAF_{Norm}$)[2,3] | Estimated Shellfish Tissue Concentrations | | | Estimated Fish Tissue Concentrations | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Site-Specific Invertebrate Biota-Sediment Accumulation Factor ($BSAF_{Invert}$)[4,3] | Geomean Invertebrate Tissue Concentration (µmol/g lipid ww)[5] | Geomean Invertebrate Tissue Concentration (mg/kg ww)[5] | Site-Specific Fish Biota-Sediment Accumulation Factor ($BSAF_{Fish}$)[4,3] | Geomean Fish Tissue Concentration (µmol/g lipid ww)[5] | Geomean Fish Tissue Concentration (mg/kg ww)[5] |
| **LMW PAHs** | | | | | | | | | | | |
| Acenaphthene | 10280 | 154.2 | 0.015 | 0.00010 | 0.704 | 3.434 | 0.017 | 0.052 | 13.737 | 0.017 | 0.210 |
| Acenaphthylene | 1671 | 152.2 | 0.015 | 0.00010 | 0.754 | 3.678 | 0.018 | 0.055 | 14.712 | 0.018 | 0.221 |
| Anthracene | 34198 | 178.2 | 0.016 | 0.00009 | 0.673 | 3.283 | 0.014 | 0.052 | 13.132 | 0.014 | 0.207 |
| Fluoranthene | 121339 | 202.2 | 0.022 | 0.00011 | 0.641 | 3.127 | 0.017 | 0.069 | 12.507 | 0.017 | 0.277 |
| Fluorene | 16144 | 166.2 | 0.015 | 0.00009 | 0.692 | 3.376 | 0.015 | 0.051 | 13.502 | 0.015 | 0.203 |
| Naphthalene | 2270 | 128.2 | 0.049 | 0.00038 | 0.746 | 3.639 | 0.070 | 0.179 | 14.556 | 0.070 | 0.717 |
| Phenanthrene | 37239 | 178.3 | 0.016 | 0.00009 | 0.670 | 3.268 | 0.015 | 0.053 | 13.073 | 0.0149 | 0.213 |
| **Sum of LMW PAHs:** | | | **0.149** | **0.00096** | | | **0.167** | **0.512** | | **0.1668** | **2.05** |
| **HMW PAHs** | | | | | | | | | | | |
| Benzo(b+j)fluoranthene | 1901078 | 252.3 | 0.026 | 0.00010 | 0.577 | 2.815 | 0.015 | 0.074 | 11.2585 | 0.0148 | 0.298 |
| Benzo(a)anthracene | 34198 | 228.3 | 0.029 | 0.00013 | 0.673 | 3.283 | 0.021 | 0.094 | 13.1317 | 0.0206 | 0.376 |
| Benzo[a]pyrene | 1279381 | 252.3 | 0.025 | 0.00010 | 0.586 | 2.859 | 0.014 | 0.071 | 11.4341 | 0.0140 | 0.283 |
| Benzo(g,h,i)perylene | 3213661 | 276.3 | 0.020 | 0.00007 | 0.566 | 2.761 | 0.010 | 0.056 | 11.0439 | 0.0101 | 0.223 |
| Benzo(k)fluoranthene | 1954339 | 252.4 | 0.024 | 0.00010 | 0.577 | 2.815 | 0.014 | 0.068 | 11.2585 | 0.0135 | 0.273 |
| Chrysene | 516416 | 228.3 | 0.024 | 0.00010 | 0.607 | 2.961 | 0.015 | 0.070 | 11.8439 | 0.0154 | 0.281 |
| Dibenz(A,H)Anthracene | 5164164 | 278.3 | 0.017 | 0.00006 | 0.556 | 2.712 | 0.008 | 0.045 | 10.8488 | 0.0082 | 0.182 |
| Indeno (1,2,3-CD) Pyrene | 5272299 | 276.3 | 0.018 | 0.00006 | 0.555 | 2.707 | 0.009 | 0.048 | 10.8293 | 0.0087 | 0.193 |
| Pyrene | 83560 | 202.2 | 0.021 | 0.00010 | 0.650 | 3.171 | 0.016 | 0.065 | 12.6829 | 0.0161 | 0.261 |
| **Sum of HMW PAHs:** | | | **0.203** | **0.00083** | | | **0.121** | **0.592** | | **0.1214** | **2.37** |
| **Total PAHs:** | | | **0.352** | **0.00179** | | | **0.288** | **1.104** | | **0.29** | **4.42** |

Notes:

1, Geometric mean of PAH concentrations reported in Table H-6 in EHS Support (2023); PAH concentrations below detection were estimated at 50 percent of the reporting limit.

2, BSAFs for PAH compounds were estimated on an organic carbon and lipid-normalized basis as a function of the octanol-water partitioning coefficient (Kow):

$$BSAF_{norm} = \frac{C_{lipid}}{C_{oc}} = K_{ow}^{-0.038}$$

where:

$BSAF_{norm}$ = BSAF normalized by organism lipid content and sediment organic carbon content (g organic carbon/g lipid)
$C_{lipid}$ = Tissue lipid concentration (µmol PAH/g lipid)
$C_{OC}$ = Sediment organic carbon concentration (µmol PAH/g organic carbon)
$K_{ow}$ = Octanol-water partitioning coefficient

3, A lipid content of 8 percent (wet weight) was assumed for fish tissue based on the upper end of the range of lipid content for fish reported in Sydney Harbour (Manning and Batley, 2023). For shellfish, a lipid content of 2 percent (wet weight) was assumed based on the average average lipid concentrations reported for marine crustaceans and mollusks in the U.S. Army Corps of Engineers (USACE) Biota-Sediment Accumulation Factor Database (USACE, 2022).

4, Organic carbon and lipid-normalized BSAFs were estimated on a dry weight basis using assumed lipid and organic carbon content in sediments as follows:

$$BSAF = BSAF_{norm} \times f_{lipid} \times \frac{1}{f_{oc}}$$

where:

BSAF = BSAF specific to prey type and compound (g sediment/g tissue, wet weight)
$BSAF_{norm}$ = BSAF normalized by organism lipid content and sediment organic carbon content (g organic carbon/g lipid)
$f_{lipid}$ = Fraction of lipid in target tissue (wet weight)
$f_{OC}$ = Fraction of organic carbon in sediment (dry weight); estimated as geometric mean TOC concentration for sediment samples included in the assessment (0.0041)

# Table A1-2
## Estimated TEQ Concentrations in Fish Tissue Based on Sediment Bioaccumulation
## Environment Southland Independent Monitoring Programme – Coastal Marine Area Investigation
## Tiwai Point, New Zealand

| **Sampling Station** | **Estimated Fish Tissue Concentrations for Human Health Protection** | | **Estimated Fish Tissue Concentrations for Fish Protection** | |
|---|---|---|---|---|
| | **Sediment $TEQ_{HH}$ (pg/g dw)[1]** | **Fish Tissue $TEQ_{HH}$ (pg/g ww)[2,3]** | **Sediment $TEQ_{Fish}$ (pg/g dw)[1]** | **Fish Tissue $TEQ_{Fish}$ (pg/g ww)[2,3]** |
| NOD-SE 01_0-10cm | 3.01 | 4.02 | 2.72 | 3.63 |
| NOD-SE 02_0-10cm | 0.97 | 2.58 | 0.87 | 2.31 |
| WOD-SE 01_0-10cm | 4.37 | 17.48 | 6.72 | 26.87 |
| WOD-SE 02_0-10cm | 0.62 | 4.93 | 0.69 | 5.50 |
| WOD-SE 03_10-50cm | 0.69 | 2.74 | 0.70 | 2.81 |
| **Geomean TEQ Concentration:** | **1.40** | **4.76** | **1.50** | **5.11** |

Notes:

1, TEQ concentrations calcualted from sediment concentrations reported in Table H-6 in EHS Support (2023) multiplied respective toxicity equivalency factor (TEF) from WHO (Van den Berg et al., 1998; Van den Berg et al., 2006); dioxin/furan concentrations below detection were estimated at 50 percent of the reporting limit.

2, $BSAF_{norm}$ of 0.1 (lipid and organic carbon normalized) was selected for this assessment to capture the range of potential dioxin/furan bioaccumulation (Manning and Bately, 2023)

$$Tissue\,TEQ \quad = BSAF_{norm} \times f_{lipid} \times \frac{1}{f_{oc}} \times Sed\,TEQ$$

where:

Tissue TEQ = Estimated TEQ in fish tissue for the protection of human health or fish (pg/g , wet weight)

$BSAF_{norm}$ = Organic carbon and lipid normalized BSAF specific to prey type and compound (gram [g] organic carbon/gram [g] lipid)

$f_{lipid}$ = Tissue lipid concentration (mg PAH/kg li Tissue lipid concentration (mg PAH/kg lipid)

$f_{OC}$ = Fraction of organic carbon in sediment (dry weight)

Sed TEQ = Sediment TEQ based on WHO TEFs for human health or fish (pg/g, dry weight)

3, A lipid content of 8 percent (wet weight) was assumed for fish tissue based on the upper end of the range of lipid content for fish reported in Sydney Harbour (Manning and Batley, 2023).

## Table A1-3
## Estimated TEQ Concentrations in Shellfish Tissue Based on Sediment Bioaccumulation
## Environment Southland Independent Monitoring Programme – Coastal Marine Area Investigation
## Tiwai Point, New Zealand

| Polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans(PCDFs) | Toxicity Equivalency Factors (TEFs)[1] | Normalized Biota-Sediment Accumulation Factor ($BSAF_{Norm}$)[2] | NOD-SE 01_0-10cm | | NOD-SE 02_0-10cm | | WOD-SE 01_0-10cm | | WOD-SE 02_0-10cm | | WOD-SE 03_10-50cm | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sediment Concentration (pg/g dw)[3] | Estimated Shellfish Tissue Concentration (pg TEQ/g ww)[4] | Sediment Concentration (pg/g dw)[3] | Estimated Shellfish Tissue Concentration (pg TEQ/g ww)[4] | Sediment Concentration (pg/g dw)[3] | Estimated Shellfish Tissue Concentration (pg TEQ/g ww)[4] | Sediment Concentration (pg/g dw)[3] | Estimated Shellfish Tissue Concentration (pg TEQ/g ww)[4] | Sediment Concentration (pg/g dw)[3] | Estimated Shellfish Tissue Concentration (pg TEQ/g ww)[4] |
| 2.3.7.8-TCDD | 1.0000 | 0.927 | 0.10 | 0.77 | 0.05 | 0.39 | 0.05 | 0.39 | 0.05 | 0.39 | 0.05 | 0.39 |
| 1.2.3.7.8-PeCDD | 1.0000 | 1.580 | 0.55 | 7.24 | 0.25 | 3.29 | 0.25 | 3.29 | 0.25 | 3.29 | 0.25 | 3.29 |
| 1.2.3.4.7.8-HxCDD | 0.1000 | 1.900 | 0.55 | 0.87 | 0.25 | 0.40 | 0.25 | 0.40 | 0.25 | 0.40 | 0.25 | 0.40 |
| 1.2.3.6.7.8-HxCDD | 0.1000 | 0.326 | 0.55 | 0.15 | 1.70 | 0.46 | 1.70 | 0.46 | 0.25 | 0.07 | 0.25 | 0.07 |
| 1.2.3.7.8.9-HxCDD | 0.1000 | 0.619 | 0.55 | 0.28 | 0.25 | 0.13 | 0.25 | 0.13 | 0.25 | 0.13 | 0.25 | 0.13 |
| 1.2.3.4.6.7.8-HpCDD | 0.0100 | 0.084 | 55.00 | 0.39 | 8.30 | 0.06 | 4.30 | 0.03 | 3.90 | 0.03 | 10.00 | 0.07 |
| OCDD | 0.0003 | 0.077 | 150.00 | 0.03 | 14.00 | 0.00 | 5.50 | 0.00 | 3.80 | 0.00 | 9.90 | 0.00 |
| 2.3.7.8-TCDF | 0.1000 | 1.680 | 0.10 | 0.14 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 |
| 1.2.3.7.8-PeCDF | 0.0300 | 1.680 | 0.55 | 0.23 | 0.25 | 0.11 | 3.20 | 1.34 | 0.25 | 0.11 | 0.25 | 0.11 |
| 2.3.4.7.8-PeCDF | 0.3000 | 0.982 | 0.55 | 1.35 | 0.25 | 0.61 | 12.00 | 29.46 | 0.25 | 0.61 | 0.25 | 0.61 |
| 1.2.3.4.7.8-HxCDF | 0.1000 | 0.768 | 3.30 | 2.11 | 0.70 | 0.45 | 0.25 | 0.16 | 0.25 | 0.16 | 0.25 | 0.16 |
| 1.2.3.6.7.8-HxCDF | 0.1000 | 1.370 | 8.50 | 9.70 | 1.30 | 1.48 | 0.25 | 0.29 | 0.25 | 0.29 | 0.25 | 0.29 |
| 2.3.4.6.7.8-HxCDF | 0.1000 | 0.917 | 0.55 | 0.42 | 0.25 | 0.19 | 0.25 | 0.19 | 0.25 | 0.19 | 0.25 | 0.19 |
| 1.2.3.7.8.9-HxCDF | 0.1000 | 0.622 | 0.55 | 0.29 | 0.25 | 0.13 | 0.25 | 0.13 | 0.25 | 0.13 | 0.25 | 0.13 |
| 1.2.3.4.6.7.8-HpCDF | 0.0100 | 0.048 | 11.00 | 0.04 | 1.90 | 0.01 | 0.25 | 0.00 | 1.10 | 0.00 | 1.80 | 0.01 |
| 1.2.3.4.7.8.9-HpCDF | 0.0100 | 0.333 | 0.55 | 0.02 | 0.25 | 0.01 | 0.25 | 0.01 | 0.25 | 0.01 | 0.25 | 0.01 |
| OCDF | 0.0003 | 0.047 | 16.00 | 0.00 | 1.40 | 0.00 | 0.55 | 0.00 | 0.50 | 0.00 | 0.55 | 0.00 |
| **Station-Specific Estimated Shellfish Tissue TEQ:[5]** | | | | **24.0** | | **7.8** | | **36.3** | | **5.9** | | **5.9** |
| **Geomean Estimated Shellfish Tissue TEQ:** | | | **11.9** | | | | | | | | | |

Notes:

1, Toxicity equivalency factor (TEF) for human exposure from WHO (Van den Berg et al., 2006)

2, $BSAF_{norm}$ based on 95 percent upper confidence limit (UCL) BSAFs (lipid and organic carbon normalized) reported by Clark et al. (2004).

3, Sediment concentrations reported in Table H-6 in EHS Support (2023); dioxin/furan concentrations below detection were estimated at 50 percent of the reporting limit.

4, Concentrations of each individual congener were estimated for shellfish tissue using the normalized congener specific BSAF:

$$C_{invert} = \left(BSAF_{norm} \times f_{lipid} \times \frac{1}{f_{oc}} \times C_{sed}\right) \times TEF$$

where:

$C_{invert}$ =

$BSAF_{norm}$ = Organic carbon and lipid normalized BSAF specific to prey type and compound (gram [g] organic carbon/gram [g] lipid)

$f_{lipid}$ = Tissue lipid con Tissue lipid concentration (mg PAH/kg lipid)

$f_{OC}$ = Fraction of organic carbon in sediment (dry weight)

$TEF$ = Toxicity equivalency factor (TEF) for human exposure from WHO (Van den Berg et al., 2006)

5, Calculated as the sum of estimated shellfish tissue concentration of the 17 individual congeners

6, Calculated as the geometric mean of the 5 estimated station-specific shellfish tissue TEQ concentrations.

# Table A2-1
## Calculation of NOAEL-Based Tissue Benchmark Concentration for the Protection of Semi-Aquatic Wildlife
## Environment Southland Independent Monitoring Programme – Coastal Marine Area Investigation
## Tiwai Point, New Zealand

**Exposure Parameters:**

| Receptor Group (Surrogate Species) | Body Weight[1] (kg) | Food Ingestion Rate (FIR)[2] (kg ww/day) | Assumed Diet |
|---|---|---|---|
| Sediment Probing Avian Receptor<br>Variable oystercatcher (*Haematopus unicolor*) | 0.67 | 0.426 | 100% invertebrates |
| Sediment Probing Avian Receptor<br>Banded dotterel (*Charadrius bicinctus*) | 0.0594 | 0.044 | 100% invertebrates |
| Avian Piscivore<br>Caspian tern (*Sterna caspia*) | 0.655 | 0.280 | 100% fish |

**Notes:**

1. Body weight obtained as average body compiled in Dunning (2008).
2. FIR, food ingestion rate based on allometric relationships to body weight as developed by Nagy (1987) for shorebirds (Charadriiformes):
   $FIR_{ww}$ (kg ww/day) = $(1.914 \times BW(g)^{0.769})/1000$

**Tissue Benchmark Concentration Calculations:**

| Receptor | Concentration in dietary item ($B_i$)[3] (mg/kg ww) | NOAEL[4,5] (mg/kg BW $d^{-1}$) |
|---|---|---|
| **LMW PAHs** | | |
| Sediment Probing Avian Receptor<br>Variable oystercatcher (*Haematopus unicolor*) | 25.4 | 16.1 |
| Sediment Probing Avian Receptor<br>Banded dotterel (*Charadrius bicinctus*) | **21.6** | 16.1 |
| Avian Piscivore<br>Caspian tern (*Sterna caspia*) | 37.6 | 16.1 |
| **HMW PAHs** | | |
| Sediment Probing Avian Receptor<br>Variable oystercatcher (*Haematopus unicolor*) | 3.2 | 2.0 |
| Sediment Probing Avian Receptor<br>Banded dotterel (*Charadrius bicinctus*) | **2.7** | 2.0 |
| Avian Piscivore<br>Caspian tern (*Sterna caspia*) | 4.7 | 2.0 |

**Notes:**

3, Tissue benchmark concentration calculated as follows:

$$EDD = \frac{B_i \times FIR}{BW} = NOAEL$$

$$B_i = \frac{NOAEL \ \times BW}{FIR}$$

where:

EDD = Estimated daily dose through the ingestion of fish or shellfish tissue (mg/kg BW $d^{-1}$)

$B_i$= Estimated tissue benchmark concentration in dietary item (mg/kg wet weight [ww])

FIR = Food ingestion rate (kg food ww/kg bw [wet weight] $d^{-1}$)

NOAEL= Lowest observable adverse effects level (mg/kg BW $d^{-1}$)

BW = Body weight of receptor (kg)

4, The NOAEL dose for LMW PAHs was selected based on the no effect dose reported for mallard by Patton and Dieter (1980).

5, The NOAEL dose for HMW PAHs was selected based on the no effect dose reported for European starling by Trust et al. (1994).

Bold values indicate tissue benchmark concentration based on most sensitive wildlife receptor.

Dose estimates assume foraging 100 percent of the time at an average tissue concentration equal to the tissue benchmark concentration.

BW = body weight

bw/d = body weight per day

mg/kg = milligrams per kilogram

# Table A3-1
# USEPA RSL Calculator
# Fish and Shellfish Ingestion Inputs
# Environment Southland Independent Monitoring Programme – Coastal Marine Area Investigation
# Tiwai Point, New Zealand

| Variable | Site-Specific Value | Source | Notes |
|---|---|---|---|
| AT (averaging time) | 365 | USEPA, 2023 | Default |
| BW$_{\text{res-a}}$ (body weight) kg | 70 | MfE, 2011 | Default |
| ED$_{\text{res}}$ (exposure duration) yr | 14 | MfE, 2011 | Default for residential |
| EF$_{\text{res-a}}$ (exposure frequency) days/yr | 350 | USEPA, 2023 | Default for residential |
| THQ (target hazard quotient) unitless | 1 | MfE, 2011 | Default |
| IRFI$_{\text{res-a}}$ (fish consumption rate - adult) mg/day | 32000 | MfE, 1998 | Recommended value in Table D1 which represents an 8 ounce serving per week |
| IRFI$_{\text{res-a}}$ (shellfish consumption rate - adult) mg/day | 9900 | MfE, 1998 | Recommended value in Table D1 which represents an ~ 2.4 ounce serving per week |
| LT (lifetime) yr | 75 | MfE, 2011 | Default |
| TR (target cancer risk) unitless | 0.00001 | MfE, 2011 | Default |

MfE. (1998). Concentrations of PCDDS, PCDFs and PCBs in retail foods and an assessment of dietary intake for New Zealanders.

MfE. (2011). Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.
Retrieved from http://www.mfe.govt.nz/publications/hazardous/deriving-standards-for-contaminants-in-soil/methodology-for-deriving-standards-for-contaminants-in-soil.doc.

USEPA. (2023). Regional Screening Level User’s Guide. May 2023. Available on-lin

# Table A3-2
## USEPA RSL Calculator
## Fish Ingestion Output
## Environment Southland Independent Monitoring Programme – Coastal Marine Area Investigation
## Tiwai Point, New Zealand

**Site-specific**

## Fish Risk-Based Regional Screening Levels (RSL) for Fish

**Key:ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL**

| Chemical | CAS Number | Mutagen? | Volatile? | Chemical Type | Sfo (mg/kg-day)$^{-1}$ | Sfo Ref | RfD (mg/kg-day) | RfD Ref | Ingestion SL TR=1E-05 (mg/kg) | Ingestion SL THQ=1 (mg/kg) | Screening Level (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 83-32-9 | No | Yes | Organics | - |  | 6.00E-02 | IRIS | - | 1.37E+02 | 1.37E+02 nc |
| Anthracene | 120-12-7 | No | Yes | Organics | - |  | 3.00E-01 | IRIS | - | 6.84E+02 | 6.84E+02 nc |
| Benzo[a]pyrene | 50-32-8 | Yes | No | Organics | 2.08E+00 | MfE | 3.00E-04 | IRIS | 5.88E-02 | 6.84E-01 | 5.88E-02 ca* |
| Pyrene | 129-00-0 | No | Yes | Organics | - |  | 3.00E-02 | IRIS | - | 6.84E+01 | 6.84E+01 nc |
| TCDD, 2,3,7,8- | 1746-01-6 | No | Yes | Organics | - |  | 2.30E-09 | JECFA | - | 5.25E-06 | 5.25E-06 nc |

Output generated 19JUL2023:22:31:44

TRV Sources:
IRIS - United States Environmental Protection Agency Integrated Risk Information Syste

JECFA - Joint Expert Committee on Food Additives (JECFA) of the WHO and from the UN Food and Agriculture Organisation (FAO) established in June 20(
a provisional tolerable monthly intake (PTMI) at 70 pg/kg b.w. for dioxins and dioxin-like PCBs. WHO Technical Report series, 909. Evaluation of certain food additives and contaminants, p. 121-1
Available at http://whqlibdoc.who.int/trs/WHO_TRS_909.pd

MfE - Ministry of the Environmental, 2011 Toxicological Intake Values for Priority Contaminants in S

# Table A3-3
# USEPA RSL Calculator
# Shellfish Ingestion Output
# Environment Southland Independent Monitoring Programme – Coastal Marine Area Investigation
# Tiwai Point, New Zealand

**Site-specific**

## Fish Risk-Based Regional Screening Levels (RSL) for Fish

**Key: ca = cancer; nc = noncancer; * = where: nc SL < 100X ca SL; ** = where nc SL < 10X ca SL**

| Chemical | CAS Number | Mutagen? | Volatile? | Chemical Type | Sfo $(mg/kg\text{-}day)^{-1}$ | Sfo Ref | RfD (mg/kg-day) | RfD Ref | Ingestion SL TR=1E-05 (mg/kg) | Ingestion SL THQ=1 (mg/kg) | Screening Level (mg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 83-32-9 | No | Yes | Organics | - |  | 6.00E-02 | IRIS | - | 4.42E+02 | 4.42E+02 nc |
| Anthracene | 120-12-7 | No | Yes | Organics | - |  | 3.00E-01 | IRIS | - | 2.21E+03 | 2.21E+03 nc |
| Benzo[a]pyrene | 50-32-8 | Yes | No | Organics | 2.08E+00 | MfE | 3.00E-04 | IRIS | 1.90E-01 | 2.21E+00 | 1.90E-01 ca* |
| Pyrene | 129-00-0 | No | Yes | Organics | - |  | 3.00E-02 | IRIS | - | 2.21E+02 | 2.21E+02 nc |
| TCDD, 2,3,7,8- | 1746-01-6 | No | Yes | Organics | - |  | 2.30E-09 | JECFA | - | 1.70E-05 | 1.70E-05 nc |

Output generated 19JUL2023:22:43:59

TRV Sources:
IRIS - United States Environmental Protection Agency Integrated Risk Information Syste

JECFA - Joint Expert Committee on Food Additives (JECFA) of the WHO and from the UN Food and Agriculture Organisation (FAO) established in June 20(
a provisional tolerable monthly intake (PTMI) at 70 pg/kg b.w. for dioxins and dioxin-like PCBs. WHO Technical Report series, 909. Evaluation of certain food additives and contaminants, p. 121-1
Available at http://whqlibdoc.who.int/trs/WHO_TRS_909.pd

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# Appendix K Landfill AEE Tables

# APPENDIX K

## 1. Disclaimer

EHS Support New Zealand Ltd (EHS Support) has reviewed the original document and tables provided by GHD New Zealand Limited (GHD) as part of the New Zealand Aluminium Smelters Ltd. (NZAS) Landfill Consent Application (Consent #202196; GHD, 2023). It was determined that several tables included in the appendices did not match the laboratory analytical reports provided with the report. Therefore, EHS Support has only provided the analytical result tables from the Landfill Consent Application where the results have been confirmed by the accompanying laboratory reports.

## 2. References

GHD New Zealand Ltd. (2023). NZAS Landfill Resource Consent Application and Assessment of Environmental Effects. 26 May 2023.

## Appendix B - Table B4
## Landfill and reference sediment analytical results - Human health assessment criteria

| | | | | | | | | Minor ions | Inorganics | | | | Unassigned | | Major Ions | | | | | | Nutrients | | | Organic Indicators | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | 2-Chlorobiphenyl | Dichlorobiphenyl | Calcium | Magnesium | Potassium | Sodium | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Total Organic Carbon | Aluminium | Antimony | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Chromium (Trivalent) |
| | | | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | % | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 0.006 | 0.006 | 12.5 | 5 | 5 | 125 | 3 | 3 | 5 | 2.4 | 1 | 0.1 | 2.5 | 0.025 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.4 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | 240 | | | | | | | | | | | | | | | | 300 | | 90 | 20000 | 90 | 300 | 300 | |
| New Zealand Legislation for Priority Contaminants | | | | | | | | | | | | | | | | | | | | | | | | | | | 80 | | | 10,000 | 400 | | | 2700 |
| US EPA Regional Screening Levels | | | | | | | | | | | | | | | | | | | | | | | | | 77,000 | | | | | | | | | |
| CCME Soil Quality Guidelines for the Protection of Environmental and Human Health | | | | | | | | | | | | | | | | | | | | | | | | | | | | 500 | | | | | | |
| New Zealand 1997 Gasworks Guidelines | | | | | | | | | | | 780 | 2000 | | | | | | | | | | | | | | | | | | | | | | |
| **Field ID** | **Location Code** | **Area** | **Location Details** | **Sample Depth (m)** | **Sampled Date** | **Matrix** | **Sample Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_SED13 | CMA_SED13 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 180 | 9 | 8 | <0.2 | <0.2 | <0.006 | <0.006 | 5430 | 1520 | 290 | 1400 | 2491.5 | 130.3 | <5 | <2.5 | <1 | <0.2 | 2640 | 0.062 | 2.6 | 3.01 | 0.084 | 2 | 0.017 | 5.9 | <0.4 | 5.89 |
| CMA_SED14 | CMA_SED14 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 140 | 18 | 7.7 | <0.2 | <0.2 | - | - | 3230 | 1440 | 340 | 2900 | 4380.4 | 228.5 | <5 | <2.6 | <1 | <0.2 | 2470 | 0.04 | 2.7 | 2.9 | 0.075 | 2.7 | 0.015 | 5.4 | <0.5 | 5.44 |
| CMA_SED15 | CMA_SED15 | Landfill coast | North - intertidal | 0.1-0.5 | 30/11/2022 | SD | Normal | 180 | 22 | 7.6 | <0.2 | <0.2 | - | - | 2360 | 1650 | 370 | 1800 | 2914.7 | 173 | <5 | <2.6 | <1 | <0.2 | 3160 | 0.3 | 4.1 | 4.1 | 0.11 | 2.1 | 0.015 | 4 | <0.5 | 3.98 |
| CMA_SED15 | CMA_SED15 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 180 | 15 | 7.8 | <0.2 | <0.2 | - | - | 7740 | 1570 | 370 | 1600 | 2760.8 | 143.6 | <5 | <2.6 | <1 | <0.2 | 3020 | 0.11 | 3.5 | 4.22 | 0.097 | 3.3 | 0.0077 | 5.9 | <0.5 | 5.92 |
| CMA_SED16 | CMA_SED16 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 160 | 27 | 7.8 | <0.2 | <0.3 | - | - | 9850 | 2640 | 607 | 3200 | 4784.7 | 251 | <5 | <2.6 | <1 | <0.2 | 4380 | 0.093 | 4 | 7 | 0.13 | 3.8 | 0.019 | 9 | <0.6 | 8.97 |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0.1-0.5 | 30/11/2022 | SD | Normal | 180 | 29 | 7.9 | <0.2 | <0.3 | - | - | 5430 | 1550 | 330 | 1500 | 2634.4 | 126.3 | <5 | <2.7 | <1 | <0.2 | 2820 | 0.042 | 3.1 | 3.49 | 0.093 | 2.7 | 0.01 | 5.4 | <0.6 | 5.37 |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0.5-0.8 | 30/11/2022 | SD | Normal | 280 | 40 | 5.8 | <0.2 | <0.3 | - | - | 6080 | 6400 | 1780 | 9100 | 10,013 | 1259.9 | 22.7 | <2.5 | <1 | <0.2 | 10,600 | 0.11 | 7 | 19.8 | 0.28 | 58 | 0.12 | 20 | <0.7 | 20 |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 190 | 23 | 7.9 | <0.2 | <0.2 | - | - | 7380 | 1510 | 360 | 1700 | 2601.5 | 146.1 | <5 | <2.5 | <1 | 4.7 | 2690 | 0.078 | 3 | 3.72 | 0.09 | 1.9 | 0.012 | 5.6 | <0.5 | 5.55 |
| CMA_SED_DUP2 | CMA_SED17 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3090 | - | 3.1 | 3.8 | 0.097 | 2.5 | 0.017 | 5.9 | - | - |
| CMA_SED18 | CMA_SED18 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 160 | 24 | 7.6 | <0.2 | <0.2 | - | - | 22,200 | 2010 | 480 | 2100 | 3276.6 | 174.1 | 5.62 | <2.5 | <1 | <0.2 | 3420 | 0.065 | 5.1 | 5.67 | 0.11 | 4.7 | 0.036 | 6.2 | <0.6 | 6.24 |
| CMA_SED19 | CMA_SED19 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 210 | 19 | 6.8 | <0.2 | <0.2 | - | - | 12,500 | 1390 | 230 | 400 | 181.8 | 9.9 | <5 | <2.6 | <1 | <0.2 | 2920 | 0.048 | 7.1 | 3.13 | 0.093 | <1.3 | 0.049 | 4.8 | <0.5 | 4.81 |
| CMA_SED20 | CMA_SED20 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 260 | 18 | 7.3 | <0.2 | <0.3 | - | - | 26,100 | 2050 | 360 | 1900 | 2643.5 | 126.2 | <5 | <2.6 | <1 | 0.25 | 3140 | 0.056 | 9.3 | 3.81 | 0.11 | 2.8 | 0.08 | 5.9 | <0.5 | 5.9 |
| CMA_SED21 | CMA_SED21 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 210 | 3 | 8.6 | <0.2 | <0.2 | <0.006 | <0.006 | 117,000 | 1680 | 210 | 1900 | 618.4 | 28.2 | <5 | <2.5 | <1 | <0.2 | 2210 | - | 13.1 | 4.75 | 0.11 | <1.3 | 0.051 | 3.8 | <0.4 | 3.76 |
| CMA_SED22 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 180 | 7 | 8.6 | <0.2 | <0.2 | <0.006 | <0.006 | 91,600 | 1870 | 220 | 1700 | 976.4 | 41.1 | <5 | <2.5 | <1 | <0.2 | 2760 | - | 13.5 | 4.37 | 0.13 | <1.3 | 0.075 | 5 | <0.4 | 5.01 |
| CMA_SED_DUP3 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Interlab_D | 108 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2500 | - | 11 | - | <0.2 | <20 | <0.1 | 3 | - | - |
| CMA_SED_DUP3 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2650 | - | 12.5 | - | 0.083 | 3.2 | 0.049 | 3.7 | - | - |
| CMA_SED31 | CMA_SED31 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 210 | 8 | 6.8 | <0.2 | <0.2 | <0.006 | <0.006 | 95,900 | 1690 | 190 | 2200 | 1894.6 | 87.8 | <5 | <2.5 | <1 | 0.5 | 2250 | - | 12 | 4.14 | 0.083 | 3 | 0.12 | 4.2 | <0.5 | 4.18 |
| CMA_SED32 | CMA_SED32 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | 210 | 6 | 7.6 | <0.2 | <0.2 | - | - | 65,100 | 759 | 88 | 1100 | 1151.2 | 54.2 | <5 | <2.6 | <1 | <0.2 | 985 | - | 6.1 | 2.1 | 0.036 | <1.3 | 0.022 | 1.4 | <0.4 | 1.44 |
| CMA_SED32 | CMA_SED32 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 200 | 11 | 7.2 | <0.2 | <0.2 | - | - | 47,500 | 930 | 98 | 980 | 1157.9 | 52.2 | <5 | <2.5 | <1 | 0.68 | 1330 | - | 6.7 | 2.2 | 0.047 | 1.9 | 0.072 | 2.2 | <0.5 | 2.17 |
| CMA_SED33 | CMA_SED33 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 140 | 5 | 7.2 | <0.2 | <0.2 | - | - | 76,600 | 1380 | 170 | 1800 | 1416.8 | 64.2 | <5 | <2.6 | <1 | 0.31 | 1840 | - | 8.3 | 4.17 | 0.067 | 2.2 | 0.052 | 2.9 | <0.4 | 2.88 |
| CMA_SED34 | CMA_SED34 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | 190 | 4 | 7.9 | <0.2 | <0.2 | - | - | 46,300 | 516 | 56 | 820 | 1041.7 | 49.4 | <5 | <2.4 | <1 | <0.2 | 841 | - | 3.4 | 1.6 | 0.029 | <1.3 | 0.011 | 0.93 | <0.4 | 0.93 |
| CMA_SED34 | CMA_SED34 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 280 | 6 | 8.1 | <0.2 | <0.2 | - | - | 113,000 | 1260 | 110 | 1900 | 791.3 | 31.2 | <5 | <2.6 | <1 | 0.41 | 1460 | - | 9 | 3.48 | 0.046 | 1.7 | 0.0096 | 1.7 | <0.4 | 1.74 |
| CMA_SED35 | CMA_SED35 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 160 | 6 | 7.3 | <0.2 | <0.2 | - | - | 88,400 | 1480 | 180 | 2100 | 1568.3 | 69.3 | <5 | <2.5 | <1 | 0.66 | 2040 | - | 9.4 | 3.65 | 0.066 | 2.8 | 0.055 | 3.1 | <0.4 | 3.1 |
| CMA_SED36 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | 1400 | 6 | 8.1 | <0.2 | <0.2 | <0.006 | <0.006 | 105,000 | 1640 | 200 | 2000 | 1057.5 | 47 | <5 | <2.6 | <1 | <0.2 | 2070 | - | 12 | 4.26 | 0.078 | 2.3 | 0.04 | 3 | <0.4 | 3.01 |
| CMA_SED36 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 180 | 8 | 8.3 | <0.2 | <0.2 | <0.006 | <0.006 | 54,000 | 686 | 81 | 1000 | 1375.7 | 61.8 | <5 | <2.5 | <1 | 0.85 | 802 | - | 4.7 | 2 | 0.026 | <1.3 | 0.0086 | 1.3 | <0.5 | 1.28 |
| CMA_SED_dup4 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2080 | - | 8.6 | - | 0.082 | 4.4 | 0.064 | 4.3 | - | - |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 5/12/2022 | SD | Normal | 240 | 10 | 6.9 | <0.2 | <0.2 | - | - | 92,700 | 1870 | 220 | 2200 | 1743.3 | 76.4 | <5 | <2.6 | <1 | 2.3 | 3070 | - | 13 | 6.08 | 0.13 | 3.9 | 0.094 | 5.4 | <0.5 | 5.36 |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Normal | 280 | 17 | 7.4 | <0.2 | <0.2 | - | - | 80,100 | 1800 | 240 | 2200 | 2154.3 | 96.8 | <5 | <2.7 | <1 | 0.24 | 2830 | - | 13.4 | 4.43 | 0.12 | 4.4 | 0.042 | 4.4 | <0.5 | 4.39 |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 390 | 13 | 6.1 | <0.2 | <0.2 | - | - | 73,700 | 1850 | 240 | 1900 | 1265.9 | 54.5 | <5 | <2.6 | <1 | 0.7 | 3070 | - | 12 | 4.32 | 0.13 | 4.2 | 0.12 | 6 | <0.5 | 6.01 |
| CMA_SED_DUP5 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 12/12/2022 | SD | Interlab_D | 112 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2400 | - | 11 | - | <0.2 | <20 | <0.1 | 4 | - | - |
| CMA_SED_DUP5 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.11 | <1.3 | 0.097 | 4.8 | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 5/12/2022 | SD | Normal | 230 | 6 | 8.6 | <0.2 | <0.2 | - | - | 98,000 | 1750 | 220 | 2100 | 1311.4 | 55 | <5 | <2.5 | <1 | <0.2 | 2350 | - | 13 | 4.52 | 0.1 | <1.3 | 0.043 | 4.2 | <0.4 | 4.17 |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Normal | 170 | 10 | 8.7 | <0.2 | <0.2 | - | - | 128,000 | 1820 | 210 | 2800 | 2036.7 | 85.2 | <5 | <2.6 | <1 | <0.2 | 2450 | - | 12.8 | 4.64 | 0.1 | <1.3 | 0.071 | 4.5 | <0.4 | 4.48 |
| CMA_SED_DUP6 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Interlab_D | 194 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3400 | - | 13 | - | <0.2 | <20 | 0.13 | 5 | - | - |
| CMA_SED_DUP6 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 4150 | - | 12.9 | - | 0.13 | 4 | 0.17 | 6.3 | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 250 | 9 | 8.6 | <0.2 | <0.2 | <0.006 | <0.006 | 76,200 | 2040 | 270 | 2000 | 1751.2 | 75.7 | <5 | <2.6 | <1 | <0.2 | 3730 | - | 13.3 | 5.3 | 0.17 | 1.6 | 0.2 | 6.3 | <0.4 | 6.28 |
| CMA_SED39 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 240 | 7 | 8.3 | <0.2 | <0.2 | - | - | 83,900 | 1730 | 210 | 1700 | 989.5 | 42.3 | <5 | <2.4 | <1 | <0.2 | 2600 | - | 12.8 | 7.48 | 0.12 | <1.3 | 0.084 | 4.6 | <0.4 | 4.58 |
| CMA_SED_DUP7 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Interlab_D | 113 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2700 | - | 12 | - | <0.2 | <20 | 0.11 | 4 | - | - |
| CMA_SED_DUP7 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2880 | - | 12.9 | - | 0.088 | 3.1 | 0.073 | 3.8 | - | - |
| CMA_SED40 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 30/11/2022 | SD | Normal | 210 | 15 | 7 | <0.2 | <0.3 | - | - | 10,500 | 2030 | 380 | 1600 | 2664.7 | 159.8 | <5 | <2.5 | <1 | <0.2 | 3590 | 0.099 | 4.5 | 4.42 | 0.12 | 3 | 0.052 | 7.5 | <0.5 | 7.53 |
| CMA_SED40 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 5/12/2022 | SD | Normal | 300 | 8 | 7.5 | <0.2 | <0.2 | - | - | 80,900 | 1820 | 250 | 2000 | 1678.8 | 75.6 | <5 | <2.5 | <1 | 1 | 3290 | - | 12.7 | 4.5 | 0.14 | 4 | 0.088 | 6 | <0.4 | 6.01 |
| CMA_SED_DUP8 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 2880 | - | 12 | - | 0.086 | 3.3 | 0.072 | 4.3 | - | - |
| CMA_SED41 | CMA_SED41 | Landfill coast | West - 50 m | 0-0.1 | 30/11/2022 | SD | Normal | 230 | 25 | 7.2 | <0.2 | <0.3 | - | - | 5620 | 2170 | 410 | 2500 | 4558.5 | 217.6 | <5 | <2.5 | <1 | <0.2 | 4110 | 0.064 | 5.2 | 4.7 | 0.13 | 3.4 | 0.046 | 6.9 | <0.5 | 6.93 |
| CMA_SED42 | CMA_SED42 | Landfill coast | West - 150 m | 0-0.1 | 1/12/2022 | SD | Normal | 120 | 21 | 8 | <0.2 | <0.2 | - | - | 4640 | 2270 | 420 | 2200 | 3133.5 | 142.2 | <5 | <2.5 | <1 | <0.2 | 4420 | - | 3.1 | 4.84 | 0.13 | 9.4 | 0.015 | 7.5 | <0.5 | 7.47 |
| CMA_SED43 | CMA_SED43 | Landfill coast | West - 0 m | 0-0.1 | 30/11/2022 | SD | Normal | 180 | 30 | 7.6 | <0.2 | <0.3 | - | - | 8240 | 1560 | 380 | 2400 | 3847.1 | 161.8 | <5 | <2.6 | <1 | <0.2 | 2550 | 0.038 | 4 | 4.48 | 0.08 | 5.2 | 0.029 | 4.8 | <0.6 | 4.77 |
| CMA_SED44 | CMA_SED44 | Landfill coast | West - 50 m | 0-0.1 | 30/11/2022 | SD | Normal | 170 | 26 | 7.6 | <0.2 | <0.3 | - | - | 3070 | 2000 | 360 | 1900 | 4042.1 | 205.3 | <5 | <2.6 | <1 | <0.2 | 3680 | 0.071 | 3.7 | 3.47 | 0.12 | 3.5 | 0.011 | 6.7 | <0.6 | 6.71 |
| CMA_SED45 | CMA_SED45 | Landfill coast | West - 150 m | 0-0.1 | 1/12/2022 | SD | Normal | 170 | 16 | 8 | <0.2 | <0.2 | - | - | 5370 | 2150 | 490 | 2600 | 3944 | 150.5 | <5 | <2.4 | <1 | 0.22 | 5140 | - | 2.5 | 5.38 | 0.13 | 8.7 | 0.014 | 8.2 | <0.5 | 8.17 |
| CMA_SED46 | CMA_SED46 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 150 | 6 | 5.9 | <0.2 | <0.2 | - | - | 77,800 | 1770 | 240 | 1900 | 1267.5 | 58.2 | <5 | <2.6 | <1 | <0.2 | 2540 | - | 9.5 | 4.59 | 0.094 | 2.9 | 0.059 | 3.9 | <0.4 | 3.85 |
| CMA_SED_dup9 | CMA_SED46 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | 690 | 7 | - | <0.2 | <0.2 | - | - | - | - | - | - | 1936.5 | - | <5 | <2.5 | <1 | - | 2530 | - | 10 | 4.21 | 0.079 | 3.3 | 0.05 | 3.7 | <0.4 | 3.75 |
| CMA_SED47 | CMA_SED47 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 130 | 4 | 7.7 | <0.2 | <0.2 | - | - | 50,000 | 706 | 76 | 920 | 918.7 | 41.2 | <5 | <2.5 | <1 | <0.2 | 942 | - | 5.5 | 2 | 0.036 | <1.3 | 0.056 | 1.3 | <0.4 | 1.33 |
| CMA_SED_dup10 | CMA_SED47 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | 720 | 5 | - | <0.2 | <0.2 | - | - | - | - | - | - | 1249.2 | - | <5 | <2.5 | <1 | - | 1750 | - | 9.6 | 4.06 | 0.059 | 2.3 | 0.038 | 2.1 | <0.4 | 2.13 |
| CMA_SED48 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 180 | 27 | 7.4 | <0.2 | <0.3 | - | - | 4390 | 2200 | 470 | 3100 | 3924.3 | 166.4 | <5 | <2.5 | <1 | <0.2 | 3460 | 0.054 | 5.3 | 4.83 | 0.11 | 4.2 | 0.032 | 6.8 | <0.6 | 6.83 |
| CMA_SED48 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 150 | 5 | 8.2 | <0.2 | <0.2 | - | - | 94,400 | 1850 | 210 | 1700 | 1019.9 | 46.8 | <5 | <2.5 | <1 | <0.2 | 3220 | - | 13.1 | 4.51 | 0.13 | <1.3 | 0.071 | 6.2 | <0.4 | 6.21 |
| CMA_SED_DUP11 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3520 | - | 13.4 | - | 0.1 | <1.3 | 0.057 | 5.6 | - | - |
| EHS_BCK_SED4 | EHS_BCKSED4 | Landfill coast | South - intertidal | 0.1-0.5 | 6/12/2022 | SD | Normal | 350 | 6 | 8.3 | <0.2 | <0.2 | - | - | 53,600 | 2790 | 400 | 1800 | 1835.1 | 101.5 | <5 | <2.5 | <1 | <0.2 | 4830 | - | 13.4 | 6.26 | 0.19 | 7.8 | 0.17 | 8.3 | <0.4 | 8.33 |
| EHS_BCK_SED4 | EHS_BCKSED4 | Landfill coast | South - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | 390 | 5 | 8.3 | <0.2 | <0.2 | <0.006 | <0.006 | 41,300 | 2720 | 470 | 1500 | 1225.6 | 67.3 | <5 | <2.6 | <1 | 0.24 | 5620 | - | 9.4 | 6.66 | 0.14 | 2 | 0.057 | 7.1 | <0.4 | 7.15 |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_CS1_SED | CMA_CS1_SED | Background | North eastern estuary | 0-0.2 | 7/12/2022 | SD | Normal | 130 | 25 | 7.1 | <0.2 | <0.3 | - | - | 2730 | 2570 | 534 | 890 | 1053.5 | 43 | 7.87 | <2.5 | <1 | <0.2 | 7260 | - | 3.9 | 5.92 | 0.19 | 5.3 | 0.011 | 7.6 | <0.5 | 7.6 |
| CMA_SED_DUP19 | CMA_CS1_SED | Background | North eastern estuary | 0-0.2 | 7/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 7110 | - | 3.9 | - | 0.18 | 5.1 | 0.0053 | 7.7 | - | - |
| CMA_CS2_SED | CMA_CS2_SED | Background | North near bridge | 0-0.1 | 2/12/2022 | SD | Normal | 120 | 23 | 7.6 | <0.2 | <0.3 | <0.006 | <0.006 | 2540 | 1510 | 390 | 4400 | 7434.5 | 362.9 | <5 | <2.4 | <1 | <0.2 | 2690 | - | 2.5 | 3.15 | 0.091 | 4.8 | 0.0089 | 3.9 | <0.5 | 3.95 |
| CMA_SED_DUP17 | CMA_CS2_SED | Background | North near bridge | 0-0.1 | 2/12/2022 | SD | Field_D | 140 | 25 | - | <0.2 | <0.3 | - | - | - | - | - | - | 4453 | - | 6.79 | <2.5 | <1 | - | 2720 | - | 2.4 | 3.15 | 0.09 | 3.7 | 0.012 | 4 | <0.5 | 4.02 |
| CMA_CS3_SED | CMA_CS3_SED | Background | North west near island | 0-0.1 | 2/12/2022 | SD | Normal | 4100 | 25 | 7.4 | <0.2 | <0.3 | <0.006 | <0.006 | 7080 | 2760 | 626 | 4500 | 7371.2 | 387.5 | 16 | <2.5 | <1 | <0.2 | 4750 | - | 4.5 | 6.66 | 0.15 | 5 | 0.011 | 9.9 | <0.5 | 9.91 |
| CMA_SED_DUP18 | CMA_CS3_SED | Background | North west near island | 0-0.1 | 2/12/2022 | SD | Field_D | 140 | 25 | - | <0.2 | <0.3 | - | - | - | - | - | - | 6337 | - | 11.1 | <2.6 | <1 | - | 5150 | - | 4.9 | 6.23 | 0.16 | 4.9 | 0.012 | 11 | <0.5 | 11.1 |
| CMA_CS4_SED | CMA_CS4_SED | Background | Estuary mouth | 0-0.1 | 2/12/2022 | SD | Normal | 200 | 21 | 7.5 | <0.2 | <0.2 | <0.006 | <0.006 | 12,500 | 2810 | 520 | 2700 | 4255.9 | 206.3 | <5 | <2.5 | <1 | <0.2 | 5190 | - | 6 | 5.76 | 0.15 | 3.2 | 0.028 | 8.7 | <0.5 | 8.69 |
| CMA_SED_DUP16 | CMA_CS4_SED | Background | Estuary mouth | 0-0.1 | 2/12/2022 | SD | Field_D | 150 | 21 | - | <0.2 | <0.3 | - | - | - | - | - | - | 4588.1 | - | 5.9 | <2.5 | <1 | - | 5470 | - | 6.2 | 5.4 | 0.16 | 4.2 | 0.032 | 9.4 | <0.5 | 9.45 |
| EHS_BCK_SED1 | EHS_BCKSED1 | Background | Southern beach far east - intertidal | 0.1-0.2 | 6/12/2022 | SD | Normal | 240 | 32 | 5.4 | <0.2 | 0.58 | - | - | 5380 | 2270 | 1000 | 300 | 141.7 | 14.4 | 8.81 | <2.5 | <1 | 3.3 | 10,100 | - | 0.91 | 12.8 | 0.18 | 1.4 | 0.014 | 16.4 | <0.6 | 16.4 |
| EHS_BCK_SED1 | EHS_BCKSED1 | Background | Southern beach far east - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | 190 | 57 | 5.3 | <0.2 | 2.43 | <0.006 | <0.006 | 3930 | 829 | 582 | 280 | 91 | 21.5 | 14.3 | <2.7 | <1 | 8.7 | 5600 | - | 0.86 | 6.29 | 0.12 | 2.1 | 0.017 | 9.6 | <1 | 9.57 |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0.1-0.5 | 6/12/2022 | SD | Normal | 180 | 22 | 6.1 | <0.2 | <0.3 | - | - | 3650 | 2130 | 566 | 2300 | 5077 | 261.6 | <5 | <2.4 | <1 | <0.2 | 4780 | - | 1.6 | 6.38 | 0.13 | 3.2 | 0.029 | 7.2 | <0.5 | 7.24 |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0.5-0.8 | 6/12/2022 | SD | Normal | 180 | 21 | 5.4 | <0.2 | <0.2 | - | - | 3360 | 1980 | 523 | 2600 | 4213 | 229.6 | <5 | <2.7 | <1 | <0.2 | 4200 | - | 3.2 | 6.08 | 0.11 | 2 | 0.07 | 6.5 | <0.5 | 6.47 |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0-0.1 | 6/12/2022 | SD | Normal | 160 | 18 | 6.1 | <0.2 | <0.2 | <0.006 | <0.006 | 3970 | 2470 | 699 | 2800 | 4592.2 | 246.6 | 6.02 | <2.5 | <1 | 0.3 | 5580 | - | 2.8 | 8.3 | 0.15 | 7.4 | 0.018 | 8.8 | <0.5 | 8.76 |
| EHS_BCK_SED3 | EHS_BCKSED3 | Background | Southern beach east - intertidal | 0.1-0.5 | 6/12/2022 | SD | Normal | 140 | 8 | 8.3 | <0.2 | <0.2 | - | - | 123,000 | 1370 | 170 | 2800 | 1890.1 | 103 | <5 | <2.5 | <1 | <0.2 | 2000 | - | 9.2 | 4 | 0.059 | 1.4 | 0.0081 | 2 | <0.5 | 1.99 |
| EHS_BCK_SED3 | EHS_BCKSED3 | Background | Southern beach east - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | 67 | 7 | 7.3 | <0.2 | <0.2 | <0.006 | <0.006 | 60,400 | 1430 | 200 | 1400 | 1927.3 | 106.3 | <5 | 4.73 | <1 | 0.82 | 2820 | - | 7 | 3.71 | 0.085 | 1.5 | 0.014 | 3.8 | <0.4 | 3.81 |

# Appendix B - Table B4
## Landfill and reference sediment analytical results - Human health assessment criteria

| | | | | | | | | Metals | | | | | | | | | | | | | TPH | | | | PAHs - standard 16 | | | | | | | | | | | | | | | | | | PAHs - extended |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Cobalt | Copper | Iron | Lead | Lithium | Manganese | Mercury | Molybdenum | Nickel | Titanium | Tin | Vanadium | Zinc | C7-C9 | C10-C14 | C15-C36 | C7-C36 (Total) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Ca | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Cal | 2-methylnaphthalene |
| | | | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | | | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.125 | 0.025 | 0.125 | 0.05 | 0.075 | 0.25 | 0.125 | 0.05 | 10 | 15 | 25 | 50 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | 300 | 17000 | | 600 | | 19000 | 80 | | 1200 | | | | 30000 | | | | | | | | | | | | | | | | | | | | | 3 | 3 | |
| New Zealand Legislation for Priority Contaminants | | | | | | | | | 10,000 | | 880 | | | 1800 | | | | | | | | | | | | | | | | | | | | | | | | 7.2 | | 160 | 40 | 40 | |
| US EPA Regional Screening Levels | | | | | | | | | | 55,000 | | 160 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Soil Quality Guidelines for the Protection of Environmental and Human Health | | | | | | | | | | | | | | | | | | | 130 | | | | | | | | | | | | | | | | | | | | | | | | |
| New Zealand 1997 Gasworks Guidelines | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field ID** | **Location Code** | **Area** | **Location Details** | **Sample Depth (m)** | **Sampled Date** | **Matrix** | **Sample Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_SED13 | CMA_SED13 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 1.3 | 1.6 | 4970 | 1.5 | 5.45 | 55.1 | <0.025 | <0.13 | 2.3 | 303 | <0.25 | 17.5 | 12.1 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED14 | CMA_SED14 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 1.2 | 1.6 | 4450 | 1.5 | 5.01 | 51.7 | <0.025 | <0.13 | 2.1 | 305 | <0.25 | 15.2 | 14.3 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED15 | CMA_SED15 | Landfill coast | North - intertidal | 0.1-0.5 | 30/11/2022 | SD | Normal | 1.9 | 2.1 | 5280 | 0.95 | 9.27 | 64.7 | <0.025 | 0.21 | 3.3 | 350 | <0.25 | 14.3 | 9.12 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED15 | CMA_SED15 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 1.6 | 2.2 | 5230 | 1.2 | 7.29 | 60.9 | <0.025 | <0.13 | 3 | 326 | <0.25 | 17.6 | 10.3 | - | - | - | - | 0.035 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | 0.012 | <0.01 | 0.04 | 0.011 | <0.01 | <0.01 | 0.04 | 0.029 | <0.01 | 0.03 | <0.01 |
| CMA_SED16 | CMA_SED16 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 2.58 | 3.2 | 6890 | 1.6 | 9.63 | 92.1 | <0.025 | 0.51 | 4.6 | 505 | <0.25 | 20.5 | 16.4 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | 0.013 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0.1-0.5 | 30/11/2022 | SD | Normal | 1.5 | 1.6 | 4560 | 1.2 | 5.34 | 60.2 | <0.025 | <0.13 | 2.6 | 325 | <0.25 | 12.8 | 11.4 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | 0.013 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0.5-0.8 | 30/11/2022 | SD | Normal | 5.21 | 10.2 | 17,700 | 3.8 | 21.5 | 183 | 0.033 | 3.5 | 13 | 1030 | 0.62 | 45.4 | 32.8 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 1.5 | 1.7 | 4370 | 1.3 | 5.68 | 56.6 | <0.025 | 0.46 | 2.7 | 330 | <0.25 | 12 | 8.8 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP2 | CMA_SED17 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Field_D | 1.7 | 1.6 | - | 1.4 | - | - | <0.025 | - | 2.9 | - | - | 13.8 | 9.35 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED18 | CMA_SED18 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 1.9 | 2.3 | 5740 | 1.7 | 6.77 | 74.6 | <0.025 | 0.17 | 3.4 | 378 | <0.25 | 16.7 | 13.5 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED19 | CMA_SED19 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 1.7 | 1.7 | 5380 | 1.8 | 5.07 | 65.7 | <0.025 | <0.13 | 2.7 | 305 | <0.25 | 14.6 | 10 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED20 | CMA_SED20 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 2.1 | 2.5 | 6870 | 2 | 6.05 | 86.7 | <0.025 | <0.13 | 3.4 | 332 | <0.25 | 17.7 | 12.2 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | 0.015 | <0.01 | 0.053 | <0.01 | <0.01 | <0.01 | 0.02 | 0.054 | <0.01 | 0.03 | <0.01 |
| CMA_SED21 | CMA_SED21 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 1.8 | 2.2 | 5960 | 1.2 | 4.17 | 92.4 | <0.025 | <0.13 | 2.7 | 249 | <0.25 | 17.8 | 7.05 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED22 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 2.1 | 2.1 | 6620 | 1.5 | 4.85 | 103 | <0.025 | <0.13 | 3.3 | 338 | <0.25 | 21.3 | 9.07 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP3 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Interlab_D | 1.6 | <2 | - | 1.2 | - | - | <0.1 | - | 2 | - | - | <100 | 7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP3 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | 1.6 | 1.5 | - | 1.3 | - | - | <0.025 | - | 2.5 | - | - | 15.3 | 7.09 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED31 | CMA_SED31 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 1.5 | 1.5 | 5570 | 1.3 | 3.7 | 85 | <0.025 | <0.13 | 2.5 | 181 | <0.25 | 14.2 | 7.4 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED32 | CMA_SED32 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | 0.66 | 0.66 | 2550 | 0.5 | 1.6 | 41.7 | <0.025 | <0.13 | 0.89 | 74.3 | <0.25 | 6.3 | 3.1 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED32 | CMA_SED32 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 0.8 | 0.89 | 3090 | 0.69 | 2.1 | 50.3 | <0.025 | <0.13 | 1.3 | 106 | <0.25 | 8 | 4.1 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED33 | CMA_SED33 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 1.1 | 2 | 4430 | 1 | 3.35 | 69 | <0.025 | <0.13 | 1.8 | 130 | <0.25 | 11 | 6.11 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED34 | CMA_SED34 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | 0.41 | 0.44 | 1670 | 0.36 | 1.2 | 27.3 | <0.025 | <0.13 | 0.66 | 55.1 | <0.25 | 4.2 | 2.2 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED34 | CMA_SED34 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 1 | 1.5 | 4080 | 0.7 | 2.4 | 64.7 | <0.025 | <0.13 | 1.4 | 94.6 | <0.25 | 10 | 4.6 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED35 | CMA_SED35 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 1.3 | 1.3 | 4600 | 0.95 | 3.27 | 72.7 | <0.025 | <0.13 | 1.9 | 152 | <0.25 | 12 | 6.58 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED36 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | 1.4 | 1.5 | 5460 | 1.2 | 3.81 | 85.6 | <0.025 | <0.13 | 2.1 | 160 | <0.25 | 13.5 | 7.49 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED36 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 0.58 | 0.69 | 2130 | 0.44 | 1.5 | 34.3 | <0.025 | <0.13 | 0.89 | 73.3 | <0.25 | 5.1 | 2.9 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_dup4 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | 1.5 | 1.9 | - | 1.2 | - | - | <0.025 | - | 2.4 | - | - | 14.9 | 7.52 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 5/12/2022 | SD | Normal | 2.1 | 2.1 | 6840 | 1.6 | 4.83 | 114 | <0.025 | 0.13 | 3.1 | 332 | <0.25 | 23.2 | 8.98 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Normal | 1.8 | 1.9 | 5870 | 1.4 | 5.21 | 95.3 | <0.025 | <0.13 | 2.7 | 307 | <0.25 | 18.8 | 7.89 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 2.1 | 2 | 7030 | 1.6 | 5.02 | 111 | <0.025 | <0.13 | 3.2 | 341 | <0.25 | 23 | 9.99 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP5 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 12/12/2022 | SD | Interlab_D | 1.5 | <2 | - | 1.4 | - | - | <0.1 | - | 2 | - | - | <100 | 8 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP5 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | 1.9 | 2 | - | 1.6 | - | - | <0.025 | - | 2.8 | - | - | 20.7 | 8.57 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 5/12/2022 | SD | Normal | 1.7 | 1.7 | 5580 | 1.3 | 4.13 | 90.2 | <0.025 | <0.13 | 2.6 | 273 | <0.25 | 18.3 | 6.94 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Normal | 1.8 | 2 | 5680 | 4.3 | 4.06 | 99.9 | <0.025 | <0.13 | 2.5 | 286 | 2 | 18.8 | 7.24 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP6 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Interlab_D | 1.9 | <2 | - | 1.9 | - | - | <0.1 | - | 3 | - | - | <100 | 10 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP6 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Field_D | 2.5 | 2.3 | - | 1.7 | - | - | <0.025 | - | 4 | - | - | 23.3 | 10.9 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 2.3 | 2.2 | 7550 | 1.8 | 5.28 | 124 | <0.025 | 0.13 | 3.6 | 388 | <0.25 | 25 | 10.6 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED39 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 1.9 | 1.8 | 6100 | 1.4 | 4.45 | 98 | <0.025 | <0.13 | 2.8 | 286 | <0.25 | 20.1 | 7.9 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP7 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Interlab_D | 1.4 | <2 | - | 1.4 | - | - | <0.1 | - | 2 | - | - | <100 | 8 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP7 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | 1.8 | 1.8 | - | 1.4 | - | - | <0.025 | - | 2.7 | - | - | 17 | 8.02 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED40 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 30/11/2022 | SD | Normal | 2.1 | 2.4 | 6310 | 4.3 | 6.54 | 81.6 | <0.025 | 0.16 | 3.8 | 361 | <0.25 | 19.5 | 11.4 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED40 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 5/12/2022 | SD | Normal | 2.1 | 1.9 | 6820 | 1.6 | 5.15 | 111 | <0.025 | 0.14 | 3 | 361 | <0.25 | 24.2 | 8.78 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP8 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 5/12/2022 | SD | Field_D | 1.8 | 1.7 | - | 1.4 | - | - | <0.025 | - | 2.7 | - | - | 17.1 | 7.7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED41 | CMA_SED41 | Landfill coast | West - 50 m | 0-0.1 | 30/11/2022 | SD | Normal | 2.2 | 2.2 | 6550 | 1.4 | 7.32 | 88.1 | <0.025 | 0.14 | 3.7 | 446 | <0.25 | 18.9 | 12.8 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED42 | CMA_SED42 | Landfill coast | West - 150 m | 0-0.1 | 1/12/2022 | SD | Normal | 2.2 | 2.3 | 5690 | 1.3 | 7.71 | 86.1 | <0.025 | 0.19 | 4 | 440 | <0.25 | 19.3 | 11.5 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED43 | CMA_SED43 | Landfill coast | West - 0 m | 0-0.1 | 30/11/2022 | SD | Normal | 1.4 | 1.6 | 4340 | 1.2 | 5.27 | 55.6 | <0.025 | 0.46 | 2.6 | 295 | <0.25 | 12.7 | 9.94 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED44 | CMA_SED44 | Landfill coast | West - 50 m | 0-0.1 | 30/11/2022 | SD | Normal | 2 | 2 | 5570 | 1.2 | 6.99 | 77.5 | <0.025 | 0.43 | 3.5 | 382 | <0.25 | 17.3 | 11.1 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED45 | CMA_SED45 | Landfill coast | West - 150 m | 0-0.1 | 1/12/2022 | SD | Normal | 2 | 2.1 | 5130 | 1.6 | 7.35 | 81 | <0.025 | <0.13 | 3.9 | 438 | <0.25 | 18.9 | 13.3 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED46 | CMA_SED46 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 1.6 | 1.9 | 5660 | 1.1 | 3.96 | 90.2 | <0.025 | <0.13 | 2.5 | 191 | <0.25 | 14.6 | 7.42 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_dup9 | CMA_SED46 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | 1.6 | 1.7 | 5470 | 1.2 | 4.22 | 85.2 | <0.025 | <0.13 | 2.5 | 181 | <0.25 | 14.5 | 7.28 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED47 | CMA_SED47 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | 0.6 | 0.75 | 2330 | 0.6 | 1.6 | 36.7 | <0.025 | <0.13 | 0.83 | 82.5 | <0.25 | 5.8 | 3.5 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_dup10 | CMA_SED47 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | 1.1 | 1.3 | 4240 | 0.87 | 2.99 | 68 | <0.025 | <0.13 | 1.7 | 120 | <0.25 | 11 | 5.73 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED48 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | 2 | 2.2 | 5990 | 1.2 | 6.99 | 79.6 | <0.025 | 0.21 | 3.5 | 418 | <0.25 | 17.5 | 11.8 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED48 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | 2.2 | 4.9 | 6970 | 1.8 | 4.65 | 107 | <0.025 | <0.13 | 3.2 | 355 | <0.25 | 24.9 | 8.75 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP11 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | 2.1 | 2.2 | - | 1.7 | - | - | <0.025 | - | 3.1 | - | - | 23.3 | 8.67 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED4 | EHS_BCKSED4 | Landfill coast | South - intertidal | 0.1-0.5 | 6/12/2022 | SD | Normal | 2.97 | 3.3 | 8950 | 2.2 | 8.15 | 142 | <0.025 | 0.17 | 4.6 | 410 | 0.27 | 28.8 | 14.6 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| EHS_BCK_SED4 | EHS_BCKSED4 | Landfill coast | South - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | 3.02 | 4.6 | 8270 | 1.5 | 6.63 | 126 | <0.025 | 0.14 | 4.8 | 371 | 0.47 | 22.4 | 12.4 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_CS1_SED | CMA_CS1_SED | Background | North eastern estuary | 0-0.2 | 7/12/2022 | SD | Normal | 2.69 | 2.3 | 7080 | 1.9 | 29.7 | 95.5 | <0.025 | <0.13 | 6.52 | 350 | <0.25 | 16.6 | 16.7 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP19 | CMA_CS1_SED | Background | North eastern estuary | 0-0.2 | 7/12/2022 | SD | Field_D | 2.5 | 2.2 | - | 1.7 | - | - | <0.025 | - | 6.25 | - | - | 16.9 | 17.3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS2_SED | CMA_CS2_SED | Background | North near bridge | 0-0.1 | 2/12/2022 | SD | Normal | 1.1 | - | 3590 | 1.1 | 5.61 | 52.4 | <0.025 | 0.2 | 2.3 | 263 | <0.25 | 12.9 | 7.17 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP17 | CMA_CS2_SED | Background | North near bridge | 0-0.1 | 2/12/2022 | SD | Field_D | 1.2 | - | 3750 | 1.2 | 5.68 | 54 | <0.025 | 0.22 | 2.3 | 258 | <0.25 | 13 | 7.48 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS3_SED | CMA_CS3_SED | Background | North west near island | 0-0.1 | 2/12/2022 | SD | Normal | 2.2 | - | 7680 | 1.7 | 8.01 | 101 | <0.025 | 0.17 | 4.3 | 577 | <0.25 | 26.1 | 13.9 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP18 | CMA_CS3_SED | Background | North west near island | 0-0.1 | 2/12/2022 | SD | Field_D | 2.4 | - | 7950 | 1.8 | 8.15 | 108 | <0.025 | 0.17 | 4.6 | 578 | <0.25 | 28.1 | 15 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS4_SED | CMA_CS4_SED | Background | Estuary mouth | 0-0.1 | 2/12/2022 | SD | Normal | 2.75 | - | 8730 | 1.8 | 7.24 | 118 | <0.025 | <0.13 | 5.09 | 511 | 0.4 | 28.9 | 14.6 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| CMA_SED_DUP16 | CMA_CS4_SED | Background | Estuary mouth | 0-0.1 | 2/12/2022 | SD | Field_D | 2.92 | - | 9380 | 1.8 | 7.97 | 123 | <0.025 | <0.13 | 5.28 | 483 | <0.25 | 29.4 | 15 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED1 | EHS_BCKSED1 | Background | Southern beach far east - intertidal | 0.1-0.2 | 6/12/2022 | SD | Normal | 1.8 | 2.7 | 5470 | 4.2 | 20.9 | 89.8 | 0.026 | 0.74 | 5.99 | 686 | 1.2 | 24.7 | 13.9 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| EHS_BCK_SED1 | EHS_BCKSED1 | Background | Southern beach far east - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | 0.39 | 3 | 1560 | 3.8 | 3.28 | 27.4 | 0.055 | 1.1 | 3.2 | 92.6 | 1.5 | 11 | 4.8 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0.1-0.5 | 6/12/2022 | SD | Normal | 2 | 2.7 | 5520 | 1.2 | 7.72 | 88.8 | <0.025 | 0.29 | 3.9 | 506 | 0.55 | 20.2 | 10.8 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0.5-0.8 | 6/12/2022 | SD | Normal | 2 | 4.3 | 5460 | 1.2 | 6.34 | 81.8 | <0.025 | 1.3 | 4 | 459 | 1.2 | 18.5 | 10.3 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0-0.1 | 6/12/2022 | SD | Normal | 2.2 | 3 | 6850 | 1.9 | 8.31 | 99.9 | <0.025 | 0.33 | 4.7 | 571 | 0.69 | 24.3 | 14.6 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | 0.021 | 0.041 | <0.01 | 0.022 | 0.019 | <0.01 | <0.02 | <0.01 | 0.02 | <0.01 | <0.01 | <0.02 | 0.03 | 0.04 | <0.01 |
| EHS_BCK_SED3 | EHS_BCKSED3 | Background | Southern beach east - intertidal | 0.1-0.5 | 6/12/2022 | SD | Normal | 1.1 | 1.2 | 4010 | 0.87 | 2.99 | 64.1 | <0.025 | <0.13 | 1.8 | 183 | 0.36 | 10 | 4.7 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |
| EHS_BCK_SED3 | EHS_BCKSED3 | Background | Southern beach east - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | 1.4 | 1.5 | 4410 | 1 | 3.27 | 76.9 | <0.025 | <0.13 | 2.3 | 243 | 0.37 | 13.3 | 6.51 | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 |

## Appendix B - Table B4
## Landfill and reference sediment analytical results - Human health assessment criteria

| | | | | | | | | Phenols | | Phenols - Halogenated | | | | | | Phenols - Non-Halogenated | | | | | SVOCs | PCBs | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 2,3,5,6-Tetrachlorophenol | 2-Phenylphenol | 2-Chlorophenol | 2,4-Dichlorophenol | 2,4,5-Trichlorophenol | 2,4,6-Trichlorophenol | 2,6-Dichlorophenol | 4-Chloro-3-methylphenol | Phenol | 2-Nitrophenol | 2-Methylphenol (o-Cresol) | 2,4-Dimethylphenol | 4-Methylphenol (p-Cresol) | 1-Methylnaphthalene | 2,3,7,8-TCDD TEQ | PCB-121 | PCB-128 | PCB-141 | PCB-149 | PCB-151 | PCB-159 | PCB-170 | PCB-18 | PCB-187 2,2',3,4',5,5',6-Heptachlorobiphenyl | PCB-194 | PCB-195 2,2',3,3',4,4',5,6-Octachlorobiphenyl | PCB-206 | PCB-3 4-Chlorobiphenyl | PCB-31 | PCB-4 2,2'-Dichlorobiphenyl | PCB-44 | PCB-49 | PCB-60 | PCB-66 2,3',4,4'-Tetrachlorobiphenyl | PCB-8 2,4'-Dichlorobiphenyl | PCB-86 | Decachlorobiphenyl | PCB-189 | PCB-156 | PCB-157 | PCB-167 | PCB-169 | PCB-101 |
| | | | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | | | 5 | 0.5 | 0.3 | 0.3 | 5 | 5 | 0.3 | 0.3 | 0.3 | 1 | 0.3 | 0.3 | 0.3 | 0.01 | 0.0006 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.006 | 0.003 | 0.003 | 0.003 | 0.003 | 0.006 | 0.003 | 0.006 | 0.003 | 0.003 | 0.003 | 0.003 | 0.006 | 0.005 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | 40000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| New Zealand Legislation for Priority Contaminants | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA Regional Screening Levels | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Soil Quality Guidelines for the Protection of Environmental and Human Health | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| New Zealand 1997 Gasworks Guidelines | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field ID** | **Location Code** | **Area** | **Location Details** | **Sample Depth (m)** | **Sampled Date** | **Matrix** | **Sample Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_SED13 | CMA_SED13 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | <0.0006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| CMA_SED14 | CMA_SED14 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED15 | CMA_SED15 | Landfill coast | North - intertidal | 0.1-0.5 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED15 | CMA_SED15 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED16 | CMA_SED16 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0.1-0.5 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0.5-0.8 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP2 | CMA_SED17 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED18 | CMA_SED18 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED19 | CMA_SED19 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED20 | CMA_SED20 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED21 | CMA_SED21 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | <0.0006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| CMA_SED22 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | <5 | <0.5 | <0.3 | <0.3 | <5 | <5 | <0.3 | <0.3 | <0.3 | <1 | <0.3 | <0.3 | <0.3 | <0.01 | <0.0006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| CMA_SED_DUP3 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP3 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED31 | CMA_SED31 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | <0.0006 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | - | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | - | <0.003 | <0.003 |
| CMA_SED32 | CMA_SED32 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED32 | CMA_SED32 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED33 | CMA_SED33 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED34 | CMA_SED34 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED34 | CMA_SED34 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED35 | CMA_SED35 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED36 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | <0.0006 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | - | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | - | <0.003 | <0.003 |
| CMA_SED36 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | <0.0006 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | - | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | - | <0.003 | <0.003 |
| CMA_SED_dup4 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP5 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 12/12/2022 | SD | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP5 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP6 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP6 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | <0.0006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| CMA_SED39 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP7 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP7 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED40 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED40 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP8 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED41 | CMA_SED41 | Landfill coast | West - 50 m | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED42 | CMA_SED42 | Landfill coast | West - 150 m | 0-0.1 | 1/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED43 | CMA_SED43 | Landfill coast | West - 0 m | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED44 | CMA_SED44 | Landfill coast | West - 50 m | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED45 | CMA_SED45 | Landfill coast | West - 150 m | 0-0.1 | 1/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED46 | CMA_SED46 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_dup9 | CMA_SED46 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED47 | CMA_SED47 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_dup10 | CMA_SED47 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED48 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED48 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP11 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED4 | EHS_BCKSED4 | Landfill coast | South - intertidal | 0.1-0.5 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED4 | EHS_BCKSED4 | Landfill coast | South - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | <5 | <0.5 | <0.3 | <0.3 | <5 | <5 | <0.3 | <0.3 | <0.3 | <1 | <0.3 | <0.3 | <0.3 | <0.01 | <0.0006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_CS1_SED | CMA_CS1_SED | Background | North eastern estuary | 0-0.2 | 7/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP19 | CMA_CS1_SED | Background | North eastern estuary | 0-0.2 | 7/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS2_SED | CMA_CS2_SED | Background | North near bridge | 0-0.1 | 2/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | <0.0006 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | - | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | - | <0.003 | <0.003 |
| CMA_SED_DUP17 | CMA_CS2_SED | Background | North near bridge | 0-0.1 | 2/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS3_SED | CMA_CS3_SED | Background | North west near island | 0-0.1 | 2/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | <0.0006 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | - | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | - | <0.003 | <0.003 |
| CMA_SED_DUP18 | CMA_CS3_SED | Background | North west near island | 0-0.1 | 2/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS4_SED | CMA_CS4_SED | Background | Estuary mouth | 0-0.1 | 2/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | <0.0006 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | - | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | - | <0.003 | <0.003 |
| CMA_SED_DUP16 | CMA_CS4_SED | Background | Estuary mouth | 0-0.1 | 2/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED1 | EHS_BCKSED1 | Background | Southern beach far east - intertidal | 0.1-0.2 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED1 | EHS_BCKSED1 | Background | Southern beach far east - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | <5 | <0.5 | <0.3 | <0.3 | <5 | <5 | <0.3 | <0.3 | <0.3 | <1 | <0.3 | <0.3 | <0.3 | <0.01 | <0.0006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0.1-0.5 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0.5-0.8 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0-0.1 | 6/12/2022 | SD | Normal | <5 | <0.5 | <0.3 | <0.3 | <5 | <5 | <0.3 | <0.3 | <0.3 | <1 | <0.3 | <0.3 | <0.3 | <0.01 | <0.0006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |
| EHS_BCK_SED3 | EHS_BCKSED3 | Background | Southern beach east - intertidal | 0.1-0.5 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED3 | EHS_BCKSED3 | Background | Southern beach east - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | <5 | <0.5 | <0.3 | <0.3 | <5 | <5 | <0.3 | <0.3 | <0.3 | <1 | <0.3 | <0.3 | <0.3 | <0.01 | <0.0006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 |

# Appendix B - Table B4
## Landfill and reference sediment analytical results - Human health assessment criteria

| | | | | | | | | | | | | | | | | | | | | PFAS - Perfluoroalkyl Carboxylic Acids | | | | | | | | | | | PFAS - Perfluoroalkyl Sulfonic Acids | | | | | | | | | | | | | PFAS - Perfluoroalkyl Sulfonamide | | | | | | | PFAS - Fluorotelomer Sulfonic Acids | | | PFAS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | PCB-118 | PCB-138 | PCB-153 | PCB-180 | PCB-28 | PCB-52 | PCB-105 | PCB-114 | PCB-123 | PCB-126 | PCB-77 | PCB-81 | Perfluorobutanoic acid (PFBA) | Perfluoropentanoic acid (PFPeA) | Perfluorohexanoic acid (PFHxA) | Perfluoroheptanoic acid (PFHpA) | Perfluorooctanoic acid (PFOA) | Perfluorononanoic acid (PFNA) | Perfluorodecanoic acid (PFDA) | Perfluoroundecanoic acid (PFUnDA) | Perfluorododecanoic acid (PFDoDA) | Perfluorotridecanoic acid (PFTrDA) | Perfluorotetradecanoic acid (PFTeDA) | PFHxS (di-branched) | PFHxS (mono-branched) | PFHxS (Total) | PFOS (di-branched) | PFOS (mono-branched) | PFOS (Total) | Perfluoropropanesulfonic acid (PFPrS) | Perfluorobutane sulfonic acid (PFBS) | Perfluoropentane sulfonic acid (PFPeS) | Perfluorohexane sulfonic acid (PFHxS) | Perfluoroheptane sulfonic acid (PFHpS) | Perfluorooctane sulfonic acid (PFOS) | Perfluorodecanesulfonic acid (PFDS) | Perfluorooctane sulfonamide (FOSA) | N-Methyl perfluorooctane sulfonamide (MeFO | N-Ethyl perfluorooctane sulfonamide (EtFOSA | N-Methyl perfluorooctane sulfonamidoacetic a | N-Methyl perfluorooctane sulfonamidoethanol | N-Ethyl perfluorooctane sulfonamidoethanol ( | N-Ethyl perfluorooctane sulfonamidoacetic ac | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 6:2 Fluorotelomer Sulfonate (6:2 FTS) | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | Hexafluoropropylene oxide dimer acid (HFPO- | PFNS (68259-12-1) |
| | | | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | | | 0.003 | 0.005 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.001 | 0.001 | 0.001 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| New Zealand Legislation for Priority Contaminants | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA Regional Screening Levels | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Soil Quality Guidelines for the Protection of Environmental and Human Health | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| New Zealand 1997 Gasworks Guidelines | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field ID | Location Code | Area | Location Details | Sample Depth (m) | Sampled Date | Matrix | Sample Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_SED13 | CMA_SED13 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.016 | 0.0015 | <0.001 | <0.001 |
| CMA_SED14 | CMA_SED14 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED15 | CMA_SED15 | Landfill coast | North - intertidal | 0.1-0.5 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED15 | CMA_SED15 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED16 | CMA_SED16 | Landfill coast | North - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0.1-0.5 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0.5-0.8 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED17 | CMA_SED17 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP2 | CMA_SED17 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED18 | CMA_SED18 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED19 | CMA_SED19 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED20 | CMA_SED20 | Landfill coast | West - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED21 | CMA_SED21 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| CMA_SED22 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| CMA_SED_DUP3 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP3 | CMA_SED22 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| CMA_SED31 | CMA_SED31 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED32 | CMA_SED32 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED32 | CMA_SED32 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED33 | CMA_SED33 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED34 | CMA_SED34 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED34 | CMA_SED34 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED35 | CMA_SED35 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED36 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 29/11/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED36 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_dup4 | CMA_SED36 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED37 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP5 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 12/12/2022 | SD | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP5 | CMA_SED37 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.1-0.5 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP6 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP6 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0.5-0.8 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED38 | CMA_SED38 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| CMA_SED39 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP7 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP7 | CMA_SED39 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED40 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED40 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP8 | CMA_SED40 | Landfill coast | West - 0 m | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED41 | CMA_SED41 | Landfill coast | West - 50 m | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED42 | CMA_SED42 | Landfill coast | West - 150 m | 0-0.1 | 1/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED43 | CMA_SED43 | Landfill coast | West - 0 m | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED44 | CMA_SED44 | Landfill coast | West - 50 m | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED45 | CMA_SED45 | Landfill coast | West - 150 m | 0-0.1 | 1/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED46 | CMA_SED46 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_dup9 | CMA_SED46 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED47 | CMA_SED47 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_dup10 | CMA_SED47 | Landfill coast | Southern beach - intertidal | 0-0.1 | 29/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED48 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED48 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_SED_DUP11 | CMA_SED48 | Landfill coast | Southern beach - intertidal | 0-0.1 | 5/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED4 | EHS_BCKSED4 | Landfill coast | South - intertidal | 0.1-0.5 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED4 | EHS_BCKSED4 | Landfill coast | South - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_CS1_SED | CMA_CS1_SED | Background | North eastern estuary | 0-0.2 | 7/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| CMA_SED_DUP19 | CMA_CS1_SED | Background | North eastern estuary | 0-0.2 | 7/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS2_SED | CMA_CS2_SED | Background | North near bridge | 0-0.1 | 2/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| CMA_SED_DUP17 | CMA_CS2_SED | Background | North near bridge | 0-0.1 | 2/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS3_SED | CMA_CS3_SED | Background | North west near island | 0-0.1 | 2/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.0056 | <0.001 | <0.001 | <0.001 |
| CMA_SED_DUP18 | CMA_CS3_SED | Background | North west near island | 0-0.1 | 2/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS4_SED | CMA_CS4_SED | Background | Estuary mouth | 0-0.1 | 2/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | - | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| CMA_SED_DUP16 | CMA_CS4_SED | Background | Estuary mouth | 0-0.1 | 2/12/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED1 | EHS_BCKSED1 | Background | Southern beach far east - intertidal | 0.1-0.2 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED1 | EHS_BCKSED1 | Background | Southern beach far east - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0.1-0.5 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0.5-0.8 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED2 | EHS_BCKSED2 | Background | North eastern estuary | 0-0.1 | 6/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |
| EHS_BCK_SED3 | EHS_BCKSED3 | Background | Southern beach east - intertidal | 0.1-0.5 | 6/12/2022 | SD | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_SED3 | EHS_BCKSED3 | Background | Southern beach east - intertidal | 0-0.1 | 6/12/2022 | SD | Normal | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.001 |

# Appendix B - Table B2
## Landfill coast and reference ocean water analytical results - human health assessment criteria

| | | | | | | | Minor ions | Inorganics | | | | | | | | Acidity & Alkalinity | Major Ions | | | | | | | | | | | | Nutrients | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Fluoride | EC/10* (EC/10) | pH (Lab) | Electrical conductivity (lab) | COD | Cyanide (Free) | Cyanide (Total) | Cyanide (Total) (Filtered) | Cyanide (WAD) | Alkalinity (total as CaCO3) | Calcium | Calcium (Filtered) | Magnesium | Magnesium (Filtered) | Potassium | Potassium (Filtered) | Sodium | Sodium (Filtered) | Chloride (Filtered) | Sulfate (Filtered) | Cations Total | Anions Total | Ammonia as N (Filtered) | Nitrate (as NO3-) (Filtered) | Nitrite (as NO2-) (Filtered) | Reactive Phosphorus as P (Filtered) |
| | | | | | | | mg/L | (mS/m)/10 | pH Units | µS/cm | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | meq/L | meq/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | | | | 0.04 | 0.002 | 1 | 0.2 | 10 | 0.001 | 0.001 | 0.005 | 0.001 | 1 | 0.05 | 0.05 | 0.01 | 0.01 | 0.05 | 0.05 | 0.01 | 0.01 | 0.5 | 0.15 | 0.01 | 0.01 | 0.005 | 0.002 | 0.001 | 0.002 |
| ADWG 2011 multiplied by a factor of 20 for recreational use | | | | | | | 30 | | | | | | 1.6 | 1.6 | | | | | | | | | | | | | | | | 500 | 30 | |
| MOH (2018) multiplied by a factor 20 for recreatonal use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2022) multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAS NEMP 2.0 (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field ID** | **Location Code** | **Area** | **Location Details** | **Sampled Date** | **Matrix** | **Sample Type** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_OC 13 | CMA_OC13 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | 0.77 | 526.9 | 7.7 | 52,690 | 269 | <0.001 | <0.001 | - | <0.001 | 115 | - | 412 | - | 1230 | - | 391 | - | 11,200 | 18,027 | 2460 | 619 | 561.91 | <0.005 | 0.0099 | <0.001 | 0.006 |
| CMA_OC 14 | CMA_OC14 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | 0.77 | 528.5 | 7.8 | 52,850 | 281 | <0.001 | <0.001 | - | <0.001 | 113 | - | 452 | - | 1290 | - | 404 | - | 11,800 | 18,091 | 2470 | 652.36 | 563.77 | <0.005 | <0.002 | <0.001 | 0.006 |
| CMA_OC 15 | CMA_OC15 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | 0.8 | 524.9 | 7.6 | 52,490 | 262 | <0.001 | <0.001 | - | <0.001 | 111 | - | 416 | - | 1210 | - | 390 | - | 11,300 | 18,525 | 2540 | 621.88 | 577.53 | <0.005 | <0.002 | <0.001 | 0.009 |
| CMA_OC 16 | CMA_OC16 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | 0.81 | 530.1 | 7.7 | 53,010 | 244 | <0.001 | <0.001 | - | <0.001 | 116 | - | 431 | - | 1220 | - | 390 | - | 11,100 | 19,419 | 2660 | 614.75 | 605.28 | <0.005 | 0.002 | <0.001 | 0.006 |
| CMA_OC 17 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | 1.1 | 530.3 | 7.2 | 53,030 | 237 | <0.001 | <0.001 | - | <0.001 | 113 | - | 447 | - | 1270 | - | 396 | - | 11,600 | 18,298 | 2500 | 641.56 | 570.26 | <0.005 | 0.002 | <0.001 | 0.009 |
| CMA_OC DUP2 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 18 | CMA_OC18 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | 0.93 | 518 | 7.6 | 51,800 | 231 | <0.001 | <0.001 | - | <0.001 | 121 | - | 397 | - | 1120 | - | 363 | - | 10,500 | 18,587 | 2540 | 578.03 | 580.42 | 0.03 | 13.7 | <0.001 | 0.007 |
| CMA_OC 19 | CMA_OC19 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | 0.84 | 521.4 | 7.8 | 52,140 | 290 | <0.001 | <0.001 | - | <0.001 | 119 | - | 429 | - | 1220 | - | 391 | - | 11,200 | 17,694 | 2410 | 619.02 | 551.45 | <0.005 | 0.0164 | <0.001 | 0.005 |
| CMA_OC 20 | CMA_OC20 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | 0.83 | 521.7 | 7.8 | 52,170 | 298 | <0.001 | <0.001 | - | <0.001 | 119 | - | 389 | - | 1150 | - | 368 | - | 10,500 | 18,409 | 2510 | 580.23 | 573.81 | <0.005 | 0.0033 | <0.001 | 0.006 |
| CMA_OC21D | CMA_OC21D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.9 | 532.6 | 7.7 | 53,260 | 246 | - | <0.001 | <0.01 | <0.001 | 114 | - | 439 | - | 1330 | - | 417 | - | 11,300 | 19,532 | 2650 | 633.59 | 608.2 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC21S | CMA_OC21S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.9 | 530.9 | 8.1 | 53,090 | 172 | - | <0.001 | <0.01 | <0.001 | 132 | - | 441 | - | 1370 | - | 412 | - | 11,500 | 19,044 | 2590 | 645.55 | 593.64 | <0.005 | <0.002 | <0.001 | 0.003 |
| CMA_OC_22 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Normal | 0.88 | 524.4 | 7.6 | 52,440 | 191 | <0.001 | <0.001 | - | <0.001 | 117 | - | 415 | - | 1290 | - | 389 | - | 10,600 | 19,066 | 2590 | 597.93 | 593.94 | <0.005 | <0.002 | <0.001 | 0.005 |
| CMA_OC_DUP3 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Field_D | 0.88 | 526.4 | 7.7 | 52,640 | 213 | <0.001 | <0.001 | - | <0.001 | 116 | - | 413 | - | 1260 | - | 385 | - | 10,400 | 18,378 | 2500 | 586.56 | 572.56 | 0.01 | 0.18 | <0.001 | 0.004 |
| CMA_OC31 | CMA_OC31 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | 0.93 | 531.8 | 8.1 | 53,180 | 88 | - | <0.001 | <0.01 | <0.001 | 119 | - | 454 | - | 1330 | - | 420 | - | 11,300 | 19,517 | 2670 | 634.42 | 608.35 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC32 Deep | CMA_OC32D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | 0.94 | 531.3 | 8.1 | 53,130 | 213 | - | <0.001 | <0.01 | <0.001 | 119 | - | 449 | - | 1340 | - | 427 | - | 11,500 | 19,297 | 2640 | 643.87 | 601.46 | <0.005 | 0.0048 | <0.001 | 0.005 |
| CMA_OC32 Shallow | CMA_OC32S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | 0.93 | 531 | 8.1 | 53,100 | 229 | - | <0.001 | <0.01 | <0.001 | 117 | - | 436 | - | 1280 | - | 409 | - | 11,000 | 19,145 | 2620 | 616.07 | 596.66 | <0.005 | 0.0023 | <0.001 | 0.004 |
| CMA_OC33 | CMA_OC33 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | 0.93 | 524.2 | 8.1 | 52,420 | 227 | - | <0.001 | <0.01 | <0.001 | 119 | - | 452 | - | 1400 | - | 429 | - | 11,900 | 19,643 | 2690 | 666.41 | 612.21 | <0.005 | 0.007 | <0.001 | 0.004 |
| CMA_OC34 Deep | CMA_OC34D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | 0.92 | 529.7 | 8.1 | 52,970 | 209 | - | <0.001 | <0.01 | <0.001 | 119 | - | 455 | - | 1340 | - | 420 | - | 11,400 | 19,076 | 2610 | 639.64 | 594.65 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC34 Shallow | CMA_OC34S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | 0.88 | 532 | 8.1 | 53,200 | 221 | - | <0.001 | <0.01 | <0.001 | 118 | - | 443 | - | 1310 | - | 424 | - | 11,100 | 19,593 | 2680 | 623.62 | 610.67 | <0.005 | <0.002 | <0.001 | 0.003 |
| CMA_OC35 | CMA_OC35 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.87 | 532.8 | 8.1 | 53,280 | 259 | - | <0.001 | <0.01 | <0.001 | 117 | - | 445 | - | 1330 | - | 411 | - | 11,200 | 19,174 | 2610 | 629.39 | 597.4 | <0.005 | <0.002 | <0.001 | 0.003 |
| CMA_OC36D | CMA_OC36D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.89 | 535.2 | 8.1 | 53,520 | 238 | - | <0.001 | <0.01 | <0.001 | 119 | - | 438 | - | 1380 | - | 414 | - | 11,600 | 19,177 | 2610 | 650.63 | 597.53 | 0.008 | <0.002 | <0.001 | <0.002 |
| CMA_OC36S | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.89 | 528.6 | 7.8 | 52,860 | 230 | - | <0.001 | <0.01 | <0.001 | 115 | - | 455 | - | 1350 | - | 424 | - | 11,400 | 19,254 | 2620 | 640.56 | 599.84 | <0.005 | 0.0812 | <0.001 | 0.002 |
| CMA_OC DUP 4 | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | 0.87 | - | - | - | 246 | - | <0.001 | <0.01 | <0.001 | - | - | - | - | - | - | - | - | - | 19,424 | 2660 | - | - | <0.005 | 0.0048 | <0.001 | - |
| CMA_OC37D | CMA_OC37D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.89 | 529 | 8.1 | 52,900 | 194 | - | <0.001 | <0.01 | <0.001 | 118 | - | 435 | - | 1380 | - | 410 | - | 11,700 | 19,783 | 2700 | 654.73 | 616.39 | <0.005 | 0.149 | <0.001 | 0.003 |
| CMA_OC37S | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.88 | 532.5 | 8.2 | 53,250 | 230 | - | <0.001 | <0.01 | <0.001 | 118 | - | 443 | - | 1340 | - | 413 | - | 11,400 | 18,764 | 2540 | 638.86 | 584.4 | <0.005 | 0.0052 | <0.001 | 0.003 |
| CMA_OC DUP 5 | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | 0.89 | - | - | - | 132 | - | <0.001 | <0.01 | <0.001 | - | - | - | - | - | - | - | - | - | 19,104 | 2600 | - | - | <0.005 | <0.002 | <0.001 | - |
| CMA_OC38 | CMA_OC38 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.87 | 530.4 | 8.1 | 53,040 | 277 | - | <0.001 | <0.01 | <0.001 | 117 | - | 447 | - | 1340 | - | 425 | - | 11,500 | 19,532 | 2660 | 643.72 | 608.55 | <0.005 | <0.002 | <0.001 | 0.003 |
| CMA_OC39 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.89 | 529.7 | 8.1 | 52,970 | 258 | - | <0.001 | <0.01 | <0.001 | 118 | - | 443 | - | 1320 | - | 426 | - | 11,200 | 19,037 | 2580 | 628.85 | 592.89 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC DUP 7 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | 0.9 | 530 | 7.8 | 53,000 | 168 | - | <0.001 | <0.01 | <0.001 | 114 | - | 442 | - | 1310 | - | 424 | - | 11,100 | 19,364 | 2640 | 623.57 | 603.3 | <0.005 | <0.002 | <0.001 | 0.003 |
| CMA_OC_40D | CMA_OC40D | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | 0.87 | 524.6 | 7.8 | 52,460 | 199 | <0.001 | <0.001 | - | <0.001 | 118 | - | 407 | - | 1290 | - | 383 | - | 10,500 | 19,412 | 2640 | 593.03 | 604.76 | <0.005 | 0.0023 | <0.001 | 0.004 |
| CMA_OC_40S | CMA_OC40S | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | 0.88 | 520.8 | 7.6 | 52,080 | 203 | <0.001 | <0.001 | - | <0.001 | 117 | - | 400 | - | 1290 | - | 376 | - | 10,600 | 20,194 | 2760 | 596.85 | 629.21 | <0.005 | 0.0036 | <0.001 | <0.002 |
| CMA_OC 41 | CMA_OC41 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | 0.87 | 520.2 | 7.8 | 52,020 | 254 | <0.001 | <0.001 | - | <0.001 | 117 | - | 425 | - | 1170 | - | 386 | - | 10,800 | 18,205 | 2480 | 597.18 | 567.43 | <0.005 | <0.002 | <0.001 | 0.006 |
| CMA_OC 42 | CMA_OC42 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | 0.87 | 526.3 | 7.5 | 52,630 | 296 | <0.001 | <0.001 | - | <0.001 | 110 | - | 410 | - | 1160 | - | 381 | - | 10,900 | 18,897 | 2590 | 599.83 | 588.93 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC 43 | CMA_OC43 | Landfill coast | West - 0 m | 30/11/2022 | OC | Normal | 0.93 | 505.1 | 7.8 | 50,510 | 254 | <0.001 | <0.001 | - | <0.001 | 126 | - | 430 | - | 1190 | - | 385 | - | 11,000 | 18,294 | 2490 | 607.75 | 570.51 | <0.005 | 3.23 | <0.001 | 0.007 |
| CMA_OC 44 | CMA_OC44 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | 0.95 | 528 | 8.2 | 52,800 | 108 | <0.001 | <0.001 | - | <0.001 | 114 | - | 419 | - | 1170 | - | 377 | - | 10,800 | 18,365 | 2500 | 596.65 | 572.29 | <0.005 | <0.002 | <0.001 | 0.005 |
| CMA_OC 45 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | 0.89 | 523 | 8 | 52,300 | 275 | <0.001 | <0.001 | - | <0.001 | 121 | - | 436 | - | 1260 | - | 398 | - | 11,400 | 18,237 | 2490 | 631.54 | 568.49 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC DUP11 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 46 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | 0.88 | 524.7 | 7.9 | 52,470 | 128 | <0.001 | 0.001 | - | <0.001 | 120 | - | 428 | - | 1280 | - | 407 | - | 11,500 | 18,400 | 2510 | 637.37 | 573.52 | 0.01 | 0.0038 | <0.001 | 0.007 |
| CMA_OC DUP9 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 47 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | 0.88 | 526.5 | 8 | 52,650 | 262 | <0.001 | <0.001 | - | <0.001 | 118 | - | 407 | - | 1160 | - | 373 | - | 10,700 | 18,342 | 2500 | 590.78 | 571.57 | <0.005 | 0.0026 | <0.001 | 0.003 |
| CMA_OC DUP10 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 48 | CMA_OC48 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | 0.9 | 526 | 7.6 | 52,600 | 202 | <0.001 | 0.002 | - | <0.001 | 111 | - | 430 | - | 1240 | - | 397 | - | 11,300 | 18,253 | 2480 | 625.22 | 568.66 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC 49 | CMA_OC49 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | 0.91 | 528.8 | 7.9 | 52,880 | 238 | <0.001 | <0.001 | - | <0.001 | 119 | - | 441 | - | 1240 | - | 406 | - | 11,300 | 18,561 | 2530 | 626 | 578.54 | <0.005 | <0.002 | <0.001 | 0.006 |
| CMA_OC50 | CMA_OC50 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | 0.92 | 528.2 | 8.1 | 52,820 | 218 | - | <0.001 | <0.01 | <0.001 | 119 | - | 443 | - | 1350 | - | 416 | - | 11,500 | 19,309 | 2630 | 644.11 | 601.53 | <0.005 | <0.002 | <0.001 | 0.005 |
| CMA_OC51 | CMA_OC51 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | 0.99 | 531.6 | 8.1 | 53,160 | 240 | - | <0.001 | <0.01 | <0.001 | 114 | - | 437 | - | 1320 | - | 416 | - | 11,200 | 19,325 | 2640 | 628.29 | 602.2 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC_52 | CMA_OC52 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | 0.89 | 524.9 | 7.9 | 52,490 | 212 | <0.001 | <0.001 | - | <0.001 | 116 | - | 412 | - | 1280 | - | 381 | - | 10,400 | 18,729 | 2530 | 588.06 | 583.04 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC_53 | CMA_OC53 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | 0.87 | 523.5 | 7.9 | 52,350 | 129 | <0.001 | <0.001 | - | <0.001 | 118 | - | 415 | - | 1330 | - | 388 | - | 10,700 | 19,159 | 2610 | 605.55 | 596.93 | <0.005 | 0.0047 | <0.001 | 0.003 |
| EHS_BCK_OC4D | EHS_BCK_OC4D | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | 0.84 | 515.8 | 7.5 | 51,580 | 180 | - | <0.001 | <0.01 | <0.001 | 113 | - | 413 | - | 1320 | - | 388 | - | 11,000 | 16,564 | 2240 | 617.68 | 515.88 | 0.01 | 0.0027 | <0.001 | 0.004 |
| EHS_BCK_OC4S | EHS_BCK_OC4S | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | 0.84 | 517.7 | 7.8 | 51,770 | 52 | - | <0.001 | <0.01 | <0.001 | 116 | - | 427 | - | 1370 | - | 403 | - | 11,500 | 20,779 | 2850 | 644.63 | 647.52 | <0.005 | 0.0021 | <0.001 | 0.003 |
| EHS_OC 1 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | 0.79 | 526.9 | 7.4 | 52,690 | 218 | <0.001 | <0.001 | - | <0.001 | 108 | - | 420 | - | 1200 | - | 386 | - | 11,000 | 18,477 | 2520 | 608.1 | 575.69 | <0.005 | <0.002 | <0.001 | 0.006 |
| CMA_OC DUP15 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_OC 2 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Normal | 0.81 | 528.7 | 7.7 | 52,870 | 252 | <0.001 | <0.001 | - | <0.001 | 121 | - | 455 | - | 1290 | - | 403 | - | 11,600 | 18,263 | 2490 | 643.79 | 569.31 | <0.005 | <0.002 | <0.001 | 0.008 |
| CMA_OC DUP16 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EHS_BCK_OC2D | EHS_BCK_OC2D | Background | North eastern estuary | 6/12/2022 | OC | Normal | 0.79 | 473.4 | 7.6 | 47,340 | 120 | - | <0.001 | <0.01 | <0.001 | 106 | - | 389 | - | 1210 | - | 354 | - | 10,100 | 17,973 | 2410 | 567.41 | 559.13 | 0.01 | 0.0045 | <0.001 | 0.002 |
| EHS_BCK_OC2S | EHS_BCK_OC2S | Background | North eastern estuary | 6/12/2022 | OC | Normal | 0.77 | 468.7 | 8 | 46,870 | 165 | - | <0.001 | <0.01 | <0.001 | 117 | - | 387 | - | 1200 | - | 356 | - | 10,200 | 17,835 | 2410 | 570.89 | 555.44 | 0.02 | 0.0054 | <0.001 | 0.006 |
| EHS_BCK_OC3 | EHS_BCK_OC3 | Background | Southern beach east - intertidal | 6/12/2022 | OC | Normal | 0.84 | 517.4 | 7.8 | 51,740 | 175 | - | <0.001 | <0.01 | <0.001 | 121 | - | 437 | - | 1380 | - | 401 | - | 11,500 | 20,466 | 2800 | 645.9 | 637.81 | <0.005 | 0.0024 | <0.001 | 0.006 |
| EHS_BCK_SW1 | EHS_BCK_SW1 | Background | Southern beach far east - intertidal | 6/12/2022 | OC | Normal | 0.19 | 2.86 | 5.5 | 286 | 74 | - | <0.001 | <0.01 | <0.001 | 2.2 | - | 2.2 | - | 4.62 | - | 1.3 | - | 45.1 | 57 | <15 | 2.49 | 1.65 | 0.02 | <0.002 | 0.011 | <0.002 |
| CMA_CS1_OCD | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Normal | 0.72 | 504.1 | 7.8 | 50,410 | 25 | - | <0.001 | 0.137 | <0.001 | 118 | - | 415 | - | 1290 | - | 398 | - | 10,800 | 19,525 | 2660 | 639.8 | 608.23 | 0.02 | <0.002 | <0.001 | 0.007 |
| CMA_OC_DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Interlab_D | 0.8 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC-DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS1_OCS | CMA_CS1_OCS | Background | North eastern estuary | 7/12/2022 | OC | Normal | 0.72 | 503.4 | 7.8 | 50,340 | 135 | - | <0.001 | <0.01 | <0.001 | 121 | - | 423 | - | 1310 | - | 402 | - | 11,100 | 18,709 | 2530 | 655.1 | 582.57 | 0.02 | 0.003 | <0.001 | 0.003 |
| CMA_CS2_OC | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Normal | 0.85 | 533.5 | 7.9 | 53,350 | 222 | - | <0.001 | <0.01 | <0.001 | 120 | - | 406 | - | 1310 | - | 380 | - | 11,000 | 18,637 | 2420 | 616.3 | 578.3 | <0.005 | <0.002 | <0.001 | 0.004 |
| CMA_OC_DUP21 | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS3_OC | CMA_CS3_OC | Background | North west near island | 2/12/2022 | OC | Normal | 0.85 | 529.5 | 7.9 | 52,950 | 272 | - | <0.001 | <0.01 | <0.001 | 118 | - | 405 | - | 1340 | - | 389 | - | 11,200 | 17,951 | 1990 | 627.65 | 549.92 | <0.005 | 0.0022 | <0.001 | 0.003 |
| CMA_CS4_OC | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Normal | 0.85 | 520.4 | 7.9 | 52,040 | 225 | - | <0.001 | <0.01 | <0.001 | 115 | - | 411 | - | 1320 | - | 383 | - | 11,100 | 19,484 | 2790 | 621.8 | 609.79 | <0.005 | 0.0025 | <0.001 | <0.002 |
| CMA_OC_DUP20 | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

## Appendix B - Table B2
## Landfill coast and reference ocean water analytical results - human health assessment criteria

| Field ID | Location Code | Area | Location Details | Sampled Date | Matrix | Sample Type | Organic Indicators | | Metals | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Dissolved Organic Carbon (Filtered) | Total Organic Carbon | Aluminium | Aluminium (Filtered) | Arsenic | Arsenic (Filtered) | Barium | Barium (Filtered) | Beryllium | Beryllium (Filtered) | Boron | Boron (Filtered) | Cadmium | Cadmium (Filtered) | Chromium (III+VI) | Chromium (III+VI) (Filtered) | Chromium (hexavalent) (Filtered) | Chromium (Trivalent) (Filtered) | Cobalt | Cobalt (Filtered) | Copper | Copper (Filtered) | Iron | Iron (Filtered) | Lead |
| | | | | | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | | | | 0.5 | 0.5 | 0.003 | 0.003 | 0.0005 | 0.0005 | 0.0001 | 0.0002 | 0.00001 | 0.00001 | 0.005 | 0.01 | 0.00002 | 0.00002 | 0.0002 | 0.0002 | 0.002 | 0.002 | 0.00001 | 0.00001 | 0.0002 | 0.0002 | 0.005 | 0.005 | 0.00005 |
| ADWG 2011 multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | 1.2 | | | | | | | | | | | | | | | | |
| MOH (2018) multiplied by a factor 20 for recreatonal use | | | | | | | | | 20 | | 0.01 | | 0.7 | | | | 28 | | 0.08 | | | | 1 | | | | 40 | | | | 0.2 |
| US EPA (2022) multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | | | 0.12 | | | | | | |
| PFAS NEMP 2.0 (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field ID | Location Code | Area | Location Details | Sampled Date | Matrix | Sample Type | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_OC 13 | CMA_OC13 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 3.42 | <0.03 | <0.005 | <0.005 | 0.011 | 0.0055 | <0.0001 | <0.0001 | 3.67 | 4.56 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | 0.003 | 0.28 | <0.05 | 0.00914 |
| CMA_OC 14 | CMA_OC14 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.13 | <0.03 | <0.005 | <0.005 | 0.0043 | 0.0056 | <0.0001 | <0.0001 | 3.51 | 4.46 | <0.0002 | <0.0002 | <0.002 | 0.0022 | <0.002 | <0.002 - 0.002 | <0.0001 | <0.0001 | <0.002 | 0.0034 | 0.2 | <0.05 | 0.0022 |
| CMA_OC 15 | CMA_OC15 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.5 | 2 | 0.55 | <0.03 | 0.0056 | <0.005 | 0.0062 | 0.0054 | <0.0001 | <0.0001 | 3.5 | 4.57 | <0.0002 | <0.0002 | 0.0031 | <0.002 | <0.002 | <0.002 | 0.00016 | <0.0001 | 0.0033 | <0.002 | 0.627 | <0.05 | 0.0165 |
| CMA_OC 16 | CMA_OC16 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.15 | <0.03 | <0.005 | <0.005 | 0.0048 | 0.0049 | <0.0001 | <0.0001 | 3.39 | 4.46 | <0.0002 | <0.0002 | <0.002 | 0.0024 | <0.002 | <0.002 - 0.002 | <0.0001 | <0.0001 | <0.002 | 0.0039 | 0.19 | <0.05 | 0.0025 |
| CMA_OC 17 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | 0.69 | 0.62 | 0.2 | <0.03 | <0.005 | <0.005 | 0.0052 | 0.006 | <0.0001 | <0.0001 | 3.48 | 4.58 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | 0.0027 | 0.004 | 0.23 | <0.05 | 0.0042 |
| CMA_OC DUP2 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | 0.22 | <0.03 | <0.005 | <0.005 | - | - | <0.0001 | <0.0001 | 3.5 | 4.93 | <0.0002 | <0.0002 | <0.002 | 0.0056 | - | - | <0.0001 | <0.0001 | 0.003 | <0.002 | - | - | 0.0025 |
| CMA_OC 18 | CMA_OC18 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.5 | 0.56 | 0.22 | <0.03 | <0.005 | <0.005 | 0.0041 | 0.0053 | <0.0001 | <0.0001 | 3.35 | 4.54 | <0.0002 | <0.0002 | <0.002 | 0.0021 | <0.002 | <0.002 - 0.002 | 0.00012 | <0.0001 | <0.002 | 0.0037 | 0.27 | <0.05 | 0.0034 |
| CMA_OC 19 | CMA_OC19 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.2 | <0.03 | <0.005 | <0.005 | 0.0045 | 0.0048 | <0.0001 | <0.0001 | 3.43 | 4.51 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | 0.0025 | 0.16 | <0.05 | 0.0039 |
| CMA_OC 20 | CMA_OC20 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.12 | <0.03 | <0.005 | <0.005 | 0.0041 | 0.0051 | <0.0001 | <0.0001 | 3.41 | 4.5 | <0.0002 | <0.0002 | <0.002 | 0.0024 | <0.002 | <0.002 - 0.002 | <0.0001 | <0.0001 | <0.002 | 0.004 | 0.064 | <0.05 | 0.00537 |
| CMA_OC21D | CMA_OC21D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.037 | <0.03 | <0.005 | <0.005 | 0.0054 | 0.0069 | <0.0001 | <0.0001 | 4.88 | 4.09 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC21S | CMA_OC21S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.033 | <0.03 | <0.005 | <0.005 | 0.006 | 0.0061 | 0.00023 | <0.0001 | 4.82 | 4.09 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC_22 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Normal | <0.5 | <0.5 | 0.031 | <0.03 | <0.005 | <0.005 | 0.005 | 0.0059 | <0.0001 | <0.0001 | 4.66 | 4.29 | 0.00027 | <0.0002 | 0.348 | <0.002 | <0.002 | <0.002 - 0.35 | 0.00036 | <0.0001 | <0.002 | <0.002 | 1.87 | <0.05 | <0.0005 |
| CMA_OC_DUP3 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Field_D | <0.5 | <0.5 | 0.12 | <0.03 | <0.005 | <0.005 | 0.0051 | 0.0059 | 0.00016 | <0.0001 | 4.48 | 4.24 | 0.00026 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.00019 | 0.00017 | <0.002 | 0.0026 | 0.095 | <0.05 | <0.0005 |
| CMA_OC31 | CMA_OC31 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.5 | <0.5 | 0.031 | <0.03 | <0.005 | <0.005 | 0.0059 | 0.0054 | 0.00019 | <0.0001 | 4.78 | 4.3 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC32 Deep | CMA_OC32D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.5 | <0.5 | <0.03 | <0.03 | <0.005 | <0.005 | 0.0054 | 0.0052 | <0.0001 | <0.0001 | 4.68 | 4.3 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.00013 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC32 Shallow | CMA_OC32S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.5 | <0.5 | 0.043 | <0.03 | <0.005 | <0.005 | 0.006 | 0.006 | <0.0001 | <0.0001 | 4.76 | 4.26 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC33 | CMA_OC33 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.5 | <0.5 | 0.11 | <0.03 | <0.005 | <0.005 | 0.0063 | 0.0056 | <0.0001 | <0.0001 | 4.76 | 4.28 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.00023 | <0.0001 | <0.002 | <0.002 | 0.1 | <0.05 | <0.0005 |
| CMA_OC34 Deep | CMA_OC34D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.5 | <0.5 | 0.065 | <0.03 | <0.005 | <0.005 | 0.0056 | 0.0053 | 0.00021 | <0.0001 | 4.76 | 4.41 | 0.00027 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | 0.12 | <0.05 | <0.0005 |
| CMA_OC34 Shallow | CMA_OC34S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.5 | <0.5 | 0.1 | <0.03 | <0.005 | <0.005 | 0.0063 | 0.0055 | 0.00016 | <0.0001 | 4.94 | 4.26 | 0.00035 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | 0.089 | <0.05 | <0.0005 |
| CMA_OC35 | CMA_OC35 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | <0.03 | <0.03 | <0.005 | <0.005 | 0.0057 | 0.0069 | 0.0001 | <0.0001 | 4.71 | 4.21 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC36D | CMA_OC36D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.033 | <0.03 | <0.005 | <0.005 | 0.0059 | 0.0055 | 0.00022 | <0.0001 | 4.75 | 4.19 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC36S | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.032 | <0.03 | <0.005 | <0.005 | 0.0054 | 0.0069 | <0.0001 | <0.0001 | 4.76 | 4.26 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC DUP 4 | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | 0.036 | <0.03 | <0.005 | <0.005 | 0.0059 | 0.0057 | <0.0001 | <0.0001 | 4.75 | 4.31 | 0.00021 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC37D | CMA_OC37D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.053 | <0.03 | <0.005 | <0.005 | 0.0064 | 0.0065 | 0.00018 | <0.0001 | 4.86 | 4.27 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC37S | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.037 | <0.03 | <0.005 | <0.005 | 0.0058 | 0.0062 | <0.0001 | <0.0001 | 4.83 | 4.21 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC DUP 5 | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | 0.2 | <0.03 | <0.005 | <0.005 | 0.0059 | 0.0064 | 0.0001 | <0.0001 | 4.75 | 4.29 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC38 | CMA_OC38 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | <0.03 | <0.03 | <0.005 | <0.005 | 0.0056 | 0.0071 | <0.0001 | <0.0001 | 4.79 | 4.42 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC39 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.042 | <0.03 | <0.005 | <0.005 | 0.0053 | 0.0063 | 0.00013 | <0.0001 | 4.66 | 4 | <0.0002 | <0.0002 | 0.0024 | <0.002 | <0.002 | <0.002 - 0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC DUP 7 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | 0.034 | <0.03 | <0.005 | <0.005 | 0.0052 | 0.0057 | <0.0001 | <0.0001 | 4.8 | 4.07 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC_40D | CMA_OC40D | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | <0.5 | <0.5 | 0.096 | <0.03 | <0.005 | <0.005 | 0.0051 | 0.0052 | <0.0001 | <0.0001 | 4.58 | 4.17 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.00024 | <0.0001 | <0.002 | <0.002 | 0.054 | <0.05 | <0.0005 |
| CMA_OC_40S | CMA_OC40S | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | <0.5 | <0.5 | 0.052 | <0.03 | <0.005 | <0.005 | 0.0064 | 0.005 | <0.0001 | <0.0001 | 4.69 | 4.21 | 0.00026 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC 41 | CMA_OC41 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.3 | <0.03 | <0.005 | <0.005 | 0.0044 | 0.0053 | <0.0001 | <0.0001 | 3.34 | 4.59 | <0.0002 | <0.0002 | <0.002 | 0.0029 | 0.007 | <0.002 | 0.00012 | <0.0001 | 0.0034 | 0.0041 | 0.21 | <0.05 | 0.0146 |
| CMA_OC 42 | CMA_OC42 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.884 | <0.03 | <0.005 | <0.005 | 0.0046 | 0.0056 | <0.0001 | <0.0001 | 3.31 | 4.65 | <0.0002 | <0.0002 | <0.002 | 0.0028 | <0.002 | <0.002 - 0.003 | <0.0001 | <0.0001 | 0.012 | 0.0028 | 0.16 | <0.05 | 0.0769 |
| CMA_OC 43 | CMA_OC43 | Landfill coast | West - 0 m | 30/11/2022 | OC | Normal | 2.1 | 1 | 0.25 | <0.03 | <0.005 | <0.005 | 0.0045 | 0.0058 | <0.0001 | <0.0001 | 3.35 | 4.76 | <0.0002 | <0.0002 | <0.002 | 0.003 | <0.002 | <0.002 - 0.003 | <0.0001 | <0.0001 | 0.0044 | 0.0042 | 0.096 | <0.05 | 0.019 |
| CMA_OC 44 | CMA_OC44 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | 0.67 | 0.72 | 0.12 | <0.03 | <0.005 | <0.005 | 0.0043 | 0.0052 | <0.0001 | <0.0001 | 3.32 | 4.69 | <0.0002 | <0.0002 | <0.002 | 0.0027 | <0.002 | <0.002 - 0.003 | <0.0001 | <0.0001 | 0.0026 | 0.0037 | 0.062 | <0.05 | 0.00784 |
| CMA_OC 45 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.784 | <0.03 | <0.005 | <0.005 | 0.0047 | 0.0054 | <0.0001 | <0.0001 | 3.36 | 4.74 | <0.0002 | <0.0002 | <0.002 | 0.0032 | <0.002 | <0.002 - 0.003 | 0.00017 | <0.0001 | 0.0071 | 0.0041 | 0.48 | <0.05 | 0.0423 |
| CMA_OC DUP11 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Field_D | - | - | 0.28 | <0.03 | <0.005 | <0.005 | - | - | <0.0001 | <0.0001 | 3.38 | 5.08 | <0.0002 | <0.0002 | <0.002 | 0.0045 | - | - | 0.00015 | <0.0001 | <0.002 | 0.0042 | - | - | 0.0016 |
| CMA_OC 46 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.16 | <0.03 | <0.005 | <0.005 | 0.0042 | 0.0052 | <0.0001 | <0.0001 | 3.55 | 4.6 | <0.0002 | <0.0002 | <0.002 | 0.0029 | <0.002 | <0.002 - 0.003 | <0.0001 | <0.0001 | 0.0029 | 0.0041 | 0.058 | <0.05 | 0.0128 |
| CMA_OC DUP9 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | 0.052 | <0.03 | <0.005 | <0.005 | - | - | <0.0001 | <0.0001 | 3.56 | 5.04 | <0.0002 | <0.0002 | <0.002 | 0.0052 | - | - | <0.0001 | <0.0001 | <0.002 | 0.0041 | - | - | 0.0022 |
| CMA_OC 47 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | 0.51 | <0.5 | 0.14 | <0.03 | <0.005 | <0.005 | 0.0042 | 0.0052 | <0.0001 | <0.0001 | 3.52 | 4.74 | <0.0002 | <0.0002 | <0.002 | 0.0046 | <0.002 | <0.002 - 0.005 | <0.0001 | <0.0001 | <0.002 | 0.0029 | 0.14 | <0.05 | 0.0047 |
| CMA_OC DUP10 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Field_D | - | - | 0.078 | <0.03 | <0.005 | <0.005 | - | - | <0.0001 | <0.0001 | 3.47 | 4.98 | <0.0002 | <0.0002 | <0.002 | 0.0045 | - | - | <0.0001 | <0.0001 | <0.002 | 0.0028 | - | - | 0.003 |
| CMA_OC 48 | CMA_OC48 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.18 | <0.03 | <0.005 | <0.005 | 0.0042 | 0.0062 | <0.0001 | <0.0001 | 3.21 | 4.57 | <0.0002 | <0.0002 | <0.002 | 0.0036 | <0.002 | <0.002 - 0.004 | <0.0001 | <0.0001 | <0.002 | 0.0037 | 0.21 | <0.05 | 0.0033 |
| CMA_OC 49 | CMA_OC49 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | 2.2 | 1.6 | 0.412 | <0.03 | <0.005 | <0.005 | 0.0053 | 0.005 | <0.0001 | <0.0001 | 3.43 | 4.74 | <0.0002 | <0.0002 | <0.002 | 0.004 | <0.002 | <0.002 - 0.004 | 0.00018 | <0.0001 | 0.0021 | 0.0039 | 0.48 | <0.05 | 0.003 |
| CMA_OC50 | CMA_OC50 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | <0.5 | <0.5 | 0.048 | <0.03 | <0.005 | <0.005 | 0.0058 | 0.0053 | 0.0001 | <0.0001 | 4.87 | 4.28 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | 0.0034 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC51 | CMA_OC51 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | <0.5 | <0.5 | <0.03 | <0.03 | <0.005 | <0.005 | 0.0057 | 0.0052 | <0.0001 | <0.0001 | 4.8 | 4.32 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC_52 | CMA_OC52 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | <0.5 | <0.5 | 0.13 | <0.03 | <0.005 | <0.005 | 0.0053 | 0.0048 | <0.0001 | <0.0001 | 4.61 | 4.25 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.00015 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | 0.0009 |
| CMA_OC_53 | CMA_OC53 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | <0.5 | <0.5 | <0.03 | <0.03 | <0.005 | <0.005 | 0.0055 | 0.0057 | <0.0001 | <0.0001 | 4.56 | 4.22 | <0.0002 | <0.0002 | <0.002 | 0.0024 | <0.002 | <0.002 - 0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| EHS_BCK_OC4D | EHS_BCK_OC4D | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.5 | <0.5 | 0.066 | <0.03 | <0.005 | <0.005 | 0.0053 | 0.0043 | <0.0001 | <0.0001 | 3.64 | 4.45 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.00018 | <0.0001 | <0.002 | <0.002 | 0.059 | <0.05 | <0.0005 |
| EHS_BCK_OC4S | EHS_BCK_OC4S | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.5 | <0.5 | 0.12 | <0.03 | <0.005 | <0.005 | 0.0053 | 0.0055 | <0.0001 | <0.0001 | 3.64 | 4.72 | <0.0002 | <0.0002 | 0.0034 | <0.002 | <0.002 | <0.002 - 0.003 | <0.0001 | <0.0001 | <0.002 | <0.002 | 0.15 | <0.05 | <0.0005 |
| EHS_OC 1 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.23 | <0.03 | <0.005 | <0.005 | 0.0047 | 0.0062 | <0.0001 | <0.0001 | 3.57 | 4.53 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | 0.0034 | 0.26 | <0.05 | 0.0028 |
| CMA_OC DUP15 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Field_D | - | - | 0.11 | <0.03 | <0.005 | <0.005 | - | - | <0.0001 | <0.0001 | 3.39 | 4.58 | <0.0002 | <0.0002 | <0.002 | 0.0039 | - | - | <0.0001 | 0.00016 | <0.002 | 0.0041 | - | - | 0.0014 |
| EHS_OC 2 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Normal | <0.5 | <0.5 | 0.17 | <0.03 | <0.005 | <0.005 | 0.005 | 0.0056 | <0.0001 | <0.0001 | 3.63 | 4.5 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | 0.0043 | 0.18 | <0.05 | 0.002 |
| CMA_OC DUP16 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Field_D | - | - | 0.27 | <0.03 | <0.005 | <0.005 | - | - | <0.0001 | <0.0001 | 3.17 | 4.2 | <0.0002 | <0.0002 | <0.002 | <0.002 | - | - | 0.0002 | <0.0001 | <0.002 | <0.002 | - | - | <0.0005 |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EHS_BCK_OC2D | EHS_BCK_OC2D | Background | North eastern estuary | 6/12/2022 | OC | Normal | 0.84 | 0.99 | 0.17 | <0.03 | <0.005 | <0.005 | 0.0074 | 0.0054 | 0.00014 | <0.0001 | 3.28 | 4.2 | 0.00039 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.00039 | <0.0001 | <0.002 | <0.002 | 0.21 | <0.05 | 0.0019 |
| EHS_BCK_OC2S | EHS_BCK_OC2S | Background | North eastern estuary | 6/12/2022 | OC | Normal | 2.2 | 2.1 | 0.041 | <0.03 | <0.005 | <0.005 | 0.0054 | 0.0053 | <0.0001 | <0.0001 | 3.41 | 4.16 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.00015 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| EHS_BCK_OC3 | EHS_BCK_OC3 | Background | Southern beach east - intertidal | 6/12/2022 | OC | Normal | <0.5 | <0.5 | 0.16 | <0.03 | <0.005 | <0.005 | 0.0054 | 0.0056 | <0.0001 | <0.0001 | 3.7 | 4.71 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.0002 | <0.0001 | <0.002 | <0.002 | 0.15 | <0.05 | 0.00075 |
| EHS_BCK_SW1 | EHS_BCK_SW1 | Background | Southern beach far east - intertidal | 6/12/2022 | OC | Normal | 22.8 | 25.1 | 0.27 | 0.222 | <0.005 | <0.005 | <0.001 | <0.002 | <0.0001 | <0.0001 | <0.05 | 0.4 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | 0.00012 | 0.0038 | <0.002 | 0.076 | 0.11 | <0.0005 |
| CMA_CS1_OCD | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Normal | 0.89 | 1.2 | <0.03 | <0.03 | <0.005 | <0.005 | 0.0057 | 0.0052 | <0.0001 | <0.0001 | 3.48 | 4.4 | <0.0002 | 0.00027 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_OC_DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Interlab_D | - | - | <0.063 | - | <0.021 | - | - | - | <0.0021 | - | 4 | - | <0.0011 | - | <0.011 | - | - | - | <0.0042 | - | <0.011 | - | - | - | <0.0021 |
| CMA_OC-DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Field_D | - | - | 0.048 | <0.03 | <0.005 | <0.005 | - | - | <0.0001 | <0.0001 | 3.59 | 4.41 | <0.0002 | 0.00028 | <0.002 | <0.002 | 0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | - | - | <0.0005 |
| CMA_CS1_OCS | CMA_CS1_OCS | Background | North eastern estuary | 7/12/2022 | OC | Normal | 1.3 | 1.2 | <0.03 | <0.03 | <0.005 | <0.005 | 0.0054 | 0.0064 | <0.0001 | <0.0001 | 3.56 | 4.44 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | <0.05 | <0.05 | <0.0005 |
| CMA_CS2_OC | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Normal | <0.5 | <0.5 | 0.044 | <0.03 | <0.005 | <0.005 | 0.0048 | 0.0062 | <0.0001 | <0.0001 | 4.12 | 4.23 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | 0.1 | <0.05 | <0.0005 |
| CMA_OC_DUP21 | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Field_D | - | - | 0.055 | <0.03 | <0.005 | <0.005 | - | - | <0.0001 | <0.0001 | 3.86 | 4.32 | <0.0002 | <0.0002 | <0.002 | <0.002 | - | - | <0.0001 | <0.0001 | <0.002 | <0.002 | - | - | <0.0005 |
| CMA_CS3_OC | CMA_CS3_OC | Background | North west near island | 2/12/2022 | OC | Normal | <0.5 | <0.5 | 0.032 | <0.03 | <0.005 | <0.005 | 0.0052 | 0.0062 | <0.0001 | <0.0001 | 3.9 | 4.22 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | 0.0027 | <0.002 | 0.21 | <0.05 | <0.0005 |
| CMA_CS4_OC | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Normal | <0.5 | <0.5 | <0.03 | <0.03 | <0.005 | <0.005 | 0.0047 | 0.0051 | <0.0001 | <0.0001 | 4.04 | 4.16 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 | 0.11 | <0.05 | <0.0005 |
| CMA_OC_DUP20 | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Field_D | - | - | 0.05 | <0.03 | <0.005 | <0.005 | - | - | <0.0001 | <0.0001 | 3.81 | 4.2 | <0.0002 | <0.0002 | <0.002 | <0.002 | - | - | <0.0001 | <0.0001 | <0.002 | <0.002 | - | - | 0.0022 |

## Appendix B - Table B2
## Landfill coast and reference ocean water analytical results - human health assessment criteria

| Field ID | Location Code | Area | Location Details | Sampled Date | Matrix | Sample Type | Lead (Filtered) | Lithium | Lithium (Filtered) | Manganese | Manganese (Filtered) | Mercury | Mercury (Filtered) | Molybdenum | Molybdenum (Filtered) | Nickel | Nickel (Filtered) | Titanium | Titanium (Filtered) | Tin | Tin (Filtered) | Vanadium | Vanadium (Filtered) | Zinc | Zinc (Filtered) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | | | 0.00005 | 0.00001 | 0.00001 | 0.0005 | 0.0005 | 0.0001 | 0.00008 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.002 | 0.002 | 0.0005 | 0.0002 | 0.0005 | 0.0005 | 0.003 | 0.001 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 |
| ADWG 2011 multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0.1 | |
| MOH (2018) multiplied by a factor 20 for recreatonal use | | | | | | | | | | 2 | | 0.14 | | 1.4 | | 1.6 | | | | | | | | | | | | | | | |
| US EPA (2022) multiplied by a factor of 20 for recreational use | | | | | | | | 0.8 | | | | | | | | | | | | 240 | | 1.72 | | | | 10.6 | | 36 | 6 | 0.2 | |
| PFAS NEMP 2.0 (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_OC 13 | CMA_OC13 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.17 | 0.159 | 0.0051 | <0.005 | <0.001 | <0.0008 | 0.0089 | 0.009 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 14 | CMA_OC14 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.167 | 0.154 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.008 | 0.008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 15 | CMA_OC15 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.168 | 0.165 | 0.011 | <0.005 | <0.001 | <0.0008 | 0.0086 | 0.008 | <0.002 | <0.002 | 0.027 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 16 | CMA_OC16 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.168 | 0.145 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0087 | 0.008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 17 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.166 | 0.154 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0079 | 0.009 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC DUP2 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | <0.0005 | - | - | - | - | <0.001 | <0.0008 | - | - | <0.002 | <0.002 | - | - | - | - | <0.005 | <0.005 | <0.03 | <0.01 | - | - | - | - | - | - |
| CMA_OC 18 | CMA_OC18 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.164 | 0.149 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0082 | 0.009 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 19 | CMA_OC19 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.166 | 0.147 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0084 | 0.007 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 20 | CMA_OC20 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.161 | 0.144 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0084 | 0.009 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC21D | CMA_OC21D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.205 | 0.207 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.01 | 0.004 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.0052 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC21S | CMA_OC21S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.196 | 0.212 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.009 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC_22 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Normal | <0.0005 | 0.222 | 0.185 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.008 | 0.012 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.014 | 0.015 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC_DUP3 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Field_D | <0.0005 | 0.217 | 0.18 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.007 | <0.002 | 0.0022 | 0.029 | <0.02 | <0.005 | <0.002 | 0.011 | 0.015 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC31 | CMA_OC31 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.0005 | 0.202 | 0.197 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.01 | 0.006 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC32 Deep | CMA_OC32D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.0005 | 0.2 | 0.199 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0097 | 0.006 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC32 Shallow | CMA_OC32S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.0005 | 0.201 | 0.186 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC33 | CMA_OC33 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.0005 | 0.2 | 0.2 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.01 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC34 Deep | CMA_OC34D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.0005 | 0.199 | 0.196 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0092 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC34 Shallow | CMA_OC34S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.0005 | 0.202 | 0.197 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.005 | <0.002 | <0.002 | 0.023 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC35 | CMA_OC35 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.195 | 0.199 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC36D | CMA_OC36D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.2 | 0.201 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.012 | 0.006 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC36S | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.192 | 0.209 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.012 | 0.006 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC DUP 4 | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | <0.0005 | 0.198 | 0.197 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.004 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | - | - | - | - | - | - |
| CMA_OC37D | CMA_OC37D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.201 | 0.21 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.006 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC37S | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.199 | 0.216 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC DUP 5 | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | <0.0005 | 0.192 | 0.206 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | - | - | - | - | - | - |
| CMA_OC38 | CMA_OC38 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.197 | 0.207 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.004 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC39 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.197 | 0.211 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.012 | 0.004 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC DUP 7 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | <0.0005 | 0.202 | 0.214 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | - | - | - | - | - | - |
| CMA_OC_40D | CMA_OC40D | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | <0.0005 | 0.223 | 0.177 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.007 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.0099 | 0.014 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC_40S | CMA_OC40S | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | <0.0005 | 0.221 | 0.177 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.013 | 0.007 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.011 | 0.014 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 41 | CMA_OC41 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | <0.0005 | 0.162 | 0.147 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0084 | 0.009 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 42 | CMA_OC42 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | <0.0005 | 0.162 | 0.147 | 0.008 | <0.005 | <0.001 | <0.0008 | 0.009 | 0.008 | 0.0045 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | 0.063 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 43 | CMA_OC43 | Landfill coast | West - 0 m | 30/11/2022 | OC | Normal | <0.0005 | 0.162 | 0.151 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0088 | 0.009 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | 0.298 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 44 | CMA_OC44 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | <0.0005 | 0.163 | 0.144 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0097 | 0.008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 45 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | <0.0005 | 0.162 | 0.144 | 0.0095 | <0.005 | <0.001 | <0.0008 | 0.0087 | 0.01 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | 0.043 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC DUP11 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Field_D | <0.0005 | - | - | - | - | <0.001 | <0.0008 | - | - | <0.002 | <0.002 | - | - | - | - | <0.005 | <0.005 | <0.03 | <0.01 | - | - | - | - | - | - |
| CMA_OC 46 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.175 | 0.141 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.009 | 0.009 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC DUP9 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | <0.0005 | - | - | - | - | <0.001 | <0.0008 | - | - | <0.002 | <0.002 | - | - | - | - | <0.005 | <0.005 | <0.03 | <0.01 | - | - | - | - | - | - |
| CMA_OC 47 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | <0.0005 | 0.172 | 0.143 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.009 | 0.008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC DUP10 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Field_D | <0.0005 | - | - | - | - | <0.001 | <0.0008 | - | - | <0.002 | <0.002 | - | - | - | - | <0.005 | <0.005 | <0.03 | <0.01 | - | - | - | - | - | - |
| CMA_OC 48 | CMA_OC48 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | <0.0005 | 0.17 | 0.136 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0089 | 0.009 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC 49 | CMA_OC49 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | <0.0005 | 0.173 | 0.14 | 0.0069 | <0.005 | <0.001 | <0.0008 | 0.0099 | 0.009 | <0.002 | <0.002 | 0.023 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC50 | CMA_OC50 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | <0.0005 | 0.202 | 0.199 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.012 | 0.006 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC51 | CMA_OC51 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | <0.0005 | 0.201 | 0.193 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.003 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC_52 | CMA_OC52 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | <0.0005 | 0.222 | 0.179 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.007 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.0095 | 0.014 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC_53 | CMA_OC53 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | <0.0005 | 0.218 | 0.181 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.013 | 0.007 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.012 | 0.014 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| EHS_BCK_OC4D | EHS_BCK_OC4D | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.0005 | 0.174 | 0.184 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.006 | 0.0031 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.015 | 0.011 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| EHS_BCK_OC4S | EHS_BCK_OC4S | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.0005 | 0.173 | 0.192 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.01 | 0.007 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.014 | 0.01 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| EHS_OC 1 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.173 | 0.156 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0085 | 0.008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | 0.064 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC DUP15 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Field_D | <0.0005 | - | - | - | - | <0.001 | <0.0008 | - | - | <0.002 | <0.002 | - | - | - | - | <0.005 | <0.005 | <0.03 | <0.01 | - | - | - | - | - | - |
| EHS_OC 2 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Normal | <0.0005 | 0.174 | 0.153 | 0.0053 | <0.005 | <0.001 | <0.0008 | 0.008 | 0.008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC DUP16 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Field_D | <0.0005 | - | - | - | - | <0.001 | <0.0008 | - | - | <0.002 | <0.002 | - | - | - | - | <0.005 | <0.005 | <0.03 | <0.01 | - | - | - | - | - | - |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EHS_BCK_OC2D | EHS_BCK_OC2D | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.0005 | 0.152 | 0.17 | 0.0077 | <0.005 | <0.001 | <0.0008 | 0.0092 | 0.006 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.015 | 0.0093 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| EHS_BCK_OC2S | EHS_BCK_OC2S | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.0005 | 0.154 | 0.169 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0088 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.012 | 0.0082 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| EHS_BCK_OC3 | EHS_BCK_OC3 | Background | Southern beach east - intertidal | 6/12/2022 | OC | Normal | <0.0005 | 0.175 | 0.192 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.012 | 0.007 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.015 | 0.01 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| EHS_BCK_SW1 | EHS_BCK_SW1 | Background | Southern beach far east - intertidal | 6/12/2022 | OC | Normal | <0.0005 | 0.00196 | 0.00114 | 0.0054 | 0.0065 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.0073 | <0.005 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_CS1_OCD | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Normal | <0.0005 | 0.164 | 0.191 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.0088 | 0.007 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.014 | 13,800 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC_DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Interlab_D | - | - | - | - | - | <0.00008 | - | - | - | <0.011 | - | - | - | - | - | <0.021 | - | <0.021 | - | - | - | - | - | - | - |
| CMA_OC-DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Field_D | <0.0005 | - | - | - | - | <0.001 | <0.0008 | - | - | <0.002 | <0.002 | - | - | - | - | 0.014 | 0.0079 | <0.03 | <0.01 | - | - | - | - | - | - |
| CMA_CS1_OCS | CMA_CS1_OCS | Background | North eastern estuary | 7/12/2022 | OC | Normal | <0.0005 | 0.173 | 0.192 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.006 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.014 | 14,000 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_CS2_OC | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Normal | <0.0005 | 0.184 | 0.189 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.006 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | 0.0077 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC_DUP21 | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Field_D | <0.0005 | - | - | - | - | <0.001 | <0.0008 | - | - | <0.002 | <0.002 | - | - | - | - | 0.0052 | 0.0098 | <0.03 | <0.01 | - | - | - | - | - | - |
| CMA_CS3_OC | CMA_CS3_OC | Background | North west near island | 2/12/2022 | OC | Normal | <0.0005 | 0.175 | 0.187 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.007 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | 0.0055 | 0.01 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_CS4_OC | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Normal | <0.0005 | 0.179 | 0.187 | <0.005 | <0.005 | <0.001 | <0.0008 | 0.011 | 0.005 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.002 | <0.005 | 0.0064 | <0.03 | <0.01 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 |
| CMA_OC_DUP20 | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Field_D | <0.0005 | - | - | - | - | <0.001 | <0.0008 | - | - | <0.002 | <0.002 | - | - | - | - | <0.005 | 0.01 | <0.03 | <0.01 | - | - | - | - | - | - |

## Appendix B - Table B2
## Landfill coast and reference ocean water analytical results - human health assessment criteria

| | | | | | | | PAHs - standard 16 | | | | | | | | | | | | | PAHs - extended | Phenols | | Phenols - Halogenated | | | | | | Phenols - Nor | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | 2,3,5,6-Tetrachlorophenol | 2-Phenylphenol | 2-Chlorophenol | 2,4-Dichlorophenol | 2,4,5-Trichlorophenol | 2,4,6-Trichlorophenol | 2,6-Dichlorophenol | 4-Chloro-3-methylphenol | Phenol | 2-Nitrophenol | 2-Methylphenol (o-Cresol) |
| | | | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | | | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.06 | 0.06 | 0.03 | 0.02 | 0.02 | 0.05 | 0.06 | 0.3 | 5 | 0.3 | 0.3 | 0.5 | 0.5 | 0.3 | 0.3 | 2 | 0.5 | 0.3 |
| ADWG 2011 multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | 6000 | 4000 | | 400 | | | | | |
| MOH (2018) multiplied by a factor 20 for recreatonal use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2022) multiplied by a factor of 20 for recreational use | | | | | | | 500 | | 5000 | | | 5800 | 50 | 24 | 24 | | 2400 | 0.2 | 0.2 | | | | | | | | | | | | |
| PFAS NEMP 2.0 (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field ID** | **Location Code** | **Area** | **Location Details** | **Sampled Date** | **Matrix** | **Sample Type** | | | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_OC 13 | CMA_OC13 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 14 | CMA_OC14 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 15 | CMA_OC15 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 16 | CMA_OC16 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 17 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP2 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 18 | CMA_OC18 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 19 | CMA_OC19 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 20 | CMA_OC20 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC21D | CMA_OC21D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| CMA_OC21S | CMA_OC21S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_22 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| CMA_OC_DUP3 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Field_D | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC31 | CMA_OC31 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Deep | CMA_OC32D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Shallow | CMA_OC32S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC33 | CMA_OC33 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Deep | CMA_OC34D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Shallow | CMA_OC34S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC35 | CMA_OC35 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36D | CMA_OC36D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36S | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 4 | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37D | CMA_OC37D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37S | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 5 | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC38 | CMA_OC38 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC39 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 7 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40D | CMA_OC40D | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40S | CMA_OC40S | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 41 | CMA_OC41 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 42 | CMA_OC42 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 43 | CMA_OC43 | Landfill coast | West - 0 m | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 44 | CMA_OC44 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 45 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP11 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 46 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP9 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 47 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP10 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 48 | CMA_OC48 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 49 | CMA_OC49 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC50 | CMA_OC50 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC51 | CMA_OC51 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_52 | CMA_OC52 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_53 | CMA_OC53 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_OC4D | EHS_BCK_OC4D | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| EHS_BCK_OC4S | EHS_BCK_OC4S | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| EHS_OC 1 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| CMA_OC DUP15 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_OC 2 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| CMA_OC DUP16 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EHS_BCK_OC2D | EHS_BCK_OC2D | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| EHS_BCK_OC2S | EHS_BCK_OC2S | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| EHS_BCK_OC3 | EHS_BCK_OC3 | Background | Southern beach east - intertidal | 6/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| EHS_BCK_SW1 | EHS_BCK_SW1 | Background | Southern beach far east - intertidal | 6/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | <2 | <0.5 | <0.3 |
| CMA_CS1_OCD | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC-DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS1_OCS | CMA_CS1_OCS | Background | North eastern estuary | 7/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS2_OC | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_DUP21 | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS3_OC | CMA_CS3_OC | Background | North west near island | 2/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS4_OC | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Normal | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_DUP20 | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

## Appendix B - Table B2

## Landfill coast and reference ocean water analytical results - human health assessment criteria

| | | | | | | | -Halogenated | | | SVOCs | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 2,4-Dimethylphenol | 4-Nitrophenol | 4-Methylphenol (p-Cresol) | 1-Methylnaphthalene | 2,3,7,8-TCDD TEQ | PCB-121 | PCB-128 & PCB-167 2,2',3,3',4,4'-Hexachlorobiphenyl&2,3',4 | PCB-141 | PCB-149 | PCB-151 | PCB-159 | PCB-170 | PCB-18 | PCB-187 2,2',3,4',5,5',6-Heptachlorobiphenyl | PCB-194 | PCB-195 2,2',3,3',4,4',5,6-Octachlorobiphenyl | PCB-206 | PCB-28 & PCB-31 PCB-28 & PCB-31 | PCB-3 4-Chlorobiphenyl | PCB-4 2,2'-Dichlorobiphenyl | PCB-44 | PCB-49 | PCB-60 |
| | | | | | | | µg/L | µg/L | µg/L | µg/L | g/m3 | µg/L | g/m3 | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | g/m3 | µg/L | g/m3 | µg/L | g/m3 | g/m3 | g/m3 | µg/L | µg/L | µg/L |
| EQL | | | | | | | 1 | 1 | 0.3 | 0.06 | 0.000002 | 0.005 | 0.000005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.01 | 0.00001 | 0.005 | 0.000005 | 0.005 | 0.00001 | 0.00001 | 0.00001 | 0.005 | 0.01 | 0.005 |
| ADWG 2011 multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MOH (2018) multiplied by a factor 20 for recreatonal use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2022) multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAS NEMP 2.0 (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field ID** | **Location Code** | **Area** | **Location Details** | **Sampled Date** | **Matrix** | **Sample Type** | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_OC 13 | CMA_OC13 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| CMA_OC 14 | CMA_OC14 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 15 | CMA_OC15 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 16 | CMA_OC16 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 17 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP2 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 18 | CMA_OC18 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 19 | CMA_OC19 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 20 | CMA_OC20 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC21D | CMA_OC21D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| CMA_OC21S | CMA_OC21S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| CMA_OC_22 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| CMA_OC_DUP3 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Field_D | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC31 | CMA_OC31 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Deep | CMA_OC32D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Shallow | CMA_OC32S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC33 | CMA_OC33 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Deep | CMA_OC34D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Shallow | CMA_OC34S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC35 | CMA_OC35 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36D | CMA_OC36D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36S | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| CMA_OC DUP 4 | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37D | CMA_OC37D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37S | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 5 | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC38 | CMA_OC38 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| CMA_OC39 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 7 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40D | CMA_OC40D | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40S | CMA_OC40S | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 41 | CMA_OC41 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 42 | CMA_OC42 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 43 | CMA_OC43 | Landfill coast | West - 0 m | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 44 | CMA_OC44 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 45 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP11 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 46 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP9 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 47 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP10 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 48 | CMA_OC48 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 49 | CMA_OC49 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC50 | CMA_OC50 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC51 | CMA_OC51 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_52 | CMA_OC52 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_53 | CMA_OC53 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_OC4D | EHS_BCK_OC4D | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| EHS_BCK_OC4S | EHS_BCK_OC4S | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| EHS_OC 1 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| CMA_OC DUP15 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_OC 2 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| CMA_OC DUP16 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EHS_BCK_OC2D | EHS_BCK_OC2D | Background | North eastern estuary | 6/12/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| EHS_BCK_OC2S | EHS_BCK_OC2S | Background | North eastern estuary | 6/12/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| EHS_BCK_OC3 | EHS_BCK_OC3 | Background | Southern beach east - intertidal | 6/12/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| EHS_BCK_SW1 | EHS_BCK_SW1 | Background | Southern beach far east - intertidal | 6/12/2022 | OC | Normal | <1 | <1 | <0.3 | <0.06 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 |
| CMA_CS1_OCD | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC-DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS1_OCS | CMA_CS1_OCS | Background | North eastern estuary | 7/12/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS2_OC | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_DUP21 | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS3_OC | CMA_CS3_OC | Background | North west near island | 2/12/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS4_OC | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Normal | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_DUP20 | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

## Appendix B - Table B2

## Landfill coast and reference ocean water analytical results - human health assessment criteria

| | | | | | | | PCBs | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | PCB-66 2,3',4,4'-Tetrachlorobiphenyl | PCB-8 2,4'-Dichlorobiphenyl | PCB-86 | Decachlorobiphenyl | PCB-189 | PCB-156 | PCB-157 | PCB-169 | PCB-101 | PCB-118 | PCB-138 | PCB-153 | PCB-180 | PCB-52 | PCB-105 | PCB-114 | PCB-123 | PCB-126 | PCB-77 | PCB-81 | Perfluorobutanoic acid (PFBA) | Perfluoropentanoic acid (PFPeA) | Perfluorohexanoic acid (PFHxA) |
| | | | | | | | g/m3 | g/m3 | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | | | 0.000005 | 0.00001 | 0.005 | 0.01 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.01 | 0.005 | 0.005 | 0.005 | 0.01 | 0.005 | 0.005 | 0.001 | 0.0005 | 0.0004 |
| ADWG 2011 multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MOH (2018) multiplied by a factor 20 for recreatonal use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2022) multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAS NEMP 2.0 (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field ID** | **Location Code** | **Area** | **Location Details** | **Sampled Date** | **Matrix** | **Sample Type** | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_OC 13 | CMA_OC13 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | <0.0004 |
| CMA_OC 14 | CMA_OC14 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 15 | CMA_OC15 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 16 | CMA_OC16 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 17 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP2 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 18 | CMA_OC18 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 19 | CMA_OC19 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 20 | CMA_OC20 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC21D | CMA_OC21D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | <0.0004 |
| CMA_OC21S | CMA_OC21S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | - | - | - |
| CMA_OC_22 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | <0.0004 |
| CMA_OC_DUP3 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC31 | CMA_OC31 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Deep | CMA_OC32D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Shallow | CMA_OC32S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC33 | CMA_OC33 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Deep | CMA_OC34D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Shallow | CMA_OC34S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC35 | CMA_OC35 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36D | CMA_OC36D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36S | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | <0.0004 |
| CMA_OC DUP 4 | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37D | CMA_OC37D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37S | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 5 | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC38 | CMA_OC38 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | 0.0022 |
| CMA_OC39 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 7 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40D | CMA_OC40D | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40S | CMA_OC40S | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 41 | CMA_OC41 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 42 | CMA_OC42 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 43 | CMA_OC43 | Landfill coast | West - 0 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 44 | CMA_OC44 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 45 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP11 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 46 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP9 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 47 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP10 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 48 | CMA_OC48 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 49 | CMA_OC49 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC50 | CMA_OC50 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC51 | CMA_OC51 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_52 | CMA_OC52 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_53 | CMA_OC53 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_OC4D | EHS_BCK_OC4D | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.001 | <0.0004 |
| EHS_BCK_OC4S | EHS_BCK_OC4S | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | <0.0004 |
| EHS_OC 1 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | 0.0017 |
| CMA_OC DUP15 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_OC 2 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | <0.0004 |
| CMA_OC DUP16 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.001 | <0.0005 | <0.0004 |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EHS_BCK_OC2D | EHS_BCK_OC2D | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.001 | 0.00046 |
| EHS_BCK_OC2S | EHS_BCK_OC2S | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | <0.0004 |
| EHS_BCK_OC3 | EHS_BCK_OC3 | Background | Southern beach east - intertidal | 6/12/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.001 | <0.0005 | <0.0004 |
| EHS_BCK_SW1 | EHS_BCK_SW1 | Background | Southern beach far east - intertidal | 6/12/2022 | OC | Normal | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | 0.007 | <0.005 | <0.0004 |
| CMA_CS1_OCD | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.001 | <0.0005 | <0.0004 |
| CMA_OC_DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC-DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS1_OCS | CMA_CS1_OCS | Background | North eastern estuary | 7/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS2_OC | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.001 | <0.0005 | <0.0004 |
| CMA_OC_DUP21 | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS3_OC | CMA_CS3_OC | Background | North west near island | 2/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.001 | <0.0005 | <0.0004 |
| CMA_CS4_OC | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.001 | <0.0005 | <0.0004 |
| CMA_OC_DUP20 | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

## Appendix B - Table B2
## Landfill coast and reference ocean water analytical results - human health assessment criteria

| | | | | | | | PFAS - Perfluoroalkyl Carboxylic Acids | | | | | | | | PFAS - Perfluoroalkyl Sulfonic Acids | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Perfluoroheptanoic acid (PFHpA) | Perfluorooctanoic acid (PFOA) | Perfluorononanoic acid (PFNA) | Perfluorodecanoic acid (PFDA) | Perfluoroundecanoic acid (PFUnDA) | Perfluorododecanoic acid (PFDoDA) | Perfluorotridecanoic acid (PFTrDA) | Perfluorotetradecanoic acid (PFTeDA) | PFHxS (di-branched) | PFHxS (mono-branched) | PFHxS (Total) | PFOS (di-branched) | PFOS (mono-branched) | PFOS (Total) | Perfluoropropanesulfonic acid (PFPrS) | Perfluorobutane sulfonic acid (PFBS) | Perfluoropentane sulfonic acid (PFPeS) | Perfluorohexane sulfonic acid (PFHxS) | Perfluoroheptane sulfonic acid (PFHpS) | Perfluorooctane sulfonic acid (PFOS) | Perfluorodecanesulfonic acid (PFDS) | Perfluorooctane sulfonamide (FOSA) | N-Methyl perfluorooctane sulfonamide (MeFOSA) |
| | | | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | | | 0.0003 | 0.0002 | 0.0002 | 0.0002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | 0.0001 | 0.0002 | 0.0001 | 0.001 | 0.0002 | 0.001 |
| ADWG 2011 multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MOH (2018) multiplied by a factor 20 for recreatonal use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2022) multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAS NEMP 2.0 (2022) | | | | | | | | 10 | | | | | | | | | | | | 2 | | | | 2 | | | | | |
| **Field ID** | **Location Code** | **Area** | **Location Details** | **Sampled Date** | **Matrix** | **Sample Type** | | | | | | | | | | | | | | | | | | | | | | | |
| CMA_OC 13 | CMA_OC13 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 |
| CMA_OC 14 | CMA_OC14 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 15 | CMA_OC15 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 16 | CMA_OC16 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 17 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP2 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 18 | CMA_OC18 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 19 | CMA_OC19 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 20 | CMA_OC20 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC21D | CMA_OC21D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.00016 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | 0.00016 | <0.001 | <0.0002 | <0.001 |
| CMA_OC21S | CMA_OC21S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_22 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 |
| CMA_OC_DUP3 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC31 | CMA_OC31 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Deep | CMA_OC32D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Shallow | CMA_OC32S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC33 | CMA_OC33 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Deep | CMA_OC34D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Shallow | CMA_OC34S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC35 | CMA_OC35 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36D | CMA_OC36D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36S | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 |
| CMA_OC DUP 4 | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37D | CMA_OC37D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37S | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 5 | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC38 | CMA_OC38 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | 0.00031 | 0.00029 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.00016 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | 0.00016 | <0.001 | <0.0002 | <0.001 |
| CMA_OC39 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 7 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40D | CMA_OC40D | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40S | CMA_OC40S | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 41 | CMA_OC41 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 42 | CMA_OC42 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 43 | CMA_OC43 | Landfill coast | West - 0 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 44 | CMA_OC44 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 45 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP11 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 46 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP9 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 47 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP10 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 48 | CMA_OC48 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 49 | CMA_OC49 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC50 | CMA_OC50 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC51 | CMA_OC51 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_52 | CMA_OC52 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_53 | CMA_OC53 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_OC4D | EHS_BCK_OC4D | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.0003 | <0.0005 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | 0.00011 | 0.00067 | <0.0001 | 0.0003 | 0.00068 | <0.0002 | <0.0002 | <0.0002 | 0.00056 | <0.0002 | 0.00038 | <0.001 | <0.0002 | <0.001 |
| EHS_BCK_OC4S | EHS_BCK_OC4S | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 |
| EHS_OC 1 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.00011 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | 0.00011 | <0.001 | <0.0002 | <0.001 |
| CMA_OC DUP15 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_OC 2 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Normal | <0.0003 | 0.00022 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 |
| CMA_OC DUP16 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Field_D | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EHS_BCK_OC2D | EHS_BCK_OC2D | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | 0.00038 | <0.0001 | 0.0002 | 0.00051 | <0.0002 | <0.0002 | <0.0002 | 0.00038 | <0.0002 | 0.00031 | <0.001 | 0.00065 | <0.001 |
| EHS_BCK_OC2S | EHS_BCK_OC2S | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.0003 | <0.0005 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | 0.00051 | <0.001 |
| EHS_BCK_OC3 | EHS_BCK_OC3 | Background | Southern beach east - intertidal | 6/12/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | 0.0002 | <0.0001 | 0.00092 | 0.0027 | <0.0002 | <0.0002 | <0.0002 | 0.0002 | <0.0002 | 0.0017 | <0.001 | <0.0002 | <0.001 |
| EHS_BCK_SW1 | EHS_BCK_SW1 | Background | Southern beach far east - intertidal | 6/12/2022 | OC | Normal | <0.0003 | <0.001 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0002 | <0.0008 | 0.00091 | <0.0001 | 0.00013 | 0.00013 | <0.0002 | 0.00048 | 0.00035 | 0.00091 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 |
| CMA_CS1_OCD | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | 0.00024 | <0.001 |
| CMA_OC_DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC-DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS1_OCS | CMA_CS1_OCS | Background | North eastern estuary | 7/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS2_OC | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 |
| CMA_OC_DUP21 | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS3_OC | CMA_CS3_OC | Background | North west near island | 2/12/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.00013 | 0.00037 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | 0.00024 | <0.001 | <0.0002 | <0.001 |
| CMA_CS4_OC | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Normal | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 |
| CMA_OC_DUP20 | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

## Appendix B - Table B2
## Landfill coast and reference ocean water analytical results - human health assessment criteria

| | | | | | | | PFAS - Perfluoroalkyl Sulfonamide | | | | | PFAS - Fluorotelomer Sulfonic Acids | | | PFAS - Sums | | | | | PFAS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | N-Ethyl perfluorooctane sulfonamide (EtFOSA) | N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA) | N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE) | N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE) | N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA) | 4:2 Fluorotelomer sulfonic acid (4:2 FTS) | 6:2 Fluorotelomer Sulfonate (6:2 FTS) | 8:2 Fluorotelomer sulfonic acid (8:2 FTS) | Sum (PFHxS (Total) + PFOS (Total) + PFOA)* | Sum (PFHxS (Total) + PFOS (Total))* | Sum (PFOS (Total) + PFOA (Total))* | Sum of PFAS (n=10)* | Sum of PFAS (n=31)* | Hexafluoropropylene oxide dimer acid (HFPO-DA) | PFNS (68259-12-1) |
| | | | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | ug/L |
| EQL | | | | | | | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.001 | 0 | 0 | 0 | 0 | 0 | 0.001 | 0.001 |
| ADWG 2011 multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | |
| MOH (2018) multiplied by a factor 20 for recreatonal use | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2022) multiplied by a factor of 20 for recreational use | | | | | | | | | | | | | | | | | | | | | |
| PFAS NEMP 2.0 (2022) | | | | | | | | | | | | | | | 2 | 2 | | | | | |
| **Field ID** | **Location Code** | **Area** | **Location Details** | **Sampled Date** | **Matrix** | **Sample Type** | | | | | | | | | | | | | | | |
| CMA_OC 13 | CMA_OC13 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | - | <0.001 | <0.001 |
| CMA_OC 14 | CMA_OC14 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 15 | CMA_OC15 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 16 | CMA_OC16 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 17 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP2 | CMA_OC17 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 18 | CMA_OC18 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 19 | CMA_OC19 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 20 | CMA_OC20 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC21D | CMA_OC21D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.00016 | 0.00016 | 0.00016 | 0.00016 | 0.00016 | <0.001 | <0.001 |
| CMA_OC21S | CMA_OC21S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_22 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | - | <0.001 | <0.001 |
| CMA_OC_DUP3 | CMA_OC22 | Landfill coast | Southern beach - intertidal | 5/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC31 | CMA_OC31 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Deep | CMA_OC32D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC32 Shallow | CMA_OC32S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC33 | CMA_OC33 | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Deep | CMA_OC34D | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC34 Shallow | CMA_OC34S | Landfill coast | Southern beach - intertidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC35 | CMA_OC35 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36D | CMA_OC36D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC36S | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | - | <0.001 | <0.001 |
| CMA_OC DUP 4 | CMA_OC36S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37D | CMA_OC37D | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC37S | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 5 | CMA_OC37S | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC38 | CMA_OC38 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.02 | <0.002 | 0.00045 | 0.00016 | 0.00045 | 0.003 | 0.003 | <0.001 | <0.001 |
| CMA_OC39 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP 7 | CMA_OC39 | Landfill coast | Southern beach - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40D | CMA_OC40D | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_40S | CMA_OC40S | Landfill coast | West - 0 m | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 41 | CMA_OC41 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 42 | CMA_OC42 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 43 | CMA_OC43 | Landfill coast | West - 0 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 44 | CMA_OC44 | Landfill coast | West - 50 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 45 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP11 | CMA_OC45 | Landfill coast | West - 150 m | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 46 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP9 | CMA_OC46 | Landfill coast | West - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 47 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC DUP10 | CMA_OC47 | Landfill coast | West - subtidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 48 | CMA_OC48 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC 49 | CMA_OC49 | Landfill coast | West - subtidal | 30/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC50 | CMA_OC50 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC51 | CMA_OC51 | Landfill coast | Southern beach - subtidal | 29/11/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_52 | CMA_OC52 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC_53 | CMA_OC53 | Landfill coast | Southern beach - subtidal | 5/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_BCK_OC4D | EHS_BCK_OC4D | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.0014 | 0.0014 | 0.00068 | 0.0014 | 0.0014 | <0.001 | <0.001 |
| EHS_BCK_OC4S | EHS_BCK_OC4S | Landfill coast | South - intertidal | 6/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | - | <0.001 | <0.001 |
| EHS_OC 1 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.01 | <0.001 | 0.00011 | 0.00011 | 0.00011 | 0.0018 | 0.0018 | <0.001 | <0.001 |
| CMA_OC DUP15 | EHS_OC1 | Landfill coast | North - intertidal | 30/11/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_OC 2 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.00022 | - | 0.00022 | 0.00022 | 0.00022 | <0.001 | <0.001 |
| CMA_OC DUP16 | EHS_OC2 | Landfill coast | North west - intertidal | 30/11/2022 | OC | Field_D | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | - | <0.001 | <0.001 |
| **REFERENCE SAMPLES** | | | | | | | | | | | | | | | | | | | | | |
| EHS_BCK_OC2D | EHS_BCK_OC2D | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.00089 | 0.00089 | 0.00051 | 0.0014 | 0.002 | <0.001 | <0.001 |
| EHS_BCK_OC2S | EHS_BCK_OC2S | Background | North eastern estuary | 6/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | 0.00051 | <0.001 | <0.001 |
| EHS_BCK_OC3 | EHS_BCK_OC3 | Background | Southern beach east - intertidal | 6/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.0029 | 0.0029 | 0.0027 | 0.0029 | 0.0029 | <0.001 | <0.001 |
| EHS_BCK_SW1 | EHS_BCK_SW1 | Background | Southern beach far east - intertidal | 6/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.001 | 0.001 | 0.00013 | 0.0085 | 0.0089 | <0.001 | <0.001 |
| CMA_CS1_OCD | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | 0.00024 | <0.001 | <0.001 |
| CMA_OC_DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Interlab_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_OC-DUP17 | CMA_CS1_OCD | Background | North eastern estuary | 7/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS1_OCS | CMA_CS1_OCS | Background | North eastern estuary | 7/12/2022 | OC | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS2_OC | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | - | <0.001 | <0.001 |
| CMA_OC_DUP21 | CMA_CS2_OC | Background | North near bridge | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CMA_CS3_OC | CMA_CS3_OC | Background | North west near island | 2/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | 0.01 | <0.001 | 0.00037 | 0.00037 | 0.00037 | 0.01 | 0.01 | <0.001 | <0.001 |
| CMA_CS4_OC | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Normal | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | - | <0.001 | <0.001 |
| CMA_OC_DUP20 | CMA_CS4_OC | Background | Estuary mouth | 2/12/2022 | OC | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

## Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values - off-site samples

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | | | | | Nutrients | | | | Organic Indicators | Metals | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Calcium | Magnesium | Potassium | Sodium | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Total Organic Carbon | Aluminium | Antimony | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Iron | Lead | Lithium | Manganese | Mercury |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | % | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 12.5 | 5 | 5 | 125 | 3 | 2.9 | 5 | 2.4 | 1 | 2 | 0.1 | 2.5 | 0.025 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.125 | 0.025 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | | | | | | | 90 | | | | 300 | | 300 | | | | | 19000 | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | 780 | 2000 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | | | | 80 | | | >10,000 | 400 | 2700 | | | | >10,000 | | 880 | | | 1800 |
| CCME Recreational | | | | | | 400 | | | | | | | | | | | | | | | | | | | 500 | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | <6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | >8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | | 77,000 | | | | | | | | | | | | 55,000 | | 160 | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 600 | 5 | 5.5 | <0.2 | <0.2 | 3530 | 7590 | 350 | 150 | 16.5 | <3 | <5 | <2.5 | <1 | - | 2.1 | 8910 | 0.075 | 4.4 | 16.1 | 0.22 | 1.9 | 0.091 | 8.8 | <0.4 | 8.81 | 5.83 | 6.5 | 9740 | 6.62 | 6.14 | 159 | <0.025 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 260 | 8 | 4.6 | <0.2 | <0.2 | 2030 | 972 | 200 | <130 | 14.9 | <3.1 | 5.82 | <2.6 | <1 | - | 3.3 | 3910 | 0.045 | 8.3 | 5.69 | 0.11 | <1.3 | 0.043 | 4.1 | <0.5 | 4.11 | 1.4 | 1.4 | 6350 | 2.8 | 2 | 91.6 | <0.025 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 1000 | 12 | 5.1 | <0.2 | 0.89 | 3120 | 1860 | 270 | 200 | 20.7 | <3.2 | 14.8 | 6.38 | 1.36 | <2.1 | 8.2 | 16,100 | - | 4 | 12 | 0.28 | 10 | 0.13 | 6.6 | - | - | 1.8 | 8.22 | 5500 | 5 | 4.5 | 252 | <0.025 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 470 | 6 | 6.4 | <0.2 | <0.2 | 11,700 | 3050 | 290 | 230 | 11.1 | <3.2 | <5 | <2.7 | <1 | <2 | 2.7 | 7720 | - | 6.1 | 9.44 | 0.2 | 2 | 0.074 | 6.4 | - | - | 2.91 | 10.6 | 7350 | 8.15 | 5.88 | 125 | <0.025 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | 990 | 9 | 6.3 | <0.2 | 0.22 | 14,100 | 2630 | 240 | 260 | 21.7 | <3.1 | <5 | <2.6 | <1 | <2 | - | 6330 | - | 6.1 | 8.5 | 0.17 | 4.1 | 0.082 | 6.1 | - | - | 2.84 | 9.68 | 7440 | 7.09 | 5.68 | 117 | <0.025 |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 1200 | 7 | 6.8 | <0.2 | <0.2 | 20,800 | 9850 | 240 | 390 | 32.1 | <3.2 | 5.33 | <2.7 | <1 | <2 | 5.1 | 8730 | - | 7.6 | 7.66 | 0.23 | 1.3 | 0.092 | 8.5 | - | - | 6.26 | 5.8 | 8860 | 3.9 | 4.83 | 169 | <0.025 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 1100 | 9 | 7.1 | <0.03 | <0.2 | 22,100 | 1450 | 240 | 420 | 5.8 | <3 | <5 | <2.5 | <1 | <2 | 8.7 | 6840 | - | 9.8 | 6.87 | 0.21 | 1.7 | 0.31 | 5.2 | - | - | 2 | 4.3 | 6860 | 2.2 | 3.96 | 186 | 0.042 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | 340 | 19 | 7 | <0.2 | 0.42 | 11,500 | 1770 | 300 | 220 | 19.3 | <2.9 | 6.52 | <2.4 | <1 | 4.87 | 2.2 | 7860 | - | 6.5 | 14.7 | 0.18 | 3.4 | 0.058 | 6.7 | - | - | 2.54 | 5.2 | 8210 | 3.8 | 6.26 | 117 | <0.025 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 200 | 56 | 3.5 | - | <0.4 | 560 | 250 | 140 | 420 | 238.1 | 26.6 | 5.4 | <2.6 | <1 | - | 4.2 | 917 | - | 0.51 | 2.5 | 0.021 | <1.3 | 0.005 | 1.5 | - | - | 0.12 | 0.59 | 490 | 1.2 | 0.3 | 5.8 | 0.027 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | 120 | 58 | - | - | <0.5 | - | - | - | - | 225.5 | 23.8 | 5.62 | <2.6 | <1 | - | - | 860 | - | 0.46 | 2.2 | 0.023 | <1.3 | <0.005 | 1.7 | - | - | 0.075 | 0.35 | 390 | 1 | 0.29 | - | <0.025 |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 200 | 86 | 3.3 | - | 1.8 | 1100 | 935 | 140 | 750 | 289.7 | 11.6 | 14.5 | <2.6 | <1 | - | 14 | 1840 | - | 0.55 | 3.37 | 0.019 | 2.1 | 0.012 | 4 | - | - | 0.15 | 1.2 | 880 | 3.9 | 0.08 | 3 | 0.041 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 170 | 36 | 3.7 | - | 1.3 | 670 | 260 | 210 | 560 | 310.6 | 15.2 | 16.3 | <2.7 | <1 | - | 7.1 | 2270 | - | 0.9 | 3.87 | 0.035 | 1.4 | 0.018 | 1.6 | - | - | 0.22 | 0.73 | 1320 | 2 | 0.49 | 9.2 | <0.025 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs calculated as per MfE's Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (2011)

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
# Table C1
# NZAS Landfill Soil Human Health Screening Values - off-site samples

| | | | | | | | | | | | | BTEXN | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Molybdenum | Nickel | Titanium | Tin | Vanadium | Zinc | Naphthalene (BTEXN suite) | Benzene | Toluene | Ethylbenzene | Xylene (o) | Xylene (m & p) |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.125 | 0.05 | 0.075 | 0.25 | 0.125 | 0.05 | 0.1 | 0.05 | 0.1 | 0.05 | 0.05 | 0.1 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | 1200 | | | | 30000 | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | |
| CCME Recreational | | | | | | | | | | 130 | | | | | | | |
| CCME pH Low | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | |
| Field_ID | Location_Code | Sample_Depth_Range | Sampled_Date_Time | Location_Type | Sample_Type | | | | | | | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 0.2 | 41.3 | 439 | 0.4 | 24.5 | 50.6 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 0.21 | 3.3 | 270 | <0.25 | 22.6 | 9.39 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | - | 10.4 | 325 | - | 63.5 | 32.8 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | - | 17.8 | 334 | - | 27.1 | 20.5 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | - | 13.8 | 245 | - | 25.3 | 19.9 | - | - | - | - | - | - |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | - | 62.9 | 316 | - | 25.4 | 21.2 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | - | 10.8 | 290 | - | 22.9 | 15.1 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | - | 7.06 | 378 | - | 27 | 17.4 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | - | 0.87 | 104 | - | 2.7 | 2.2 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | - | 0.63 | 98.3 | - | 2.3 | 0.95 | - | - | - | - | - | - |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | - | 3.6 | 29.3 | - | 3.3 | 3.8 | <1.8 | <0.87 | <0.87 | <0.87 | <0.87 | <0.87 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | - | 0.83 | 69.4 | - | 4.8 | 1.5 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 |

| | PAHs - standard 16 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene |
| | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | 7.2/70 | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | |
| CCME Recreational | | | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | |
| Field_ID | | | | | | | | | | | | | | | |
| EHS_S11 | <0.01 | <0.01 | <0.1 - 0.025 | 0.13 - 0.45 | 0.17 - 0.73 | 0.23 | 0.083 - 0.28 | 0.12 - 0.49 | 0.21 - 0.4 | 0.016 - 0.1 | 0.32 - 0.67 | <0.01 | 0.089 - 0.57 | <0.01 | 0.094 - 0.21 |
| EHS_S12 | <0.1 - 0.021 | <0.01 | 0.058 - 0.1 | 0.32 - 0.94 | 0.41 - 1.4 | 0.54 | 0.22 - 0.47 | 0.28 - 0.88 | 0.48 - 1 | 0.043 - 0.19 | 0.75 - 1.2 | <0.01 | 0.24 - 1.1 | <0.01 | 0.22 - 0.33 |
| EHS_S13 | 0.053 - 0.19 | <0.01 | 0.17 - 2.6 | 1.8 - 20 | 2.5 - 20 | 3.2 | 1 - 20 | 1.5 - 19 | 1.7 - 20 | 0.34 - 8.5 | <0.1 - 2.2 | 0.029 - 0.16 | 1.8 - 20 | <0.01 | 0.54 - 16 |
| EHS_S14 | <0.1 - 0.068 | <0.01 | 0.13 - 0.15 | 1.2 - 1.6 | 2 - 2.3 | 2.4 | 0.78 - 0.86 | 1.2 - 1.5 | 1.1 - 1.3 | 0.31 - 0.36 | 1.5 - 1.8 | <0.1 - 0.029 | 1.5 - 1.9 | <0.01 | 0.42 - 0.5 |
| EHS_DUP8 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_S15 | <0.1 - 0.05 | <0.01 | <0.1 - 0.11 | 0.49 - 1 | 0.83 - 1.3 | 1.6 | <0.1 - 0.56 | 0.57 - 0.85 | 0.56 - 0.95 | 0.12 - 0.21 | 0.65 - 1.2 | <0.1 - 0.026 | 0.58 - 1.1 | <0.01 | 0.23 - 0.37 |
| EHS_S16 | <0.1 - 0.011 | <0.01 | <0.1 - 0.026 | 0.24 - 0.38 | 0.33 - 0.66 | 0.4 | 0.13 - 0.28 | 0.21 - 0.44 | 0.21 - 0.42 | <0.1 - 0.055 | 0.29 - 0.55 | <0.01 | 0.27 - 0.55 | <0.01 | 0.098 - 0.16 |
| EHS_S17 | <0.1 - 0.011 | <0.01 | <0.1 - 0.025 | 0.13 - 0.27 | 0.18 - 0.41 | 0.49 | <0.1 - 0.17 | 0.15 - 0.27 | 0.14 - 0.27 | <0.1 - 0.062 | 0.18 - 0.34 | <0.01 | 0.12 - 0.33 | <0.01 | <0.1 - 0.097 |
| EHS-S18 | <0.1 - 0.012 | <0.01 | 0.029 - 0.1 | 0.19 - 0.29 | 0.25 - 0.45 | 0.26 | 0.093 - 0.26 | <0.1 - 0.074 | 0.17 - 0.21 | 0.019 - 0.43 | 0.36 - 0.39 | <0.01 | 0.1 - 0.52 | <0.01 | 0.12 - 0.15 |
| EHS-Dup 3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS-S19 | 0.26 - 0.27 | <0.026 | 0.47 - 0.48 | 3.5 - 3.9 | 5.1 - 5.4 | 5.7 | 2 - 2.2 | 1.6 - 2.6 | 3.5 - 4.3 | 0.47 - 1.8 | 3.8 - 6.1 | 0.13 - 0.28 | 2.2 - 4.5 | <0.24 - 0.03 | 1.5 - 1.9 |
| EHS-S20 | <0.1 - 0.042 | <0.01 | 0.1 - 0.12 | 0.67 - 0.72 | 1.1 - 1.2 | 1.1 | 0.37 - 0.43 | 0.35 - 0.62 | 0.57 - 0.76 | <0.1 - 0.077 | 0.91 - 1.3 | <0.1 - 0.018 | 0.44 - 1 | <0.01 | 0.28 - 0.37 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for asse

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasw

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managi

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managi
Deriving Standards for Contaminants in Soil to Protect Human Health (2011)

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Cor

## Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values - off-site samples

| | | | | | | | | | PAHs - extended | SVOCs | Phthalates |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | Benzo(b)fluoranthene | Dibenzofuran | Bis(2-ethylhexyl) phthalate |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.02 | 0.01 | 0.03 | 0.1 | 0.3 | 0.5 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | 160 | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | |
| NES Recreational | | | | | | | 300 | 300 | | | |
| CCME Recreational | | | | | | | | | | | |
| CCME pH Low | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 0.32 - 0.64 | 0.24 - 1.1 | 0.24 - 1.1 | 0.85 | <0.3 | <0.5 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 0.76 - 1.2 | 0.6 - 2 | 0.6 - 2 | 1.7 | <0.3 | <0.5 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | <0.2 - 2.1 | 3.7 - 37 | 3.7 - 37 | >20 | <0.3 | <0.5 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 1.4 - 1.7 | 2.9 - 3.3 | 2.9 - 3.3 | 2.4 | <0.3 | <0.5 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | - | - | - | - | - | - |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 0.61 - 1.2 | 1.2 - 2 | 1.2 - 2 | 1.1 | <0.3 | <0.5 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 0.26 - 0.51 | 0.5 - 0.9 | 0.5 - 1 | 1.1 | <0.3 | <0.5 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | <0.2 - 0.32 | 0.2 - 0.61 | 0.3 - 0.61 | 0.33 | <0.3 | <0.5 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 0.35 - 0.37 | 0.34 - 1 | 0.34 - 1 | 0.56 | <0.3 | 0.5 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | - | - | - | - | - | - |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 3.5 - 5.8 | 7.4 - 8.8 | 7.4 - 8.8 | 7.4 | 0.34 | 1.5 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 0.87 - 1.3 | 1.5 | 1.5 - 1.6 | 1.3 | <0.3 | <0.5 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for asse

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasw

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managi

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managi
Deriving Standards for Contaminants in Soil to Protect Human Health (2011)

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Cor

# Appendix C
# Table C2
# NZAS Landfill Soil Ecological Screening Values - Off-site samples

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | | | | | Nutrients | | | | Organic Indicators | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Calcium | Magnesium | Potassium | Sodium | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Total Organic Carbon | Aluminium | Antimony | Arsenic |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | % | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 12.5 | 5 | 5 | 125 | 3 | 2.9 | 5 | 2.4 | 1 | 2 | 0.1 | 2.5 | 0.025 | 0.125 |
| ECOSGV - Recreational | | | | | | | | | | | | | | | | | | | | | | | | 58 |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | | | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational | | | | | | 400 | | 6-8 | 0.9 | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 600 | 5 | 5.5 | <0.2 | <0.2 | 3530 | 7590 | 350 | 150 | 16.5 | <3 | <5 | <2.5 | <1 | - | 2.1 | 8910 | 0.075 | 4.4 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 260 | 8 | 4.6 | <0.2 | <0.2 | 2030 | 972 | 200 | <130 | 14.9 | <3.1 | 5.82 | <2.6 | <1 | - | 3.3 | 3910 | 0.045 | 8.3 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 1000 | 12 | 5.1 | <0.2 | 0.89 | 3120 | 1860 | 270 | 200 | 20.7 | <3.2 | 14.8 | 6.38 | 1.36 | <2.1 | 8.2 | 16,100 | - | 4 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 470 | 6 | 6.4 | <0.2 | <0.2 | 11,700 | 3050 | 290 | 230 | 11.1 | <3.2 | <5 | <2.7 | <1 | <2 | 2.7 | 7720 | - | 6.1 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | 990 | 9 | 6.3 | <0.2 | 0.22 | 14,100 | 2630 | 240 | 260 | 21.7 | <3.1 | <5 | <2.6 | <1 | <2 | - | 6330 | - | 6.1 |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 1200 | 7 | 6.8 | <0.2 | <0.2 | 20,800 | 9850 | 240 | 390 | 32.1 | <3.2 | 5.33 | <2.7 | <1 | <2 | 5.1 | 8730 | - | 7.6 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 1100 | 9 | 7.1 | <0.03 | <0.2 | 22,100 | 1450 | 240 | 420 | 5.8 | <3 | <5 | <2.5 | <1 | <2 | 8.7 | 6840 | - | 9.8 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | 340 | 19 | 7 | <0.2 | 0.42 | 11,500 | 1770 | 300 | 220 | 19.3 | <2.9 | 6.52 | <2.4 | <1 | 4.87 | 2.2 | 7860 | - | 6.5 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 200 | 56 | 3.5 | - | <0.4 | 560 | 250 | 140 | 420 | 238.1 | 26.6 | 5.4 | <2.6 | <1 | - | 4.2 | 917 | - | 0.51 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | 120 | 58 | - | - | <0.5 | - | - | - | - | 225.5 | 23.8 | 5.62 | <2.6 | <1 | - | - | 860 | - | 0.46 |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 200 | 86 | 3.3 | - | 1.8 | 1100 | 935 | 140 | 750 | 289.7 | 11.6 | 14.5 | <2.6 | <1 | - | 14 | 1840 | - | 0.55 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 170 | 36 | 3.7 | - | 1.3 | 670 | 260 | 210 | 560 | 310.6 | 15.2 | 16.3 | <2.7 | <1 | - | 7.1 | 2270 | - | 0.9 |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
CCME (1991) Interim Canadian environmental quality criteria for contaminated sites (SQG)
ASC NEPM (2013) - National Envionmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
## Table C2
## NZAS Landfill Soil Ecological Screening Values - Off-site samples

| | | | | | | Metals | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Iron | Lead | Lithium | Manganese | Mercury | Molybdenum | Nickel | Titanium | Tin | Vanadium |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.125 | 0.025 | 0.125 | 0.05 | 0.075 | 0.25 | 0.125 |
| ECOSGV - Recreational | | | | | | | | 15 | 17 | | 130 | 402 | | 430 | | 1284 | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | 12 | | | | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | 21 | | | | | | 50 | | | | | | | | | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | 270 | | | |
| SQG - Recreational | | | | | | 500 | | | | | | | | | | | | | 12 | | | | | 130 |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 16.1 | 0.22 | 1.9 | 0.091 | 8.8 | <0.4 | 8.81 | 5.83 | 6.5 | 9740 | 6.62 | 6.14 | 159 | <0.025 | 0.2 | 41.3 | 439 | 0.4 | 24.5 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 5.69 | 0.11 | <1.3 | 0.043 | 4.1 | <0.5 | 4.11 | 1.4 | 1.4 | 6350 | 2.8 | 2 | 91.6 | <0.025 | 0.21 | 3.3 | 270 | <0.25 | 22.6 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 12 | 0.28 | 10 | 0.13 | 6.6 | - | - | 1.8 | 8.22 | 5500 | 5 | 4.5 | 252 | <0.025 | - | 10.4 | 325 | - | 63.5 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 9.44 | 0.2 | 2 | 0.074 | 6.4 | - | - | 2.91 | 10.6 | 7350 | 8.15 | 5.88 | 125 | <0.025 | - | 17.8 | 334 | - | 27.1 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | 8.5 | 0.17 | 4.1 | 0.082 | 6.1 | - | - | 2.84 | 9.68 | 7440 | 7.09 | 5.68 | 117 | <0.025 | - | 13.8 | 245 | - | 25.3 |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 7.66 | 0.23 | 1.3 | 0.092 | 8.5 | - | - | 6.26 | 5.8 | 8860 | 3.9 | 4.83 | 169 | <0.025 | - | 62.9 | 316 | - | 25.4 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 6.87 | 0.21 | 1.7 | 0.31 | 5.2 | - | - | 2 | 4.3 | 6860 | 2.2 | 3.96 | 186 | 0.042 | - | 10.8 | 290 | - | 22.9 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | 14.7 | 0.18 | 3.4 | 0.058 | 6.7 | - | - | 2.54 | 5.2 | 8210 | 3.8 | 6.26 | 117 | <0.025 | - | 7.06 | 378 | - | 27 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 2.5 | 0.021 | <1.3 | 0.005 | 1.5 | - | - | 0.12 | 0.59 | 490 | 1.2 | 0.3 | 5.8 | 0.027 | - | 0.87 | 104 | - | 2.7 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | 2.2 | 0.023 | <1.3 | <0.005 | 1.7 | - | - | 0.075 | 0.35 | 390 | 1 | 0.29 | - | <0.025 | - | 0.63 | 98.3 | - | 2.3 |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 3.37 | 0.019 | 2.1 | 0.012 | 4 | - | - | 0.15 | 1.2 | 880 | 3.9 | 0.08 | 3 | 0.041 | - | 3.6 | 29.3 | - | 3.3 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 3.87 | 0.035 | 1.4 | 0.018 | 1.6 | - | - | 0.22 | 0.73 | 1320 | 2 | 0.49 | 9.2 | <0.025 | - | 0.83 | 69.4 | - | 4.8 |

**References**

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USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
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**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

## Appendix C
## Table C2
## NZAS Landfill Soil Ecological Screening Values - Off-site samples

| | | | | | | | BTEXN | | | | | | PAHs - standard 16 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Zinc | Naphthalene (BTEXN suite) | Benzene | Toluene | Ethylbenzene | Xylene (o) | Xylene (m & p) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.05 | 0.1 | 0.05 | 0.1 | 0.05 | 0.05 | 0.1 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 |
| ECOSGV - Recreational | | | | | | 298 | | | | | | | | | | | 22 | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | | | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 50.6 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.01 | <0.01 | <0.1 - 0.025 | 0.13 - 0.45 | 0.17 - 0.73 | 0.23 | 0.083 - 0.28 | 0.12 - 0.49 | 0.21 - 0.4 | 0.016 - 0.1 | 0.32 - 0.67 | <0.01 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 9.39 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 - 0.021 | <0.01 | 0.058 - 0.1 | 0.32 - 0.94 | 0.41 - 1.4 | 0.54 | 0.22 - 0.47 | 0.28 - 0.88 | 0.48 - 1 | 0.043 - 0.19 | 0.75 - 1.2 | <0.01 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 32.8 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | 0.053 - 0.19 | <0.01 | 0.17 - 2.6 | 1.8 - 20 | 2.5 - 20 | 3.2 | 1 - 20 | 1.5 - 19 | 1.7 - 20 | 0.34 - 8.5 | <0.1 - 2.2 | 0.029 - 0.16 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 20.5 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 - 0.068 | <0.01 | 0.13 - 0.15 | 1.2 - 1.6 | 2 - 2.3 | 2.4 | 0.78 - 0.86 | 1.2 - 1.5 | 1.1 - 1.3 | 0.31 - 0.36 | 1.5 - 1.8 | <0.1 - 0.029 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | 19.9 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 21.2 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 - 0.05 | <0.01 | <0.1 - 0.11 | 0.49 - 1 | 0.83 - 1.3 | 1.6 | <0.1 - 0.56 | 0.57 - 0.85 | 0.56 - 0.95 | 0.12 - 0.21 | 0.65 - 1.2 | <0.1 - 0.026 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 15.1 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 - 0.011 | <0.01 | <0.1 - 0.026 | 0.24 - 0.38 | 0.33 - 0.66 | 0.4 | 0.13 - 0.28 | 0.21 - 0.44 | 0.21 - 0.42 | <0.1 - 0.055 | 0.29 - 0.55 | <0.01 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | 17.4 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 - 0.011 | <0.01 | <0.1 - 0.025 | 0.13 - 0.27 | 0.18 - 0.41 | 0.49 | <0.1 - 0.17 | 0.15 - 0.27 | 0.14 - 0.27 | <0.1 - 0.062 | 0.18 - 0.34 | <0.01 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 2.2 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 - 0.012 | <0.01 | 0.029 - 0.1 | 0.19 - 0.29 | 0.25 - 0.45 | 0.26 | 0.093 - 0.26 | <0.1 - 0.074 | 0.17 - 0.21 | 0.019 - 0.43 | 0.36 - 0.39 | <0.01 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | 0.95 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 3.8 | <1.8 | <0.87 | <0.87 | <0.87 | <0.87 | <0.87 | 0.26 - 0.27 | <0.026 | 0.47 - 0.48 | 3.5 - 3.9 | 5.1 - 5.4 | 5.7 | 2 - 2.2 | 1.6 - 2.6 | 3.5 - 4.3 | 0.47 - 1.8 | 3.8 - 6.1 | 0.13 - 0.28 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 1.5 | <0.1 | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 - 0.042 | <0.01 | 0.1 - 0.12 | 0.67 - 0.72 | 1.1 - 1.2 | 1.1 | 0.37 - 0.43 | 0.35 - 0.62 | 0.57 - 0.76 | <0.1 - 0.077 | 0.91 - 1.3 | <0.1 - 0.018 |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
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CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
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where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
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## Appendix C
## Table C2
## NZAS Landfill Soil Ecological Screening Values - Off-site samples

| | | | | | | | | | | | | PAHs - extended | | SVOCs | Phthalates |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | Benzo(b)fluoranthene | Dibenzofuran | Bis(2-ethylhexyl) phthalate |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 | 0.1 | 0.3 | 0.5 |
| ECOSGV - Recreational | | | | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | |
| EIL Recreational | | | | | | | 170 | | | 22 | 22 | | | | |
| SQG - Recreational | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 0.089 - 0.57 | <0.01 | 0.094 - 0.21 | 0.32 - 0.64 | 0.24 - 1.1 | 0.24 - 1.1 | <0.01 | 0.85 | <0.3 | <0.5 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 0.24 - 1.1 | <0.01 | 0.22 - 0.33 | 0.76 - 1.2 | 0.6 - 2 | 0.6 - 2 | <0.01 | 1.7 | <0.3 | <0.5 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 1.8 - 20 | <0.01 | 0.54 - 16 | <0.2 - 2.1 | 3.7 - 37 | 3.7 - 37 | <0.01 | >20 | <0.3 | <0.5 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 1.5 - 1.9 | <0.01 | 0.42 - 0.5 | 1.4 - 1.7 | 2.9 - 3.3 | 2.9 - 3.3 | <0.01 | 2.4 | <0.3 | <0.5 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | - | - | - | - | - | - | - | - | - | - |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 0.58 - 1.1 | <0.01 | 0.23 - 0.37 | 0.61 - 1.2 | 1.2 - 2 | 1.2 - 2 | <0.01 | 1.1 | <0.3 | <0.5 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 0.27 - 0.55 | <0.01 | 0.098 - 0.16 | 0.26 - 0.51 | 0.5 - 0.9 | 0.5 - 1 | <0.01 | 1.1 | <0.3 | <0.5 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | 0.12 - 0.33 | <0.01 | <0.1 - 0.097 | <0.2 - 0.32 | 0.2 - 0.61 | 0.3 - 0.61 | <0.01 | 0.33 | <0.3 | <0.5 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 0.1 - 0.52 | <0.01 | 0.12 - 0.15 | 0.35 - 0.37 | 0.34 - 1 | 0.34 - 1 | <0.01 | 0.56 | <0.3 | 0.5 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | - | - | - | - | - | - | - | - | - | - |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 2.2 - 4.5 | <0.24 - 0.03 | 1.5 - 1.9 | 3.5 - 5.8 | 7.4 - 8.8 | 7.4 - 8.8 | <0.026 | 7.4 | 0.34 | 1.5 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 0.44 - 1 | <0.01 | 0.28 - 0.37 | 0.87 - 1.3 | 1.5 | 1.5 - 1.6 | <0.01 | 1.3 | <0.3 | <0.5 |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
CCME (1991) Interim Canadian environmental quality criteria for contaminated sites (SQG)
ASC NEPM (2013) - National Envionmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
# Table C3
# NZAS Landfill Sediment Human Health Screening Values - Off-site samples

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | | | | | Nutrients | | | Organic Indicators | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Calcium | Magnesium | Potassium | Sodium | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Total Organic Carbon | Aluminium | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | % | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 12.5 | 5 | 5 | 125 | 3 | 3 | 5 | 2.4 | 1 | 0.1 | 2.5 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | | | | | 90 | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | 780 | 2000 | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | | 80 | | | >10,000 | 400 | 2700 |
| CCME Recreational | | | | | | 400 | | | | | | | | | | | | | | | | | 500 | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | 77,000 | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | 610 | 69 | 5.3 | <0.2 | 18.7 | - | - | - | - | 87.7 | 58.5 | 10.8 | <2.6 | <1 | 7.4 | 9680 | 5 | 10 | 0.2 | 5.5 | 0.11 | 7.9 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | 230 | 27 | 5.5 | <0.2 | <0.3 | - | - | - | - | 30.6 | 20.7 | <5 | <2.5 | <1 | 1.3 | 5680 | 4.4 | 5.67 | 0.13 | 3 | 0.055 | 5.9 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | 1800 | 91 | 4.7 | <0.2 | 54.8 | - | - | - | - | 522.6 | 2741.1 | 45.5 | <26 | <1 | 45.4 | 12,400 | 17.5 | 16.7 | 0.26 | 23 | 0.25 | 12.7 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | 500 | 31 | 5.6 | <0.03 | <0.3 | - | - | - | - | 37.9 | 270.6 | 8.23 | <2.6 | <1 | 0.77 | 5590 | 8.6 | 11.9 | 0.15 | 2.9 | 0.18 | 6.2 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 6750 | 9.6 | - | 0.17 | 2.8 | 0.22 | 7 |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | 2700 | 94 | 6.2 | <0.2 | 9.66 | 12,800 | 2690 | 966 | 2900 | 878.3 | 227.7 | 23.5 | <2.7 | <1 | 28.2 | 16,600 | 4.6 | 26.1 | 0.56 | 60 | 0.682 | 11 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | 490 | 92 | 5.6 | <0.2 | 4.28 | 2490 | 1710 | 330 | 2200 | 1168.8 | 21.5 | 25.4 | <2.7 | <1 | 25.7 | 4110 | 1.3 | 6.82 | 0.1 | 16 | 0.18 | 3.3 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 5600 | 18 | 6.2 | <0.2 | <0.2 | 2490 | 1640 | 280 | 500 | 44 | 8.5 | <5 | 5.61 | <1 | 0.44 | 7120 | 12 | 5.53 | 0.16 | 12 | 0.032 | 6 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 1600 | 37 | 7.5 | <0.2 | 9.16 | 6260 | 6680 | 340 | 6800 | 160.3 | 20.7 | 29.8 | <2.6 | <1 | 18.8 | 119,000 | 5 | 35.3 | 1.1 | 22 | 0.24 | 18.8 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 1000 | 53 | 5.9 | <0.2 | 5.67 | 2520 | 1810 | 170 | <270 | 30.3 | 24 | <5 | <2.6 | <1 | 6.6 | 72,500 | 8.1 | 57.4 | 0.67 | <2.7 | 1.5 | 18.1 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 140 | 13 | 5.3 | <0.2 | 1.6 | 3040 | 1770 | 250 | 150 | 45.8 | 13 | <5 | <2.5 | <1 | 1.7 | 11,900 | 7.9 | 19.3 | 0.21 | 2.9 | 0.27 | 12.7 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs calculated as per MfE's Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (2011)

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

## Appendix C
## Table C3
## NZAS Landfill Sediment Human Health Screening Values - Off-site samples

| | | | | | | Metals | | | | | | | | | | | | | | | TPH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Chromium (hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Iron | Lead | Lithium | Manganese | Mercury | Molybdenum | Nickel | Titanium | Tin | Vanadium | Zinc | C7-C9 | C10-C14 | C15-C36 | C7-C36 (Total) |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.5 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.125 | 0.025 | 0.125 | 0.05 | 0.075 | 0.25 | 0.125 | 0.05 | 10 | 15 | 25 | 50 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | 300 | | 300 | | | | | 19000 | | | 1200 | | | | 30000 | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | >10,000 | | 880 | | | 1800 | | | | | | | | | | |
| CCME Recreational | | | | | | | | | | | | | | | | | | | 130 | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | 55,000 | | 160 | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | - | - | 2.4 | 5.6 | 8200 | 4.4 | 5.39 | - | 0.044 | - | 7.43 | 281 | - | 26.1 | 27 | <10 | <15 | 1261 | 1261 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | - | - | 2 | 2.6 | 7110 | 3.2 | 5.38 | - | <0.025 | - | 4.7 | 326 | - | 21.4 | 18.7 | <10 | <15 | 189 | 189 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | - | - | 2.1 | 41.2 | 23,800 | 19.3 | 0.8 | - | 0.19 | - | 27.7 | 193 | - | 59.3 | 17.8 | <26 | <41 | 8543 | 8543 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | - | - | 2 | 1.9 | 7470 | 2.2 | 3.93 | - | <0.025 | - | 3 | 419 | - | 23.7 | 16.1 | <10 | <15 | 137 | 137 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | - | 2.2 | 2.3 | - | 2.6 | - | - | 0.031 | - | 3.4 | - | - | 26 | 18 | - | - | - | - |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | 3.36 | 17.6 | 11,100 | 28.7 | 4.5 | 123 | 0.17 | - | 17.5 | 47.3 | - | 50.8 | 67.4 | - | - | - | - |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | 0.91 | 12.2 | 2670 | 41.1 | 1.3 | 11 | 0.12 | - | 5.51 | 125 | - | 53.8 | 26.8 | - | - | - | - |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | <0.5 | 6 | 1.8 | 2.4 | 11,700 | 2.4 | 6.67 | 121 | <0.025 | 0.16 | 3.8 | 333 | <0.25 | 217 | 13.5 | - | - | - | - |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | <0.6 | 18.8 | 4.7 | 46.6 | 8490 | 16.8 | 6.74 | 123 | <0.025 | 2 | 106 | 159 | 2.1 | 69.8 | 273 | - | - | - | - |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | <0.9 | 18.1 | 2.4 | 24.2 | 4820 | 35.3 | 3.61 | 46.5 | <0.053 | 3.2 | 45.3 | 182 | 1.3 | 43.3 | 1130 | - | - | - | - |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | <0.5 | 12.7 | 2.69 | 29.7 | 10,200 | 13.7 | 6.1 | 81.3 | <0.025 | 1.8 | 14 | 321 | 0.97 | 32.6 | 171 | - | - | - | - |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contai

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contai

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial,

## Appendix C
## Table C3
## NZAS Landfill Sediment Human Health Screening Values - Off-site samples

| | | | | | | PAHs - standard 16 | | | | | | | | | | | | | | | | | | PAHs - extended | SVOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | 1-Methylnaphthalene |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 | 0.01 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | 160 | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | 7.2/70 | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | | 300 | 300 | | |
| CCME Recreational | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | 0.15 | <0.011 | 0.31 | 3.2 | 5.9 | 7.2 | 2.3 | 2.6 | 3.6 | 0.6 | 4.2 | 0.076 | 3.1 | 0.018 | 1.2 | 4.2 | 8.1 | 8.1 | <0.011 | <0.011 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | <0.01 | <0.01 | 0.016 | 0.15 | 0.29 | 0.32 | 0.1 | 0.14 | 0.16 | 0.015 | 0.22 | <0.01 | 0.16 | <0.01 | 0.056 | 0.22 | 0.38 | 0.38 | <0.01 | <0.01 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | 0.34 | <0.037 | 0.66 | 7.9 | 13 | 20 | 6.2 | 6.1 | 10 | 1.6 | 11 | 0.2 | 7.3 | <0.037 | 2.7 | 9.5 | 19 | 19 | <0.037 | <0.037 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | <0.01 | <0.01 | 0.033 | 0.25 | 0.46 | 0.51 | 0.17 | 0.19 | 0.25 | 0.017 | 0.43 | <0.01 | 0.23 | <0.01 | 0.1 | 0.44 | 0.6 | 0.6 | <0.01 | <0.01 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | 0.79 | <0.048 | 1.6 | 15 | 20 | 19 | 7.9 | 8 | 11 | 2.1 | 17 | 0.33 | 12 | 0.14 | 5 | 17 | 27 | 27 | 0.07 | <0.048 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | 0.31 | <0.041 | 0.76 | 6.2 | 8 | 8.1 | 3 | 3.8 | 4.8 | 0.89 | 8.4 | 0.15 | 5 | 0.061 | 2.4 | 8 | 11 | 11 | <0.041 | <0.041 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 0.011 | <0.01 | 0.028 | 0.29 | 0.48 | 0.58 | 0.19 | 0.39 | 0.37 | 0.057 | 0.44 | <0.01 | 0.39 | <0.01 | 0.11 | 0.44 | 0.69 | 0.69 | <0.01 | <0.01 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 0.17 | <0.01 | 0.28 | 3.1 | 3.8 | 5.7 | 1.9 | 2.7 | 5.2 | 0.63 | 4.4 | 0.088 | 2.6 | 0.017 | 1.4 | 4.1 | 5.9 | 5.9 | 0.015 | 0.011 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 0.53 | <0.01 | 0.8 | 9.4 | 13 | 17 | 5.4 | 8.7 | 11 | 2.1 | 10 | 0.24 | 9.4 | 0.064 | 3.2 | 10 | 19 | 19 | 0.031 | 0.018 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 0.17 | <0.01 | 0.6 | 4.5 | 6.7 | 7.1 | 2.6 | 5 | 4.9 | 0.71 | 7.9 | 0.081 | 5 | 0.011 | 2.2 | 8 | 9.4 | 9.4 | <0.01 | <0.01 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial
MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and
MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites
NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Conta
NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Conta

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020
CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial,

# Appendix C
## Table C4
## NZAS Landfill Sediment Ecological Screening Criteria - off-site samples

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | | | | | Nutrients | | | Organic Indicators | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Calcium | Magnesium | Potassium | Sodium | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Total Organic Carbon | Aluminium |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | % | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 12.5 | 5 | 5 | 125 | 3 | 3 | 5 | 2.4 | 1 | 0.1 | 2.5 |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV | | | | | | | | | | | | | | | | | | | | | |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high | | | | | | | | | | | | | | | | | | | | | |
| USEPA (2006) | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | 610 | 69 | 5.3 | <0.2 | 18.7 | - | - | - | - | 87.7 | 58.5 | 10.8 | <2.6 | <1 | 7.4 | 9680 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | 230 | 27 | 5.5 | <0.2 | <0.3 | - | - | - | - | 30.6 | 20.7 | <5 | <2.5 | <1 | 1.3 | 5680 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | 1800 | 91 | 4.7 | <0.2 | 54.8 | - | - | - | - | 522.6 | 2741.1 | 45.5 | <26 | <1 | 45.4 | 12,400 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | 500 | 31 | 5.6 | <0.03 | <0.3 | - | - | - | - | 37.9 | 270.6 | 8.23 | <2.6 | <1 | 0.77 | 5590 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 6750 |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | 2700 | 94 | 6.2 | <0.2 | 9.66 | 12,800 | 2690 | 966 | 2900 | 878.3 | 227.7 | 23.5 | <2.7 | <1 | 28.2 | 16,600 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | 490 | 92 | 5.6 | <0.2 | 4.28 | 2490 | 1710 | 330 | 2200 | 1168.8 | 21.5 | 25.4 | <2.7 | <1 | 25.7 | 4110 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 5600 | 18 | 6.2 | <0.2 | <0.2 | 2490 | 1640 | 280 | 500 | 44 | 8.5 | <5 | 5.61 | <1 | 0.44 | 7120 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 1600 | 37 | 7.5 | <0.2 | 9.16 | 6260 | 6680 | 340 | 6800 | 160.3 | 20.7 | 29.8 | <2.6 | <1 | 18.8 | 119,000 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 1000 | 53 | 5.9 | <0.2 | 5.67 | 2520 | 1810 | 170 | <270 | 30.3 | 24 | <5 | <2.6 | <1 | 6.6 | 72,500 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 140 | 13 | 5.3 | <0.2 | 1.6 | 3040 | 1770 | 250 | 150 | 45.8 | 13 | <5 | <2.5 | <1 | 1.7 | 11,900 |

**Notes**

[1] Polycyclic aromatic hydrocarbons, including the 18 parent PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene.

[2] Includes nitrate, nitrite, ammonia and phosphorus

[3] Bioaccumulation and secondary poisoning effects should be considered for this toxicant, based on data presented by ANZG (2018) and/or US EPA (2000).

NA - indicates appropriate published criteria not available

**References**

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality

US EPA (2000) Bioaccumulation Testing And Interpretation For The Purpose Of Sediment Quality Assessment

US EPA (2006) EPA Region III BTAG Marine screening benchmarks 7/2006

# Appendix C
## Table C4
## NZAS Landfill Sediment Ecological Screening Criteria - off-site samples

| | | | | | | Metals | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Iron | Lead | Lithium | Manganese | Mercury |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.5 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.125 | 0.025 |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV | | | | | | 20 | | | | 2 | 80 | | | | 65 | | 50 | | | 0.15 |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high | | | | | | 70 | | | | 25 | 370 | | | | 270 | | 220 | | | 1 |
| USEPA (2006) | | | | | | | | | | | | | | 50 | | 20,000 | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | 5 | 10 | 0.2 | 5.5 | 0.11 | 7.9 | - | - | 2.4 | 5.6 | 8200 | 4.4 | 5.39 | - | 0.044 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | 4.4 | 5.67 | 0.13 | 3 | 0.055 | 5.9 | - | - | 2 | 2.6 | 7110 | 3.2 | 5.38 | - | <0.025 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | 17.5 | 16.7 | 0.26 | 23 | 0.25 | 12.7 | - | - | 2.1 | 41.2 | 23,800 | 19.3 | 0.8 | - | 0.19 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | 8.6 | 11.9 | 0.15 | 2.9 | 0.18 | 6.2 | - | - | 2 | 1.9 | 7470 | 2.2 | 3.93 | - | <0.025 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | 9.6 | - | 0.17 | 2.8 | 0.22 | 7 | - | - | 2.2 | 2.3 | - | 2.6 | - | - | 0.031 |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | 4.6 | 26.1 | 0.56 | 60 | 0.682 | 11 | - | - | 3.36 | 17.6 | 11,100 | 28.7 | 4.5 | 123 | 0.17 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | 1.3 | 6.82 | 0.1 | 16 | 0.18 | 3.3 | - | - | 0.91 | 12.2 | 2670 | 41.1 | 1.3 | 11 | 0.12 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 12 | 5.53 | 0.16 | 12 | 0.032 | 6 | <0.5 | 6 | 1.8 | 2.4 | 11,700 | 2.4 | 6.67 | 121 | <0.025 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 5 | 35.3 | 1.1 | 22 | 0.24 | 18.8 | <0.6 | 18.8 | 4.7 | 46.6 | 8490 | 16.8 | 6.74 | 123 | <0.025 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 8.1 | 57.4 | 0.67 | <2.7 | 1.5 | 18.1 | <0.9 | 18.1 | 2.4 | 24.2 | 4820 | 35.3 | 3.61 | 46.5 | <0.053 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 7.9 | 19.3 | 0.21 | 2.9 | 0.27 | 12.7 | <0.5 | 12.7 | 2.69 | 29.7 | 10,200 | 13.7 | 6.1 | 81.3 | <0.025 |

**Notes**

[1] Polycyclic aromatic hydrocarbons, including the 18 parent PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthra

[2] Includes nitrate, nitrite, ammonia and phosphorus

[3] Bioaccumulation and secondary poisoning effects should be considered for this toxicant, based on data presented by ANZG (2018) and/or US EPA (2000).

NA - indicates appropriate published criteria not available

**References**

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US EPA (2000) Bioaccumulation Testing And Interpretation For The Purpose Of Sediment Quality Assessment

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# Appendix C
## Table C4
## NZAS Landfill Sediment Ecological Screening Criteria - off-site samples

| | | | | | | | | | | | | TPH | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **Molybdenum** | **Nickel** | **Titanium** | **Tin** | **Vanadium** | **Zinc** | **C7-C9** | **C10-C14** | **C15-C36** | **C7-C36 (Total)** | **Acenaphthene** | **Acenaphthylene** | **Anthracene** | **Benz(a)anthracene** | **Benzo(a)pyrene** |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.125 | 0.05 | 0.075 | 0.25 | 0.125 | 0.05 | 10 | 15 | 25 | 50 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV | | | | | | | 21 | | | | 200 | | | | 280 | | | | | |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high | | | | | | | 52 | | | | 410 | | | | 550 | | | | | |
| USEPA (2006) | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | - | 7.43 | 281 | - | 26.1 | 27 | <10 | <15 | 1261 | 1261 | 0.15 | <0.011 | 0.31 | 3.2 | 5.9 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | - | 4.7 | 326 | - | 21.4 | 18.7 | <10 | <15 | 189 | 189 | <0.01 | <0.01 | 0.016 | 0.15 | 0.29 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | - | 27.7 | 193 | - | 59.3 | 17.8 | <26 | <41 | 8543 | 8543 | 0.34 | <0.037 | 0.66 | 7.9 | 13 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | - | 3 | 419 | - | 23.7 | 16.1 | <10 | <15 | 137 | 137 | <0.01 | <0.01 | 0.033 | 0.25 | 0.46 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | 3.4 | - | - | 26 | 18 | - | - | - | - | - | - | - | - | - |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | - | 17.5 | 47.3 | - | 50.8 | 67.4 | - | - | - | - | 0.79 | <0.048 | 1.6 | 15 | 20 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | - | 5.51 | 125 | - | 53.8 | 26.8 | - | - | - | - | 0.31 | <0.041 | 0.76 | 6.2 | 8 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 0.16 | 3.8 | 333 | <0.25 | 217 | 13.5 | - | - | - | - | 0.011 | <0.01 | 0.028 | 0.29 | 0.48 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 2 | 106 | 159 | 2.1 | 69.8 | 273 | - | - | - | - | 0.17 | <0.01 | 0.28 | 3.1 | 3.8 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 3.2 | 45.3 | 182 | 1.3 | 43.3 | 1130 | - | - | - | - | 0.53 | <0.01 | 0.8 | 9.4 | 13 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 1.8 | 14 | 321 | 0.97 | 32.6 | 171 | - | - | - | - | 0.17 | <0.01 | 0.6 | 4.5 | 6.7 |

**Notes**

[1] Polycyclic aromatic hydrocarbons, including the 18 parent PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthra

[2] Includes nitrate, nitrite, ammonia and phosphorus

[3] Bioaccumulation and secondary poisoning effects should be considered for this toxicant, based on data presented by ANZG (2018) and/or US EPA (2000).

NA - indicates appropriate published criteria not available

**References**

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US EPA (2006) EPA Region III BTAG Marine screening benchmarks 7/2006

## Appendix C
## Table C4
## NZAS Landfill Sediment Ecological Screening Criteria - off-site samples

| | | | | | | PAHs - standard 16 | | | | | | | | | | | | | PAHs - extended | SVOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | 1-Methylnaphthalene |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 | 0.01 |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV | | | | | | | | | | | | | | | | | 10 | 10 | | |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high | | | | | | | | | | | | | | | | | 50 | 50 | | |
| USEPA (2006) | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | 7.2 | 2.3 | 2.6 | 3.6 | 0.6 | 4.2 | 0.076 | 3.1 | 0.018 | 1.2 | 4.2 | 8.1 | 8.1 | <0.011 | <0.011 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | 0.32 | 0.1 | 0.14 | 0.16 | 0.015 | 0.22 | <0.01 | 0.16 | <0.01 | 0.056 | 0.22 | 0.38 | 0.38 | <0.01 | <0.01 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | 20 | 6.2 | 6.1 | 10 | 1.6 | 11 | 0.2 | 7.3 | <0.037 | 2.7 | 9.5 | 19 | 19 | <0.037 | <0.037 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | 0.51 | 0.17 | 0.19 | 0.25 | 0.017 | 0.43 | <0.01 | 0.23 | <0.01 | 0.1 | 0.44 | 0.6 | 0.6 | <0.01 | <0.01 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | 19 | 7.9 | 8 | 11 | 2.1 | 17 | 0.33 | 12 | 0.14 | 5 | 17 | 27 | 27 | 0.07 | <0.048 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | 8.1 | 3 | 3.8 | 4.8 | 0.89 | 8.4 | 0.15 | 5 | 0.061 | 2.4 | 8 | 11 | 11 | <0.041 | <0.041 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 0.58 | 0.19 | 0.39 | 0.37 | 0.057 | 0.44 | <0.01 | 0.39 | <0.01 | 0.11 | 0.44 | 0.69 | 0.69 | <0.01 | <0.01 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 5.7 | 1.9 | 2.7 | 5.2 | 0.63 | 4.4 | 0.088 | 2.6 | 0.017 | 1.4 | 4.1 | 5.9 | 5.9 | 0.015 | 0.011 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 17 | 5.4 | 8.7 | 11 | 2.1 | 10 | 0.24 | 9.4 | 0.064 | 3.2 | 10 | 19 | 19 | 0.031 | 0.018 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 7.1 | 2.6 | 5 | 4.9 | 0.71 | 7.9 | 0.081 | 5 | 0.011 | 2.2 | 8 | 9.4 | 9.4 | <0.01 | <0.01 |

**Notes**

[1] Polycyclic aromatic hydrocarbons, including the 18 parent PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthra

[2] Includes nitrate, nitrite, ammonia and phosphorus

[3] Bioaccumulation and secondary poisoning effects should be considered for this toxicant, based on data presented by ANZG (2018) and/or US EPA (2000).

NA - indicates appropriate published criteria not available

**References**

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality

US EPA (2000) Bioaccumulation Testing And Interpretation For The Purpose Of Sediment Quality Assessment

US EPA (2006) EPA Region III BTAG Marine screening benchmarks 7/2006

# Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | Minor ions | Inorganics | | | | | | Unassigned | | Acidity & Alkalinity | Major Ions | | | | | | | | Nutrients | | | | | Organic Indicators |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fluoride | EC/10* (EC/10) | pH (Lab) | Electrical conductivity (lab) | COD | Cyanide (Total) | Cyanide (WAD) | 2-Chlorobiphenyl | Dichlorobiphenyl | Alkalinity (total as CaCO3) | Calcium (Filtered) | Magnesium (Filtered) | Potassium (Filtered) | Sodium (Filtered) | Chloride (Filtered) | Sulfate (Filtered) | Cations Total | Anions Total | Ammoniacal N (Filtered) | Nitrogen (Total Oxidised) (as N) ( | Nitrate (as NO3-) (Filtered) | Nitrite (as NO2-) (Filtered) | Reactive Phosphorus as P (Filter | Carbonaceous Biochemical Oxy |
| | | | | | mg/L | (mS/m)/10 | pH Units | µS/cm | mg/L | mg/L | mg/L | µg/L | µg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | meq/L | meq/L | mg/L | mg/L | mg/L | mg/L | mg/L | g/m3 |
| EQL | | | | | 0.02 | 0.002 | 1 | 0.2 | 10 | 0.001 | 0.001 | 0.01 | 0.01 | 1 | 0.05 | 0.01 | 0.05 | 0.01 | 0.5 | 0.15 | 0.01 | 0.01 | 0.005 | 0.002 | 0.002 | 0.001 | 0.002 | 1 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | 0.014 | 0.014 | | | | | | | | | | | | See Table C.1 | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | 1.1 [3] | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | 200 | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | 0.1 | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | 1.4 | 10.83 | 5.4 | 1080 | 171 | - | <0.001 | - | - | 6 | 9.44 | 24 | 6.14 | 171 | 315 | 56.1 | 10.19 | 10.18 | 0.14 | - | <0.002 | 0.0228 | 0.046 | <1 |
| A19R | A19R | 26/10/2022 | MW | Normal | 0.17 | 6.55 | 7.1 | 655 | 20 | <0.001 | <0.001 | <0.01 | <0.01 | 72.8 | 17.3 | 15.2 | 2.9 | 105 | 146 | 20.6 | 7.56 | 6 | 0.1 | - | 0.0032 | 0.0104 | 0.01 | <1 |
| A20R | A20R | 26/10/2022 | MW | Normal | 11.3 | 8.38 | 7.8 | 838 | 103 | <0.001 | <0.001 | - | - | 218 | 24.3 | 3.84 | 4.5 | 156 | 105 | 36.3 | 8.76 | 8.1 | 3.4 | - | 0.0434 | 0.0217 | <0.002 | <1 |
| A22 | A22 | 27/10/2022 | MW | Normal | 8.1 | 4.47 | 6.1 | 447 | 484 | - | 0.002 | - | - | 37 | 10.3 | 9.35 | 3.5 | 71.5 | 102 | 15 | 4.96 | 3.93 | 2.15 | - | <0.002 | 0.169 | 0.575 | 2.83 |
| A23 | A23 | 28/10/2022 | MW | Normal | 0.13 | 4.77 | 6.4 | 477 | 115 | - | <0.001 | - | - | 26 | 8.28 | 7.97 | 4.2 | 75.4 | 134 | 0.46 | 4.77 | 4.3 | 0.83 | - | 0.0293 | 0.0148 | 0.085 | <1 |
| A24 | A24 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 28/10/2022 | MW | Normal | 41.5 | 31.88 | 8.4 | 3190 | 645 | - | 0.008 | <0.01 | <0.01 | 882 | 14.4 | 3.38 | 46.3 | 617 | 234 | 393 | 35.72 | 32.98 | 89.7 | - | <0.002 | 0.252 | 0.943 | 3.71 |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A30 | A30 | 26/10/2022 | MW | Normal | 70.6 | 11.88 | 7.1 | 1190 | 83 | <0.001 | <0.001 | <0.01 | <0.01 | 97.5 | 6.65 | 1.44 | 6.07 | 247 | 53.7 | 299 | 11.47 | 10.7 | 0.66 | - | 14.2 | 0.0175 | 0.177 | <1 |
| A40 | A40 | 28/10/2022 | MW | Normal | 4.2 | 4.18 | 7 | 418 | 38 | - | <0.001 | <0.01 | <0.01 | 38.6 | 24.2 | 6.12 | 2.7 | 57 | 91 | 20.3 | 4.27 | 3.82 | 0.02 | - | 0.872 | 0.0026 | 0.003 | <1 |
| A41 | A41 | 17/02/2022 | MW | Normal | 0.76 | 4.09 | 6.8 | 409 | 25 | - | <0.001 | - | - | 58.4 | 28.3 | 5.2 | 1 | 51.4 | 75 | 26.7 | 4.1 | 3.95 | 0.009 | - | 1.55 | 0.0013 | <0.002 | <1 |
| A41 | A41 | 13/06/2022 | MW | Normal | 0.32 | 3.53 | 5.6 | 353 | 27 | <0.001 | <0.001 | <0.01 | <0.01 | 2.3 | 6.62 | 5.31 | 0.95 | 52.8 | 81.1 | 21.4 | 3.1 | 2.78 | <0.005 | - | 0.0522 | 0.0018 | <0.002 | <1 |
| A41 | A41 | 22/09/2022 | MW | Normal | 1.2 | 3.99 | 5.9 | 399 | 17 | <0.001 | <0.001 | <0.01 | <0.01 | 3.8 | 8.12 | 6.17 | 1.6 | 60.6 | 101 | 26.7 | 3.59 | 3.47 | <0.005 | - | 0.0286 | 0.0012 | <0.002 | <1 |
| A41 | A41 | 31/10/2022 | MW | Normal | 1.2 | 3.99 | 6.2 | 399 | 21 | - | <0.001 | - | - | 6.3 | 9.9 | 6.53 | 1.1 | 62.1 | 96.5 | 25.8 | 3.76 | 3.39 | <0.005 | - | 0.0357 | <0.001 | <0.002 | <1 |
| A41 | A41 | 2/12/2022 | MW | Normal | 1.2 | 4.01 | 5.7 | 401 | - | <0.001 | <0.001 | <0.01 | <0.01 | 5.3 | 8.64 | 6.53 | 0.98 | 65.3 | 97.6 | 27 | 3.84 | 3.42 | <0.005 | - | 0.0048 | 0.0014 | <0.002 | - |
| A51 | A51 | 25/10/2022 | MW | Normal | 0.4 | 6.12 | 7.6 | 612 | 134 | <0.001 | <0.001 | - | - | 182 | 44.3 | 4.37 | 6.02 | 108 | 79.3 | 42.4 | 7.67 | 6.78 | 0.45 | 0.011 | <0.002 | - | 0.209 | <1 |
| A52 | A52 | 25/10/2022 | MW | Normal | 33.7 | 7.07 | 7.6 | 707 | 86 | <0.001 | <0.001 | - | - | 404 | 85.2 | 8.93 | 12.8 | 529 | 81.7 | 801 | 28.38 | 27.12 | 0.23 | - | 0.17 | 0.0117 | 0.017 | <1 |
| A53 | A53 | 26/10/2022 | MW | Normal | 18.4 | 13.55 | 8.2 | 1360 | 53 | 0.013 | <0.001 | - | - | 439 | 39.5 | 9.2 | 13.7 | 271 | 107 | 82.1 | 14.87 | 14.02 | <0.005 | - | 4.24 | 0.0218 | 0.016 | <1 |
| A54 | A54 | 26/10/2022 | MW | Normal | 23.2 | 20.31 | 8.1 | 2030 | 202 | 0.011 | 0.002 | <0.01 | <0.01 | 480 | 71.2 | 23 | 37 | 344 | 207 | 197 | 22.31 | 20.11 | 12.2 | - | 5.97 | 0.0581 | 0.117 | <1 |
| A54D | A54D | 12/01/2023 | MW | Normal | 60 | - | 8 | 2620 | 827 | - | - | <0.01 | <0.01 | 904 | 29.5 | 2.99 | 25.3 | 447 | 217 | 116 | - | - | 92.6 | - | <0.002 | 0.294 | 1.614 | 4.96 |
| A55 | A55 | 26/10/2022 | MW | Normal | 18.2 | 66.83 | 8.1 | 6680 | 30 | 0.003 | <0.001 | - | - | 271 | 78.8 | 99.3 | 50.3 | 1170 | 1690 | 260 | 64.15 | 58.96 | 0.22 | - | 6.71 | 0.0063 | 0.079 | <1 |
| A55D | A55D | 12/01/2023 | MW | Normal | 24 | - | 8.2 | 1930 | 105 | - | - | - | - | 316 | 20.6 | 11.2 | 20.4 | 352 | 332 | 94.7 | - | - | 10.4 | - | 11.5 | 0.0358 | 0.222 | <1 |
| A56 | A56 | 26/10/2022 | MW | Normal | 8.2 | 350.84 | 7.8 | 35,084 | 1345 | <0.001 | <0.001 | - | - | 154 | 40.9 | 71.8 | 21.8 | 633 | 11,778 | 1520 | 36.06 | 367.14 | 0.02 | - | 2.98 | <0.001 | 0.014 | <1 |
| A57 | A57 | 26/10/2022 | MW | Normal | 4.7 | 490.3 | 7.7 | 49,030 | 173 | <0.001 | <0.001 | - | - | 134 | 39.2 | 105 | 33.2 | 904 | 17,305 | 2290 | 50.76 | 538.46 | <0.005 | - | 0.638 | <0.001 | 0.125 | <1 |
| A58 | A58 | 26/10/2022 | MW | Normal | 0.85 | 340.75 | 7.8 | 34,075 | 109 | <0.001 | <0.001 | - | - | 145 | 46.2 | 79.1 | 24 | 694 | 11,704 | 1490 | 39.62 | 364.03 | <0.005 | - | 1.41 | <0.001 | 0.073 | <1 |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger value for chromium (VI) in marine water waters has been adopted, as the more conservative criterion

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTAG MARINE SCREENING BENCHMARKS 7/2006
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (Marine)
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE MARINE SYSTEMS
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, Environmental Science and Pollution Research, 25: 26592–26602
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine water quality guideline values, Environmental Chemistry 19(3 & 4), 116–131. d
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
# Table C5
# NZAS Landfill Groundwater Ecological Screening Values

| | | | | | Minor ions | Inorganics | | | | | | Unassigned | | Acidity & Alkalinity | Major Ions | | | | | | | | Nutrients | | | | | Organic Indicators |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fluoride | EC/10* (EC/10) | pH (Lab) | Electrical conductivity (lab) | COD | Cyanide (Total) | Cyanide (WAD) | 2-Chlorobiphenyl | Dichlorobiphenyl | Alkalinity (total as CaCO3) | Calcium (Filtered) | Magnesium (Filtered) | Potassium (Filtered) | Sodium (Filtered) | Chloride (Filtered) | Sulfate (Filtered) | Cations Total | Anions Total | Ammoniacal N (Filtered) | Nitrogen (Total Oxidised) (as N) ( | Nitrate (as NO3-) (Filtered) | Nitrite (as NO2-) (Filtered) | Reactive Phosphorus as P (Filter | Carbonaceous Biochemical Oxy |
| | | | | | mg/L | (mS/m)/10 | pH Units | µS/cm | mg/L | mg/L | mg/L | µg/L | µg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | meq/L | meq/L | mg/L | mg/L | mg/L | mg/L | mg/L | g/m3 |
| EQL | | | | | 0.02 | 0.002 | 1 | 0.2 | 10 | 0.001 | 0.001 | 0.01 | 0.01 | 1 | 0.05 | 0.01 | 0.05 | 0.01 | 0.5 | 0.15 | 0.01 | 0.01 | 0.005 | 0.002 | 0.002 | 0.001 | 0.002 | 1 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | 0.014 | 0.014 | | | | | | | | | | | | See Table C.1 | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | 1.1[3] | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | 200 | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | 0.1 | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | 16.8 | - | 7.2 | 1580 | 119 | - | - | - | - | 686 | 31.6 | 11.7 | 18.2 | 350 | 60 | 111 | - | - | <0.005 | - | 4.08 | 0.0046 | 0.01 | <1 |
| A6 | A6 | 27/10/2022 | MW | Normal | 92 | 44.36 | 7.1 | 4440 | 173 | - | 0.002 | <0.01 | <0.01 | 415 | 13 | 7.5 | 22 | 958 | 97.1 | 1500 | 48.23 | 42.33 | 32.2 | - | <0.002 | 0.104 | 0.089 | <1 |
| A60 | A60 | 27/10/2022 | MW | Normal | 325 | 21.79 | 6.4 | 2180 | 164 | - | <0.001 | <0.01 | <0.01 | 54 | 12.1 | 2.56 | 6.1 | 408 | 44.8 | 774 | 19.73 | 18.47 | 1.77 | - | 0.37 | 0.0501 | 0.208 | <1 |
| A61 | A61 | 27/10/2022 | MW | Normal | 0.24 | 5.12 | 7.1 | 512 | 41 | - | <0.001 | - | - | 111 | 23 | 17.5 | 5.65 | 80.9 | 77.4 | 43.9 | 6.3 | 5.36 | 0.48 | - | 0.655 | 0.0973 | 0.007 | <1 |
| A62D | A62D | 11/01/2023 | MW | Normal | 0.9 | - | 6.9 | 912 | 677 | - | - | - | - | 253 | 24.6 | 18.9 | 4.6 | 151 | 149 | 10.6 | - | - | 0.05 | - | <0.002 | 0.0628 | 0.021 | 5.88 |
| A62S | A62S | 28/10/2022 | MW | Normal | 27 | 13.89 | 8 | 1390 | 76 | - | <0.001 | - | - | 528 | 48 | 61.3 | 15.4 | 171 | 124 | 15.5 | 15.56 | 15 | 1.2 | - | 6.89 | 0.127 | 0.008 | 2.65 |
| A62S | A62S | 11/01/2023 | MW | Normal | 19.6 | - | 7.6 | 1400 | 116 | - | - | - | - | 567 | 46.2 | 52.7 | 16.3 | 187 | 138 | 0.37 | - | - | 4.84 | - | 0.0429 | 0.00725 | <0.002 | 12.7 |
| A63 | A63 | 25/10/2022 | MW | Normal | 0.2 | 5.1 | 7.3 | 510 | 26 | <0.001 | <0.001 | - | - | 143 | 13.4 | 11 | 2.7 | 95.6 | 88.6 | 1.11 | 5.93 | 5.4 | 0.45 | - | <0.002 | <0.001 | 0.004 | <1 |
| A64D | A64D | 25/10/2022 | MW | Normal | 0.26 | 7.73 | 7.7 | 773 | 22 | <0.001 | <0.001 | - | - | 173 | 28.9 | 16.6 | 7.22 | 128 | 147 | 23.6 | 8.64 | 8.13 | 0.05 | - | 0.0371 | 0.0563 | <0.002 | <1 |
| A65 | A65 | 27/10/2022 | MW | Normal | 61.9 | 12.49 | 7.6 | 1250 | 53 | - | <0.001 | <0.01 | <0.01 | 249 | 27.6 | 11.9 | 32.5 | 186 | 114 | 141 | 12.47 | 11.23 | 16.1 | - | 1.09 | 0.0238 | 0.039 | <1 |
| A66 | A66 | 27/10/2022 | MW | Normal | 243 | 28.75 | 8.9 | 2880 | 175 | - | 0.003 | - | - | 642 | 4.1 | 1.39 | 30.4 | 446 | 314 | 42.5 | 25.69 | 23.97 | 71.9 | - | <0.002 | 0.0356 | 1.369 | 3.56 |
| A67 | A67 | 27/10/2022 | MW | Normal | 153 | 18.39 | 8 | 1840 | 53 | - | 0.002 | <0.01 | <0.01 | 401 | 2.8 | 14.2 | 19.3 | 345 | 130 | 61.2 | 16.99 | 14.81 | 2.4 | - | 24.1 | 0.162 | 0.083 | <1 |
| A68 | A68 | 27/10/2022 | MW | Normal | 341 | 34.73 | 9.1 | 3470 | 83 | - | 0.002 | - | - | 627 | 2.7 | 0.84 | 30 | 594 | 435 | 36.4 | 31.04 | 28.05 | 58.7 | - | 6.36 | 1.6 | 0.84 | <1 |
| A70 | A70 | 12/01/2023 | MW | Normal | 42.1 | - | 6.9 | 16,700 | 432 | - | - | <0.01 | <0.01 | 203 | 81.4 | 3.33 | 7.14 | 307 | 58.4 | 479 | - | - | 3.09 | - | 0.0056 | 0.0429 | 0.047 | <1 |
| A71 | A71 | 12/01/2023 | MW | Normal | 2.4 | - | 7.6 | 40,100 | 1124 | - | - | - | - | 149 | 321 | 852 | 288 | 8220 | 14,252 | 1990 | - | - | 0.02 | - | 4.82 | <0.001 | 0.059 | <1 |
| A72 | A72 | 11/01/2023 | MW | Normal | 92.9 | - | 7.5 | 1910 | 146 | - | - | <0.01 | <0.01 | 446 | 2.8 | 4.92 | 10.8 | 408 | 83.2 | 30.8 | - | - | 2.81 | - | 49.6 | 9.61 | 0.16 | <1 |
| A7R | A7R | 11/01/2023 | MW | Normal | 211 | - | 9 | 3010 | 102 | - | - | - | - | 632 | 0.69 | 0.41 | 37.6 | 572 | 253 | 47.4 | - | - | 69.1 | - | 0.0058 | 0.015 | 0.734 | 3.89 |
| A8 | A8 | 15/06/2022 | MW | Normal | 7.51 | 3.79 | 6.5 | 379 | 16 | <0.001 | <0.001 | <0.01 | <0.01 | 17 | 15.7 | 5.1 | 1.7 | 51.1 | 70.9 | 19.7 | 3.49 | 2.79 | <0.005 | - | 0.583 | 0.0022 | <0.002 | <1 |
| A8 | A8 | 23/09/2022 | MW | Normal | 9.7 | - | 6.9 | 365 | 32 | <0.001 | <0.001 | <0.01 | <0.01 | 27.6 | 14.3 | 4.83 | 1.8 | 67.3 | 78.9 | 16.1 | 4.1 | 3.15 | <0.005 | - | 0.481 | 0.0028 | 0.003 | <1 |
| A8 | A8 | 27/10/2022 | MW | Normal | 15.4 | 4.43 | 6.8 | 443 | 148 | - | 0.002 | - | - | 42.8 | 8.68 | 4.11 | 2.4 | 95.3 | 96.7 | 24.6 | 5.21 | 4.12 | 0.03 | - | 0.332 | 0.00935 | 0.013 | <1 |
| A8 | A8 | 2/12/2022 | MW | Normal | 10.8 | 4.56 | 6.4 | 456 | - | <0.001 | <0.001 | <0.01 | <0.01 | 32.8 | 7.93 | 3.54 | 2 | 75.3 | 89.1 | 21.9 | 4.07 | 3.64 | 0.02 | - | 0.227 | 0.0104 | 0.011 | - |
| A9 | A9 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 28/10/2022 | MW | Normal | 10.5 | 28.77 | 8.1 | 2880 | 972 | - | 0.006 | <0.01 | <0.01 | 1165 | 10.4 | 2.75 | 23 | 643 | 262 | 29 | 32.88 | 31.69 | 46.1 | - | <0.002 | 0.478 | 0.74 | 3.92 |
| C1R | C1R | 11/01/2023 | MW | Normal | 32.9 | - | 7.5 | 1590 | 265 | - | - | <0.01 | <0.01 | 681 | 37.4 | 11.3 | 19.8 | 277 | 119 | 2.51 | - | - | 39.6 | - | <0.002 | 0.0272 | 0.02 | <1 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | 0.17 | 29.28 | 7.2 | 2930 | 131 | - | <0.001 | <0.01 | <0.01 | 299 | 66.3 | 63.2 | 14.1 | 406 | 780 | 33.6 | 27.34 | 28.75 | 11 | - | 0.784 | 0.0027 | <0.002 | <1 |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | 21.9 | - | 7.4 | 2050 | 405 | - | - | <0.01 | <0.01 | 770 | 8.3 | 12 | 12.6 | 469 | 175 | 72.8 | - | - | 10.1 | - | 1.07 | 0.189 | 0.593 | <1 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | 35.6 | 20 | 7.7 | 2000 | 44 | 0.01 | <0.001 | <0.01 | <0.01 | 822 | 20.6 | 8.74 | 16.4 | 464 | 61.4 | 137 | 22.34 | 21.59 | <0.005 | - | 6.05 | 0.142 | 0.034 | <1 |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | <0.01 | <0.01 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| T1A | T1A | 27/10/2022 | MW | Normal | 3.8 | 8.45 | 7.8 | 845 | 20 | - | <0.001 | - | - | 154 | 72 | 7.19 | 6.99 | 111 | 73.4 | 31.7 | 9.18 | 8.5 | <0.005 | - | 37.3 | <0.001 | <0.002 | <1 |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger value for chromium (VI) in marine water waters has been adopted, as the more conservative criterion

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

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ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
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HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | Metals | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Aluminium | Aluminium (Filtered) | Arsenic | Arsenic (Filtered) | Barium | Barium (Filtered) | Beryllium | Beryllium (Filtered) | Boron | Boron (Filtered) | Cadmium | Cadmium (Filtered) | Chromium (III+VI) | Chromium (III+VI) (Filtered) |
| | | | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | | 0.003 | 0.003 | 0.0005 | 0.0005 | 0.0001 | 0.0002 | 0.00001 | 0.00001 | 0.005 | 0.01 | 0.00002 | 0.00002 | 0.0002 | 0.0002 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | 0.036[1] | 0.036[1] | 0.085[1, 2] | 0.085[1, 2] |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | 5.1 | 5.1 | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | 0.00066[4] | 0.00066[4] | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | 0.202 | 0.202 | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | 0.048 | 0.048 | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | 3.32 | 2.99 | 0.0047 | 0.0045 | 0.0094 | 0.009 | 0.000082 | 0.000085 | 0.1 | 0.093 | 0.00004 | 0.000035 | 0.0028 | 0.0027 |
| A19R | A19R | 26/10/2022 | MW | Normal | 0.27 | 0.138 | 0.002 | 0.0023 | 0.0246 | 0.0243 | 0.000014 | 0.000016 | 0.047 | 0.047 | <0.00002 | <0.00002 | 0.0011 | 0.00054 |
| A20R | A20R | 26/10/2022 | MW | Normal | 32.5 | 3.11 | 0.0047 | 0.0013 | 0.217 | 0.076 | 0.00088 | 0.00014 | 0.44 | 0.42 | 0.0001 | 0.000037 | 0.026 | 0.0013 |
| A22 | A22 | 27/10/2022 | MW | Normal | 6.24 | 2.99 | 0.0035 | 0.0025 | 0.018 | 0.0139 | 0.00011 | 0.000074 | 0.074 | 0.068 | 0.00018 | 0.000099 | 0.012 | 0.0024 |
| A23 | A23 | 28/10/2022 | MW | Normal | 1.27 | 0.954 | <0.0005 | <0.0005 | 0.007 | 0.0059 | 0.000055 | 0.000047 | 0.061 | 0.048 | <0.00002 | <0.00002 | 0.004 | 0.0031 |
| A24 | A24 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 28/10/2022 | MW | Normal | 21.8 | 14.8 | <0.0005 | 0.036 | 0.054 | 0.0516 | 0.00174 | 0.00158 | 4.81 | 4.43 | 0.000034 | 0.000062 | 0.0743 | 0.0756 |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | 20 | - | 0.038 | - | - | - | 0.00176 | - | 4.4 | - | 0.000039 | - | 0.0777 | - |
| A30 | A30 | 26/10/2022 | MW | Normal | 31.1 | 35.3 | 0.0049 | 0.0033 | 0.0068 | 0.0057 | 0.00311 | 0.00311 | 0.053 | 0.051 | 0.00031 | 0.0003 | 0.0046 | 0.0037 |
| A40 | A40 | 28/10/2022 | MW | Normal | 2.34 | 1.64 | 0.0013 | 0.00072 | 0.0077 | 0.0067 | 0.000068 | 0.000046 | 0.11 | 0.085 | <0.00002 | <0.00002 | 0.00083 | 0.00051 |
| A41 | A41 | 17/02/2022 | MW | Normal | - | 0.298 | - | <0.0005 | - | - | - | 0.000015 | - | 0.038 | - | <0.00002 | - | 0.00035 |
| A41 | A41 | 13/06/2022 | MW | Normal | 1.65 | 1.57 | 0.00077 | <0.0005 | 0.0036 | 0.0028 | 0.00005 | 0.000043 | 0.029 | 0.026 | <0.00002 | <0.00002 | 0.0014 | 0.00063 |
| A41 | A41 | 22/09/2022 | MW | Normal | 1.76 | 1.8 | <0.0005 | <0.0005 | 0.0033 | 0.0034 | 0.000044 | 0.000048 | 0.036 | 0.038 | <0.00002 | 0.00002 | 0.00062 | 0.00043 |
| A41 | A41 | 31/10/2022 | MW | Normal | 1.52 | 1.37 | <0.0005 | <0.0005 | 0.0033 | 0.0033 | 0.000036 | 0.000039 | 0.027 | 0.024 | <0.00002 | <0.00002 | <0.0002 | 0.00056 |
| A41 | A41 | 2/12/2022 | MW | Normal | 2.19 | 1.59 | <0.0005 | <0.0005 | 0.0037 | 0.0028 | 0.000047 | 0.000049 | <0.005 | 0.045 | <0.00002 | <0.00002 | 0.0016 | 0.00039 |
| A51 | A51 | 25/10/2022 | MW | Normal | 1.68 | 1.65 | 0.0019 | 0.0018 | 0.0062 | 0.0054 | 0.00016 | 0.00014 | 0.13 | 0.13 | <0.00002 | <0.00002 | 0.0066 | 0.0053 |
| A52 | A52 | 25/10/2022 | MW | Normal | 5.8 | 5.88 | 0.0018 | 0.0022 | 0.0015 | 0.0027 | 0.00038 | 0.00035 | 0.47 | 0.43 | 0.000028 | 0.000055 | 0.004 | 0.0039 |
| A53 | A53 | 26/10/2022 | MW | Normal | 1.31 | 1.38 | 0.0025 | 0.0025 | 0.0051 | 0.0048 | 0.000098 | 0.00011 | 1.55 | 1.43 | <0.00002 | 0.000032 | 0.003 | 0.0027 |
| A54 | A54 | 26/10/2022 | MW | Normal | 2.94 | 2.59 | 0.0092 | 0.0071 | 0.0191 | 0.0169 | 0.00029 | 0.00029 | 2.13 | 2.03 | 0.00006 | 0.000044 | 0.017 | 0.012 |
| A54D | A54D | 12/01/2023 | MW | Normal | 20.9 | 18.1 | 0.0557 | 0.048 | 0.0743 | 0.0682 | 0.00185 | 0.00174 | 4.5 | 4.44 | 0.000074 | 0.00012 | 0.0994 | 0.0785 |
| A55 | A55 | 26/10/2022 | MW | Normal | 0.13 | 0.114 | 0.0057 | 0.0058 | 0.0101 | 0.0091 | 0.000017 | 0.000018 | 1.27 | 1.21 | <0.00002 | 0.000023 | 0.00078 | 0.00056 |
| A55D | A55D | 12/01/2023 | MW | Normal | 12.1 | 0.588 | 0.028 | 0.018 | 0.0723 | 0.0288 | 0.00032 | 0.000076 | 2.73 | 2.63 | 0.00015 | 0.000045 | 0.012 | 0.0024 |
| A56 | A56 | 26/10/2022 | MW | Normal | 0.073 | 0.117 | 0.0032 | 0.0034 | 0.051 | 0.0589 | <0.00001 | 0.00003 | 2.16 | 2.61 | 0.00015 | 0.00014 | 0.00065 | 0.0036 |
| A57 | A57 | 26/10/2022 | MW | Normal | 0.017 | 0.012 | 0.0087 | 0.01 | 0.0237 | 0.0264 | <0.00001 | <0.00001 | 3.48 | 3.89 | 0.00013 | 0.0002 | <0.0002 | <0.0002 |
| A58 | A58 | 26/10/2022 | MW | Normal | 0.016 | 0.011 | 0.0087 | 0.0093 | 0.0789 | 0.0874 | <0.00001 | <0.00001 | 2.02 | 2.32 | 0.000054 | 0.000057 | <0.0002 | 0.00026 |

| | | | | | Metals | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Cobalt | Cobalt (Filtered) | Copper | Copper (Filtered) | Iron | Iron (Filtered) | Lead | Lead (Filtered) | Lithium | Lithium (Filtered) | Manganese (Filtered) | Mercury | Mercury (Filtered) | Nickel | Nickel (Filtered) | Titanium | Titanium (Filtered) | Vanadium | Vanadium (Filtered) | Zinc | Zinc (Filtered) |
| | | | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | | 0.00001 | 0.00001 | 0.0002 | 0.0002 | 0.005 | 0.005 | 0.00005 | 0.00005 | 0.00001 | 0.00001 | 0.0005 | 0.0001 | 0.00008 | 0.0002 | 0.0002 | 0.002 | 0.002 | 0.0005 | 0.0005 | 0.003 | 0.001 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | 0.15[1] | 0.15[1] | 0.008[1] | 0.008[1] | | | 0.012[1] | 0.012[1] | | | | 0.0014[1] | 0.0014[1] | 0.56[1] | 0.56[1] | | | 0.28 | 0.28 | 0.021 | 0.021 |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | 0.08 | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | 0.00171 | 0.0015 | 0.0017 | 0.0016 | 3.18 | 3.09 | 0.00044 | 0.00019 | 0.0088 | 0.00824 | 0.026 | <0.0001 | <0.00008 | 0.0025 | 0.0024 | 0.041 | 0.032 | 0.013 | 0.011 | 0.023 | 0.014 |
| A19R | A19R | 26/10/2022 | MW | Normal | 0.00344 | 0.00364 | 0.0044 | 0.0032 | 19.9 | 21.4 | 0.00033 | 0.00017 | 0.00315 | 0.00297 | 0.346 | <0.0001 | <0.00008 | 0.0041 | 0.0039 | 0.014 | <0.002 | 0.0025 | 0.0022 | 0.022 | 0.038 |
| A20R | A20R | 26/10/2022 | MW | Normal | 0.0119 | 0.00194 | 0.0407 | 0.016 | 30.1 | 2.35 | 0.00788 | 0.00016 | 0.0508 | 0.0226 | 0.398 | <0.0001 | <0.00008 | 0.0388 | 0.0087 | 1.37 | 0.0622 | 0.107 | 0.0066 | 0.049 | 0.0078 |
| A22 | A22 | 27/10/2022 | MW | Normal | 0.00361 | 0.00105 | 0.012 | 0.0051 | 12.4 | 8.88 | 0.0031 | 0.00083 | 0.09 | 0.0786 | 0.0843 | <0.0001 | <0.00008 | 0.014 | 0.0054 | 0.164 | 0.033 | 0.024 | 0.016 | 0.012 | 0.01 |
| A23 | A23 | 28/10/2022 | MW | Normal | 0.0002 | 0.00011 | 0.00064 | 0.00023 | 7.7 | 7.21 | 0.002 | <0.00005 | 0.00439 | 0.00393 | 0.0543 | <0.0001 | <0.00008 | 0.00038 | <0.0002 | 0.0503 | 0.029 | 0.013 | 0.011 | 0.0037 | 0.0075 |
| A24 | A24 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 28/10/2022 | MW | Normal | <0.00001 | 0.001 | <0.0002 | 0.0064 | 8.27 | 8.48 | 0.0032 | 0.0025 | 0.00046 | 0.00041 | 0.044 | <0.0001 | 0.0011 | <0.0002 | 0.0042 | <0.002 | 0.619 | 0.0016 | 0.276 | <0.003 | 0.02 |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | 0.00139 | - | 0.0035 | - | - | - | 0.0031 | - | - | - | - | <0.0001 | - | 0.0048 | - | - | - | 0.283 | - | 0.0062 | - |
| A30 | A30 | 26/10/2022 | MW | Normal | 0.00133 | 0.00112 | 0.0032 | 0.0022 | 4.03 | 2.58 | 0.0015 | 0.0005 | 0.00285 | 0.00271 | 0.0725 | <0.0001 | <0.00008 | 0.241 | 0.228 | 0.106 | 0.0667 | 0.017 | 0.014 | 0.0074 | 0.0071 |
| A40 | A40 | 28/10/2022 | MW | Normal | 0.00025 | 0.00017 | 0.0029 | 0.0021 | 0.48 | 0.2 | 0.00027 | <0.00005 | 0.00078 | 0.00061 | 0.004 | <0.0001 | <0.00008 | 0.0012 | 0.00092 | 0.018 | 0.0087 | 0.004 | 0.0044 | 0.0075 | 0.0063 |
| A41 | A41 | 17/02/2022 | MW | Normal | - | 0.00021 | - | 0.0014 | - | 0.066 | - | <0.00005 | - | - | 0.0019 | - | <0.00008 | - | 0.00058 | - | - | - | <0.0005 | - | 0.0027 |
| A41 | A41 | 13/06/2022 | MW | Normal | 0.00039 | 0.00036 | 0.0018 | 0.0011 | 0.3 | 0.13 | 0.00039 | 0.00012 | 0.00053 | 0.00049 | 0.009 | <0.0001 | <0.00008 | 0.00086 | 0.00059 | 0.0064 | 0.0024 | <0.0005 | <0.0005 | 0.011 | 0.0057 |
| A41 | A41 | 22/09/2022 | MW | Normal | 0.00029 | 0.00025 | 0.00086 | 0.00072 | 0.1 | 0.067 | <0.00005 | <0.00005 | 0.0005 | 0.00048 | 0.0034 | <0.0001 | <0.00008 | 0.00034 | <0.0002 | <0.002 | <0.002 | <0.0005 | <0.0005 | <0.003 | 0.0027 |
| A41 | A41 | 31/10/2022 | MW | Normal | 0.00032 | 0.0003 | 0.00088 | 0.00068 | 0.1 | 0.089 | <0.00005 | <0.00005 | 0.00056 | 0.0005 | 0.0026 | <0.0001 | <0.00008 | 0.00044 | 0.00039 | <0.002 | <0.002 | <0.0005 | <0.0005 | <0.003 | 0.0014 |
| A41 | A41 | 2/12/2022 | MW | Normal | 0.00035 | 0.00033 | 0.00096 | 0.00081 | 0.13 | 0.069 | <0.00005 | <0.00005 | 0.00072 | 0.00063 | 0.0028 | <0.0001 | <0.00008 | 0.00051 | 0.00028 | <0.002 | <0.002 | <0.0005 | 0.00074 | <0.003 | 0.0011 |
| A51 | A51 | 25/10/2022 | MW | Normal | 0.00022 | 0.00016 | 0.0004 | <0.0002 | 6.21 | 6.12 | <0.00005 | <0.00005 | 0.00066 | 0.00066 | 0.11 | <0.0001 | <0.00008 | 0.00068 | 0.00049 | 0.0575 | 0.036 | 0.044 | 0.042 | 0.008 | 0.0016 |
| A52 | A52 | 25/10/2022 | MW | Normal | 0.00026 | 0.00024 | 0.0013 | 0.0017 | 0.903 | 0.675 | 0.00056 | <0.00005 | 0.00342 | 0.00346 | 0.0683 | <0.0001 | <0.00008 | 0.0031 | 0.0032 | 0.013 | 0.011 | 0.006 | 0.0053 | <0.003 | 0.0049 |
| A53 | A53 | 26/10/2022 | MW | Normal | 0.00032 | 0.00027 | 0.0042 | 0.0038 | 0.38 | 0.31 | <0.00005 | <0.00005 | 0.0036 | 0.00335 | 0.0083 | <0.0001 | <0.00008 | 0.0018 | 0.0019 | 0.0091 | 0.0058 | 0.0071 | 0.0065 | <0.003 | 0.0016 |
| A54 | A54 | 26/10/2022 | MW | Normal | 0.00149 | 0.00112 | 0.0077 | 0.0051 | 3.04 | 1.95 | 0.00072 | 0.00026 | 0.00452 | 0.00391 | 0.029 | <0.0001 | <0.00008 | 0.0051 | 0.0043 | 0.0774 | 0.046 | 0.04 | 0.035 | <0.003 | 0.0067 |
| A54D | A54D | 12/01/2023 | MW | Normal | 0.00227 | 0.00159 | 0.0093 | 0.0045 | 16.8 | 16.2 | 0.0107 | 0.00739 | 0.00232 | 0.00191 | 0.0937 | <0.0001 | <0.00008 | 0.012 | 0.0096 | 0.734 | 0.466 | 0.412 | 0.35 | 0.013 | 0.011 |
| A55 | A55 | 26/10/2022 | MW | Normal | 0.00024 | 0.00021 | 0.0016 | 0.0012 | 0.11 | 0.0086 | <0.00005 | <0.00005 | 0.013 | 0.0125 | 0.0015 | <0.0001 | <0.00008 | 0.0013 | 0.0011 | <0.002 | 0.0029 | 0.0046 | 0.0041 | <0.003 | <0.001 |
| A55D | A55D | 12/01/2023 | MW | Normal | 0.0069 | 0.00189 | 0.227 | 0.079 | 9 | 0.791 | 0.0047 | 0.00041 | 0.00904 | 0.00448 | 0.023 | 0.00084 | 0.00073 | 0.0288 | 0.018 | 0.228 | 0.018 | 0.11 | 0.0504 | 0.12 | 0.02 |
| A56 | A56 | 26/10/2022 | MW | Normal | 0.00019 | 0.00024 | 0.0007 | 0.00033 | 0.1 | <0.005 | <0.00005 | <0.00005 | 0.0532 | 0.0644 | <0.0005 | <0.0001 | <0.00008 | 0.0014 | 0.00074 | <0.002 | <0.002 | 0.0017 | 0.0052 | <0.003 | <0.001 |
| A57 | A57 | 26/10/2022 | MW | Normal | 0.00024 | 0.00017 | 0.0011 | 0.0003 | 0.079 | <0.005 | 0.00018 | <0.00005 | 0.143 | 0.155 | <0.0005 | <0.0001 | <0.00008 | 0.0012 | 0.00066 | <0.002 | <0.002 | 0.0019 | 0.0046 | <0.003 | <0.001 |
| A58 | A58 | 26/10/2022 | MW | Normal | 0.000085 | 0.000084 | 0.0017 | 0.00066 | 0.11 | <0.005 | 0.00039 | <0.00005 | 0.0659 | 0.0737 | <0.0005 | <0.0001 | <0.00008 | 0.001 | 0.00069 | <0.002 | <0.002 | <0.0005 | 0.003 | <0.003 | <0.001 |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | Metals | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | **Aluminium** | **Aluminium (Filtered)** | **Arsenic** | **Arsenic (Filtered)** | **Barium** | **Barium (Filtered)** | **Beryllium** | **Beryllium (Filtered)** | **Boron** | **Boron (Filtered)** | **Cadmium** | **Cadmium (Filtered)** | **Chromium (III+VI)** | **Chromium (III+VI) (Filtered)** | **Cobalt** | **Cobalt (Filtered)** | **Copper** | **Copper (Filtered)** | **Iron** | **Iron (Filtered)** | **Lead** | **Lead (Filtered)** | **Lithium** | **Lithium (Filtered)** | **Manganese (Filtered)** | **Mercury** | **Mercury (Filtered)** | **Nickel** | **Nickel (Filtered)** | **Titanium** | **Titanium (Filtered)** | **Vanadium** | **Vanadium (Filtered)** | **Zinc** | **Zinc (Filtered)** |
| | | | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | | 0.003 | 0.003 | 0.0005 | 0.0005 | 0.0001 | 0.0002 | 0.00001 | 0.00001 | 0.005 | 0.01 | 0.00002 | 0.00002 | 0.0002 | 0.0002 | 0.00001 | 0.00001 | 0.0002 | 0.0002 | 0.005 | 0.005 | 0.00005 | 0.00005 | 0.00001 | 0.00001 | 0.0005 | 0.0001 | 0.00008 | 0.0002 | 0.0002 | 0.002 | 0.002 | 0.0005 | 0.0005 | 0.003 | 0.001 |
| ANZG (2018) - MW - 80%  species protection (updated 1/10/2021) | | | | | | | | | | | | | | | 0.036[1] | 0.036[1] | 0.085[1, 2] | 0.085[1, 2] | 0.15[1] | 0.15[1] | 0.008[1] | 0.008[1] | | | 0.012[1] | 0.012[1] | | | | 0.0014[1] | 0.0014[1] | 0.56[1] | 0.56[1] | | | 0.28 | 0.28 | 0.021 | 0.021 |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 0.08 | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | 5.1 | 5.1 | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | 0.00066[4] | 0.00066[4] | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | 0.202 | 0.202 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | 0.048 | 0.048 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | 2.88 | 2.96 | 0.0025 | 0.0023 | 0.0048 | 0.0045 | 0.00019 | 0.00017 | 0.794 | 0.719 | 0.00005 | 0.000052 | 0.0034 | 0.0027 | 0.00042 | 0.00035 | 0.0022 | 0.0018 | 0.506 | 0.38 | 0.00012 | 0.000067 | 0.0144 | 0.0127 | 0.017 | <0.0001 | <0.00008 | 0.0016 | 0.0014 | 0.01 | 0.01 | 0.0085 | 0.0078 | <0.003 | 0.0056 |
| A6 | A6 | 27/10/2022 | MW | Normal | 23.3 | 22.9 | 0.011 | 0.009 | 0.0122 | 0.01 | 0.00078 | 0.00072 | 0.565 | 0.584 | <0.00002 | <0.00002 | 0.0068 | 0.0071 | 0.00047 | 0.00023 | 0.00059 | 0.00022 | 54.3 | 60.6 | 0.00032 | <0.00005 | 0.0203 | 0.0178 | 7.69 | <0.0001 | <0.00008 | 0.0015 | 0.0012 | 0.046 | 0.048 | 0.02 | 0.021 | <0.003 | 0.0068 |
| A60 | A60 | 27/10/2022 | MW | Normal | 66.4 | 50.4 | 0.013 | 0.013 | 0.0107 | 0.0091 | 0.00157 | 0.00143 | 0.074 | 0.068 | 0.000086 | 0.000085 | 0.0046 | 0.0042 | 0.00898 | 0.00837 | 0.003 | 0.0016 | 20 | 20.5 | 0.00059 | 0.000081 | 0.00117 | 0.00096 | 3.75 | <0.0001 | <0.00008 | 0.182 | 0.166 | 0.0996 | 0.0782 | 0.021 | 0.019 | 0.012 | 0.022 |
| A61 | A61 | 27/10/2022 | MW | Normal | 1.98 | 0.372 | 0.00078 | 0.00062 | 0.0533 | 0.0477 | 0.000071 | 0.000045 | 0.035 | 0.033 | <0.00002 | <0.00002 | 0.0015 | 0.0012 | 0.00428 | 0.004 | 0.0031 | 0.0025 | 0.44 | 0.11 | 0.00043 | <0.00005 | 0.00203 | 0.00156 | 0.402 | <0.0001 | <0.00008 | 0.005 | 0.0045 | 0.04 | 0.011 | 0.003 | 0.0018 | 0.01 | 0.012 |
| A62D | A62D | 11/01/2023 | MW | Normal | 16 | 7.55 | 0.0081 | 0.0049 | 0.154 | 0.0896 | 0.00059 | 0.00034 | 0.34 | 0.3 | 0.00012 | 0.000059 | 0.0228 | 0.011 | 0.0111 | 0.00606 | 0.0787 | 0.0213 | 26.6 | 24 | 0.00693 | 0.0026 | 0.0172 | 0.0112 | 0.88 | <0.0001 | <0.00008 | 0.0218 | 0.0099 | 0.606 | 0.0822 | 0.115 | 0.0791 | 0.084 | 0.04 |
| A62S | A62S | 28/10/2022 | MW | Normal | 0.74 | 0.398 | 0.002 | 0.0021 | 0.0772 | 0.0748 | 0.00013 | 0.00012 | 0.41 | 0.38 | 0.00002 | <0.00002 | 0.0019 | 0.0011 | 0.00709 | 0.00622 | 0.0028 | 0.001 | 2.4 | 1.85 | 0.0006 | <0.00005 | 0.0602 | 0.0547 | 3.31 | <0.0001 | <0.00008 | 0.0097 | 0.0082 | 0.033 | 0.018 | 0.0051 | 0.0042 | 0.014 | 0.0083 |
| A62S | A62S | 11/01/2023 | MW | Normal | 0.69 | 0.578 | 0.0045 | 0.0041 | 0.105 | 0.0978 | 0.00045 | 0.00039 | 0.69 | 0.665 | <0.00002 | 0.000033 | 0.0021 | 0.0017 | 0.00382 | 0.00376 | 0.00052 | 0.00023 | 12 | 13.3 | 0.00013 | 0.000054 | 0.0584 | 0.053 | 4.76 | <0.0001 | <0.00008 | 0.005 | 0.0051 | 0.012 | 0.0077 | 0.0034 | 0.0028 | <0.003 | <0.001 |
| A63 | A63 | 25/10/2022 | MW | Normal | 5.67 | 0.728 | 0.0015 | 0.0013 | 0.0384 | 0.0284 | 0.00017 | 0.000079 | 0.064 | 0.061 | 0.000048 | 0.000037 | 0.0059 | 0.00098 | 0.00821 | 0.00469 | 0.0408 | 0.0235 | 11.9 | 2.41 | 0.0011 | 0.0003 | 0.00427 | 0.00257 | 0.432 | <0.0001 | <0.00008 | 0.0075 | 0.0026 | 0.305 | 0.0092 | 0.101 | 0.026 | 0.029 | 0.017 |
| A64D | A64D | 25/10/2022 | MW | Normal | 1.14 | 0.654 | 0.0018 | 0.0018 | 0.127 | 0.11 | 0.000051 | 0.000045 | 0.15 | 0.14 | <0.00002 | 0.000023 | 0.0011 | 0.00079 | 0.00681 | 0.00637 | 0.016 | 0.018 | 2.49 | 1.98 | 0.00047 | 0.00064 | 0.0109 | 0.00991 | 0.557 | <0.0001 | <0.00008 | 0.0072 | 0.0067 | 0.044 | 0.023 | 0.006 | 0.0045 | 0.025 | 0.031 |
| A65 | A65 | 27/10/2022 | MW | Normal | 2.79 | 3.08 | 0.0054 | 0.0056 | 0.0099 | 0.0095 | 0.000093 | 0.000099 | 0.988 | 1.17 | <0.00002 | 0.000027 | 0.0012 | 0.0013 | 0.0022 | 0.00209 | 0.0032 | 0.0027 | 1.13 | 1.17 | 0.00019 | 0.00012 | 0.0007 | 0.00074 | 0.296 | <0.0001 | <0.00008 | 0.0018 | 0.0026 | 0.0099 | 0.017 | 0.0068 | 0.0065 | 0.0037 | 0.022 |
| A66 | A66 | 27/10/2022 | MW | Normal | 2.67 | 2.22 | 0.021 | 0.019 | 0.0108 | 0.0093 | 0.00033 | 0.00029 | 3.3 | 3.23 | <0.00002 | <0.00002 | 0.011 | 0.01 | 0.0006 | 0.00041 | 0.0011 | 0.00069 | 1.34 | 0.893 | 0.00082 | 0.00045 | 0.00035 | 0.00026 | 0.017 | <0.0001 | <0.00008 | 0.0022 | 0.0017 | 0.11 | 0.104 | 0.075 | 0.0669 | 0.005 | 0.0054 |
| A67 | A67 | 27/10/2022 | MW | Normal | 9.08 | 7.71 | 0.0096 | 0.0091 | 0.0033 | 0.0029 | 0.0005 | 0.00047 | 4.65 | 4.41 | 0.000035 | 0.000044 | 0.0022 | 0.0016 | 0.00129 | 0.00108 | 0.0026 | 0.0022 | 1.12 | 0.702 | 0.00065 | 0.0001 | 0.00048 | 0.00038 | 0.122 | <0.0001 | <0.00008 | 0.0018 | 0.0016 | 0.038 | 0.031 | 2.09 | 1.95 | 0.005 | 0.0054 |
| A68 | A68 | 27/10/2022 | MW | Normal | 1.65 | 1 | 0.0585 | 0.055 | 0.006 | 0.0029 | 0.00014 | 0.00011 | 4.9 | 4.72 | 0.00011 | 0.000091 | 0.0039 | 0.0033 | 0.00252 | 0.00197 | 0.011 | 0.007 | 1.79 | 0.989 | 0.0016 | 0.00066 | 0.00087 | 0.00051 | 0.0081 | <0.0001 | <0.00008 | 0.006 | 0.0044 | 0.061 | 0.0517 | 2.07 | 1.94 | 0.012 | 0.0057 |
| A70 | A70 | 12/01/2023 | MW | Normal | 13.2 | 12.6 | 0.0049 | 0.0048 | 0.0047 | 0.0047 | 0.00058 | 0.00055 | 0.11 | 0.12 | 0.000035 | <0.00002 | 0.0086 | 0.0075 | 0.00027 | 0.00026 | 0.00067 | 0.0006 | 16.4 | 18.3 | 0.00023 | 0.00012 | 0.00117 | 0.00113 | 0.569 | <0.0001 | <0.00008 | 0.0022 | 0.0018 | 0.059 | 0.04 | 0.047 | 0.046 | <0.003 | 0.0051 |
| A71 | A71 | 12/01/2023 | MW | Normal | 0.25 | <0.03 | 0.0033 | <0.005 | 0.016 | 0.0149 | <0.00001 | <0.0001 | 2.69 | 3.7 | 0.00012 | <0.0002 | 0.00075 | <0.002 | 0.00028 | 0.00011 | 0.001 | <0.002 | 0.44 | <0.05 | 0.00021 | <0.0005 | 0.144 | 0.132 | <0.005 | <0.0001 | <0.0008 | 0.0011 | <0.002 | 0.024 | <0.02 | 0.0025 | <0.005 | <0.003 | <0.01 |
| A72 | A72 | 11/01/2023 | MW | Normal | 9.19 | 5.74 | 0.03 | 0.025 | 0.0091 | 0.0038 | 0.00057 | 0.00043 | 7.25 | 7.26 | 0.00011 | 0.000083 | 0.0061 | 0.0035 | 0.00466 | 0.00328 | 0.011 | 0.0084 | 4.34 | 1 | 0.0014 | 0.00048 | 0.00132 | 0.00017 | 0.186 | <0.0001 | <0.00008 | 0.0053 | 0.0034 | 0.122 | 0.034 | 2.53 | 2.45 | 0.0085 | 0.0092 |
| A7R | A7R | 11/01/2023 | MW | Normal | 1.11 | 0.964 | 0.035 | 0.034 | 0.0027 | 0.0033 | 0.000068 | 0.000063 | 4.12 | 4.06 | 0.000054 | 0.000066 | 0.0034 | 0.002 | 0.00034 | 0.00022 | 0.00032 | <0.0002 | 0.542 | 0.47 | 0.00026 | 0.00011 | 0.00019 | <0.00001 | 0.012 | <0.0001 | <0.00008 | 0.0014 | 0.0011 | 0.05 | 0.049 | 0.0974 | 0.0936 | <0.003 | 0.0013 |
| A8 | A8 | 15/06/2022 | MW | Normal | 3.11 | 2.99 | 0.0023 | 0.00082 | 0.0037 | 0.0032 | 0.00013 | 0.00013 | 0.089 | 0.092 | <0.00002 | 0.000029 | 0.0013 | 0.00074 | 0.00054 | 0.00045 | 0.002 | 0.0016 | 1.46 | 0.4 | 0.0012 | 0.00027 | 0.00129 | 0.00149 | 0.016 | <0.0001 | <0.00008 | 0.0016 | 0.0013 | 0.012 | 0.0063 | 0.0838 | 0.046 | 0.0094 | 0.016 |
| A8 | A8 | 23/09/2022 | MW | Normal | 3.99 | 3.67 | 0.0035 | 0.00098 | 0.0028 | 0.0019 | 0.00017 | 0.00013 | 0.12 | 0.12 | <0.00002 | 0.000027 | 0.0013 | 0.0007 | 0.00032 | 0.00021 | 0.0015 | 0.00099 | 1.99 | 0.42 | 0.0016 | 0.000096 | 0.00102 | 0.00091 | 0.0045 | <0.0001 | <0.00008 | 0.0015 | 0.001 | 0.016 | 0.0064 | 0.113 | 0.0544 | <0.003 | <0.001 |
| A8 | A8 | 27/10/2022 | MW | Normal | 10.8 | 4.05 | 0.035 | 0.0059 | 0.0172 | 0.0052 | 0.00042 | 0.00018 | 0.41 | 0.41 | 0.00019 | 0.00004 | 0.011 | 0.0032 | 0.00265 | 0.00111 | 0.0068 | 0.0028 | 25.5 | 6.44 | 0.0109 | 0.00037 | 0.00512 | 0.00297 | 0.0521 | <0.0001 | <0.00008 | 0.0068 | 0.0029 | 0.189 | 0.034 | 0.847 | 0.169 | 0.022 | 0.017 |
| A8 | A8 | 2/12/2022 | MW | Normal | 6.34 | 4.34 | 0.0043 | <0.005 | 0.0042 | 0.0025 | 0.00025 | 0.00023 | 0.28 | 0.27 | 0.000059 | <0.0002 | 0.0029 | 0.0022 | 0.00107 | 0.0008 | 0.0036 | <0.002 | 2.74 | 1.49 | 0.0006 | <0.0005 | 0.00318 | 0.00237 | 0.018 | <0.0001 | <0.0008 | 0.0047 | 0.004 | 0.03 | 0.031 | 0.153 | 0.0927 | 0.0046 | <0.01 |
| A9 | A9 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 28/10/2022 | MW | Normal | 25.8 | 18.7 | 0.031 | 0.03 | 0.105 | 0.101 | 0.00207 | 0.00183 | 5.72 | 5.68 | 0.000061 | 0.000071 | 0.106 | 0.101 | 0.00168 | 0.00129 | 0.0058 | 0.0062 | 8.29 | 8.19 | 0.0017 | 0.0011 | 0.00063 | 0.00053 | 0.0786 | <0.0001 | 0.00013 | 0.0056 | 0.005 | 0.849 | 0.852 | 0.379 | 0.341 | 0.0046 | 0.01 |
| C1R | C1R | 11/01/2023 | MW | Normal | 4.53 | 4.03 | 0.014 | 0.014 | 0.0911 | 0.0803 | 0.00037 | 0.00035 | 1.82 | 1.74 | 0.000099 | 0.000052 | 0.0074 | 0.0051 | 0.00371 | 0.00327 | 0.006 | 0.0015 | 5.68 | 5.28 | 0.0011 | 0.00051 | 0.00353 | 0.00387 | 0.558 | <0.0001 | <0.00008 | 0.0054 | 0.0044 | 0.117 | 0.0809 | 0.019 | 0.019 | 0.064 | 0.017 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | 1.36 | 0.02 | 0.00097 | <0.0005 | 0.0723 | 0.0629 | 0.00011 | <0.00001 | 0.629 | 0.646 | <0.00002 | <0.00002 | 0.0073 | 0.00083 | 0.00125 | 0.00111 | 0.00049 | <0.0002 | 57.7 | 0.11 | 0.00824 | <0.00005 | 0.00605 | 0.0061 | 0.232 | <0.0001 | <0.00008 | 0.00067 | 0.00024 | 0.0713 | <0.002 | 0.04 | 0.0007 | 0.0058 | <0.001 |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | 1.24 | - | 0.0012 | - | - | - | 0.00013 | - | 0.705 | - | 0.000039 | - | 0.0091 | - | 0.00158 | - | 0.0016 | - | - | - | 0.0091 | - | - | - | - | <0.0001 | - | 0.0011 | - | - | - | 0.047 | - | 0.013 | - |
| C3R | C3R | 11/01/2023 | MW | Normal | 8.68 | 9.02 | 0.035 | 0.034 | 0.0375 | 0.0347 | 0.00069 | 0.00068 | 3.7 | 3.66 | 0.000073 | 0.00011 | 0.0511 | 0.0481 | 0.002 | 0.00181 | 0.0073 | 0.006 | 4.94 | 5.53 | 0.0014 | 0.0012 | 0.00088 | 0.0008 | 0.0745 | <0.0001 | <0.00008 | 0.0031 | 0.0027 | 0.499 | 0.418 | 0.195 | 0.192 | 0.0075 | 0.0076 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | 8.5 | - | 0.035 | - | - | - | 0.00067 | - | 3.58 | - | 0.000055 | - | 0.0517 | - | 0.00212 | - | 0.0075 | - | - | - | 0.0014 | - | - | - | - | <0.0001 | - | 0.0031 | - | - | - | 0.194 | - | 0.0079 | - |
| C4 | C4 | 26/10/2022 | MW | Normal | 8.07 | 8.63 | 0.0023 | 0.0026 | 0.0077 | 0.0067 | 0.00084 | 0.0007 | 1.2 | 1.14 | 0.000067 | 0.000077 | 0.003 | 0.003 | 0.00029 | 0.00022 | 0.009 | 0.005 | 0.2 | 0.12 | 0.00099 | <0.00005 | 0.0214 | 0.0219 | 0.0079 | <0.0001 | <0.00008 | 0.0021 | 0.0019 | 0.013 | 0.012 | 0.011 | 0.011 | 0.024 | 0.03 |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| T1A | T1A | 27/10/2022 | MW | Normal | 0.703 | 0.215 | 0.0012 | 0.00073 | 0.0119 | 0.0167 | 0.000013 | 0.000018 | 1.37 | 1.32 | <0.00002 | <0.00002 | 0.00047 | 0.00065 | 0.00014 | 0.00016 | 0.00056 | 0.00069 | 0.11 | 0.016 | 0.00026 | <0.00005 | 0.00083 | 0.00075 | 0.00091 | <0.0001 | <0.00008 | 0.00028 | 0.00039 | 0.0057 | <0.002 | 0.013 | 0.013 | <0.003 | 0.0024 |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
# Table C5
# NZAS Landfill Groundwater Ecological Screening Values

| | | | | | BTEXN | | | | | | TPH | | | | PAHs - standard 16 | | | | | | | | | | | | | | | | | | PAHs - extended | | | | Phenols | | | Phenols - Halogenated | | | | | | | Phenols - Non-Halogenated | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Naphthalene (BTEXN suite) | Benzene | Toluene | Ethylbenzene | Xylene (o) | Xylene (m & p) | C7-C9 | C10-C14 | C15-C36 | C7-C36 (Total) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero | Total 8 PAHs (as BaP TEQ)(full L | 2-methylnaphthalene | 3-methylcholanthrene | 7,12-dimethylbenz(a)anthracene | Benzo(b)fluoranthene | 2,3,4,6-Tetrachlorophenol | 2,3,5,6-Tetrachlorophenol | 2-Phenylphenol | 2-Chlorophenol | 2,4-Dichlorophenol | 2,4,5-Trichlorophenol | 2,4,6-Trichlorophenol | 2,6-Dichlorophenol | 4-Chloro-3-methylphenol | Pentachlorophenol | Phenol | 2-Nitrophenol | 2-Methylphenol (o-Cresol) | 3,4-Methylphenol (m,p-cresol) | 2,4-Dimethylphenol | 2,4-Dinitrophenol | 4-Nitrophenol | 4-Methylphenol (p-Cresol) |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 200 | 200 | 300 | 500 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.06 | 0.03 | 0.02 | 0.02 | 0.05 | 0.06 | 5 | 5 | 0.5 | 10 | 0.3 | 5 | 0.3 | 0.3 | 0.5 | 0.5 | 0.3 | 0.3 | 10 | 2 | 0.5 | 0.3 | 6 | 1 | 30 | 1 | 0.3 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | 120[1] | 1300[1] | 330 | 160 | | | | | | | | | 7 | | 0.7 | | | | | | 2 | | | 120[1] | 8 | | | | | | | | | | | | | | | | | 55[1] | 720 | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | 6.6 | | | | | | | | | | | | | | | | | | 4.2 | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | 0.018 | | | | | | | | 3 | | | | 0.025[4] | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | 0.098 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A19R | A19R | 26/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | <30 | <30 | - |
| A20R | A20R | 26/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A22 | A22 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A23 | A23 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | 0.023 | 0.023 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | 0.14 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | 50 | <30 | - |
| A24 | A24 | 28/10/2022 | MW | Normal | 140 | 35 | 3.6 | 25 | 5.7 | 10 | <200 | 400 | 300 | 700 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A30 | A30 | 26/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | <30 | <30 | - |
| A40 | A40 | 28/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 17/02/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 13/06/2022 | MW | Normal | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 22/09/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 31/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 2/12/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | - | <0.5 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | 0.8 | <0.3 | - | - | <0.5 | - | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | - | <2 | <0.5 | <0.3 | - | <1 | - | <1 | <0.3 |
| A51 | A51 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A52 | A52 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A53 | A53 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A54 | A54 | 26/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | <30 | <30 | - |
| A54D | A54D | 12/01/2023 | MW | Normal | 340 | 180 | 86 | 27 | 81 | 77 | <200 | 900 | 400 | 1300 | 1.9 | 4 | <0.3 | <0.3 | <0.3 | - | <0.5 | <0.3 | <0.3 | <0.3 | 0.36 | 2.5 | <0.3 | <0.3 | 1.4 | 0.4 | <0.3 | 0.8 | >32 | - | - | <0.5 | - | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | - | 260 | <0.5 | 52 | - | <1 | - | <1 | 69 |
| A55 | A55 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A55D | A55D | 12/01/2023 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A56 | A56 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A57 | A57 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A58 | A58 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.
[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val
[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L
[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | BTEXN | | | | | | TPH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Naphthalene (BTEXN suite) | Benzene | Toluene | Ethylbenzene | Xylene (o) | Xylene (m & p) | C7-C9 | C10-C14 | C15-C36 | C7-C36 (Total) |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 200 | 200 | 300 | 500 |
| ANZG (2018) - MW - 80%  species protection (updated 1/10/2021) | | | | | 120[1] | 1300[1] | 330 | 160 | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |
| A6 | A6 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| A60 | A60 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| A61 | A61 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |
| A62D | A62D | 11/01/2023 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |
| A62S | A62S | 28/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |
| A62S | A62S | 11/01/2023 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |
| A63 | A63 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |
| A64D | A64D | 25/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |
| A65 | A65 | 27/10/2022 | MW | Normal | <1 | 3.9 | 4.5 | 3.6 | 4.7 | 6.3 | <200 | <200 | <300 | <500 |
| A66 | A66 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | 700 | 300 | 1000 |
| A67 | A67 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| A68 | A68 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | 300 | <300 | <500 |
| A70 | A70 | 12/01/2023 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| A71 | A71 | 12/01/2023 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |
| A72 | A72 | 11/01/2023 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| A7R | A7R | 11/01/2023 | MW | Normal | - | - | - | - | - | - | <200 | 2400 | 400 | 2800 |
| A8 | A8 | 15/06/2022 | MW | Normal | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <200 | <200 | <300 | <500 |
| A8 | A8 | 23/09/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| A8 | A8 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |
| A8 | A8 | 2/12/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| A9 | A9 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 28/10/2022 | MW | Normal | <1 | 1.4 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| C1R | C1R | 11/01/2023 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | 11 | 20 | 5.8 | 12 | 15 | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - |
| T1A | T1A | 27/10/2022 | MW | Normal | - | - | - | - | - | - | <200 | <200 | <300 | <500 |

| | | | | | PAHs - standard 16 | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero | Total 8 PAHs (as BaP TEQ)(full L |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.06 | 0.03 | 0.02 | 0.02 | 0.05 |
| ANZG (2018) - MW - 80%  species protection (updated 1/10/2021) | | | | | | | 7 | | 0.7 | | | | | | 2 | | | 120[1] | 8 | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | 6.6 | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | 0.018 | | | | | | | | 3 | | | | 0.025[4] | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A6 | A6 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - |
| A60 | A60 | 27/10/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A61 | A61 | 27/10/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A62D | A62D | 11/01/2023 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | 0.09 | <0.03 | <0.02 | <0.02 | 0.05 |
| A62S | A62S | 28/10/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A62S | A62S | 11/01/2023 | MW | Normal | 0.023 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | 0.15 | <0.03 | <0.02 | <0.02 | 0.05 |
| A63 | A63 | 25/10/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A64D | A64D | 25/10/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A65 | A65 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - |
| A66 | A66 | 27/10/2022 | MW | Normal | 3.4 | 5.5 | 0.72 | 0.033 | 0.025 | 0.026 | <0.02 | <0.02 | 0.041 | <0.02 | 0.2 | 4.1 | <0.03 | 170 | 3.8 | 0.24 | 0.03 | 0.06 |
| A67 | A67 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - |
| A68 | A68 | 27/10/2022 | MW | Normal | 4.5 | 13 | 0.56 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.06 | 8.2 | <0.03 | 0.11 | 3.3 | 0.081 | <0.02 | 0.05 |
| A70 | A70 | 12/01/2023 | MW | Normal | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | - | <0.5 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | 0.8 |
| A71 | A71 | 12/01/2023 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A72 | A72 | 11/01/2023 | MW | Normal | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | - | <0.5 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | 0.8 |
| A7R | A7R | 11/01/2023 | MW | Normal | 5.9 | 43 | 1.6 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | 0.17 | 13 | <0.03 | 90 | 9.3 | 0.2 | <0.02 | 0.05 |
| A8 | A8 | 15/06/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A8 | A8 | 23/09/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A8 | A8 | 27/10/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A8 | A8 | 2/12/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |
| A9 | A9 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - |
| A9 | A9 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C1R | C1R | 11/01/2023 | MW | Normal | 1.6 | <0.3 | <0.3 | <0.3 | <0.3 | - | <0.5 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | 0.8 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | - | <0.5 | <0.3 | <0.3 | <0.3 | 0.33 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | 0.8 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | - |
| T1A | T1A | 27/10/2022 | MW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 |

| | | | | | PAHs - extended | | | | Phenols | | | Phenols - Halogenated | | | | | | | Phenols - Non-Halogenated | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2-methylnaphthalene | 3-methylcholanthrene | 7,12-dimethylbenz(a)anthracene | Benzo(b)fluoranthene | 2,3,4,6-Tetrachlorophenol | 2,3,5,6-Tetrachlorophenol | 2-Phenylphenol | 2-Chlorophenol | 2,4-Dichlorophenol | 2,4,5-Trichlorophenol | 2,4,6-Trichlorophenol | 2,6-Dichlorophenol | 4-Chloro-3-methylphenol | Pentachlorophenol | Phenol | 2-Nitrophenol | 2-Methylphenol (o-Cresol) | 3,4-Methylphenol (m,p-cresol) | 2,4-Dimethylphenol | 2,4-Dinitrophenol | 4-Nitrophenol | 4-Methylphenol (p-Cresol) |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.06 | 5 | 5 | 0.5 | 10 | 0.3 | 5 | 0.3 | 0.3 | 0.5 | 0.5 | 0.3 | 0.3 | 10 | 2 | 0.5 | 0.3 | 6 | 1 | 30 | 1 | 0.3 |
| ANZG (2018) - MW - 80%  species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | 55[1] | 720 | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | 4.2 | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A6 | A6 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | <30 | <30 | - |
| A60 | A60 | 27/10/2022 | MW | Normal | <0.06 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | <30 | <30 | - |
| A61 | A61 | 27/10/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62D | A62D | 11/01/2023 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 28/10/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 11/01/2023 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A63 | A63 | 25/10/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A64D | A64D | 25/10/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A65 | A65 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | <30 | <30 | - |
| A66 | A66 | 27/10/2022 | MW | Normal | 23 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A67 | A67 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | 50 | <30 | - |
| A68 | A68 | 27/10/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A70 | A70 | 12/01/2023 | MW | Normal | <0.3 | - | - | <0.5 | - | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | - | <2 | <0.5 | <0.3 | - | <1 | - | <1 | <0.3 |
| A71 | A71 | 12/01/2023 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A72 | A72 | 11/01/2023 | MW | Normal | <0.3 | - | - | <0.5 | - | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | - | <2 | <0.5 | <0.3 | - | <1 | - | <1 | <0.3 |
| A7R | A7R | 11/01/2023 | MW | Normal | 23 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 15/06/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 23/09/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 27/10/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 2/12/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | 50 | <30 | - |
| A9 | A9 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C1R | C1R | 11/01/2023 | MW | Normal | <0.3 | - | - | <0.5 | - | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | - | <2 | <0.5 | <0.3 | - | 5.6 | - | <1 | <0.3 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | <30 | <30 | - |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | <0.3 | - | - | <0.5 | - | <0.3 | <5 | <0.3 | <0.3 | <0.5 | <0.5 | <0.3 | <0.3 | - | <2 | <0.5 | <0.3 | - | <1 | - | <1 | <0.3 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | <30 | <30 | - |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | <5 | <5 | <5 | - | <10 | - | - | <3 | <3 | <10 | <10 | <3 | <10 | <10 | <3 | <10 | <3 | <6 | <3 | <30 | <30 | - |
| T1A | T1A | 27/10/2022 | MW | Normal | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | VOCs | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1,1-dichloroethane | 1,2,3-trichlorobenzene | 1,2,3-trichloropropane | 1,2-dibromoethane | 1,3-dichlorobenzene | 1,4-Dioxane | 2-Chloroethylvinyl ether | 4-methyl-2-pentanone (MIBK) | Bromodichloromethane | Bromoform | Chlorodibromomethane | Chloroethane | cis-1,3-dichloropropene | Dibromomethane | Iodomethane | MTBE | Trichloroethene | Tetrachloroethene | trans-1,3-dichloropropene | trans-1,2-dichloroethene | Trichlorofluoromethane |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.5 | 0.5 | 0.5 | 0.5 | 0.3 | 10 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | 600 | 150 | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A19R | A19R | 26/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A20R | A20R | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A22 | A22 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A23 | A23 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 27/10/2022 | MW | Normal | - | <5 | - | - | <5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 28/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A30 | A30 | 26/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A40 | A40 | 28/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A41 | A41 | 17/02/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 13/06/2022 | MW | Normal | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <10 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| A41 | A41 | 22/09/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A41 | A41 | 31/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 2/12/2022 | MW | Normal | <1 | <1 | <1 | <1 | <0.3 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A51 | A51 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A52 | A52 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A53 | A53 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A54 | A54 | 26/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A54D | A54D | 12/01/2023 | MW | Normal | <1 | <1 | <1 | <1 | <0.3 | <20 | <8 | 2.3 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A55 | A55 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A55D | A55D | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A56 | A56 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A57 | A57 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A58 | A58 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| | | | | | SVOCs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1,2,3,4-tetrachlorobenzene | 1,2,3,5-Tetrachlorobenzene | 1,2,4,5-tetrachlorobenzene | 1,3,5-Trichlorobenzene | 1-Chloronaphthalene | 1-Methylnaphthalene | 1-naphthylamine | 2-naphthylamine | 2-nitroaniline | 3,3-Dichlorobenzidine | 3-nitroaniline | 4-(dimethylamino) azobenzene | 4-bromophenyl phenyl ether | 4-chloroaniline | 4-chlorophenyl phenyl ether | Aniline | Azobenzene | Benzyl alcohol | Benzyl chloride | Bis(2-chloroethoxy) methane | Bis(2-chloroethyl)ether | Bis(2-chloroisopropyl) ether | Dibenz(a,j)acridine | Dibenzofuran | Diphenylamine | Hexachlorocyclopentadiene | Hexachloroethane | N-nitrosodi-n-butylamine | N-nitrosodi-n-propylamine | n-Nitrosodiphenylamine | N-nitrosopiperidine | Pentachlorobenzene |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 5 | 5 | 5 | 5 | 5 | 0.06 | 5 | 5 | 0.5 | 0.5 | 0.3 | 5 | 0.3 | 0.5 | 0.3 | 5 | 0.3 | 0.3 | 5 | 0.3 | 0.3 | 0.3 | 5 | 0.3 | 5 | 0.3 | 0.3 | 5 | 0.3 | 0.3 | 5 | 5 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | 10 | 10 | 9 | 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A19R | A19R | 26/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| A20R | A20R | 26/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A22 | A22 | 27/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A23 | A23 | 28/10/2022 | MW | Normal | - | - | - | - | - | 0.07 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| A24 | A24 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A30 | A30 | 26/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| A40 | A40 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 17/02/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 13/06/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 22/09/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 31/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 2/12/2022 | MW | Normal | - | - | - | - | - | - | - | - | <0.5 | <0.5 | <0.3 | - | <0.3 | <0.5 | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | <0.3 | - | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | - | - |
| A51 | A51 | 25/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A52 | A52 | 25/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A53 | A53 | 26/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A54 | A54 | 26/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| A54D | A54D | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | <0.5 | <0.5 | <0.3 | - | <0.3 | <0.5 | <0.3 | - | 1.2 | <0.3 | - | <0.3 | <0.3 | <0.3 | - | 0.98 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | - | - |
| A55 | A55 | 26/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A55D | A55D | 12/01/2023 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A56 | A56 | 26/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A57 | A57 | 26/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A58 | A58 | 26/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | VOCs | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1,1-dichloroethane | 1,2,3-trichlorobenzene | 1,2,3-trichloropropane | 1,2-dibromoethane | 1,3-dichlorobenzene | 1,4-Dioxane | 2-Chloroethylvinyl ether | 4-methyl-2-pentanone (MIBK) | Bromodichloromethane | Bromoform | Chlorodibromomethane | Chloroethane | cis-1,3-dichloropropene | Dibromomethane | Iodomethane | MTBE | Trichloroethene | Tetrachloroethene | trans-1,3-dichloropropene | trans-1,2-dichloroethene | Trichlorofluoromethane |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.5 | 0.5 | 0.5 | 0.5 | 0.3 | 10 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | 600 | 150 | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A6 | A6 | 27/10/2022 | MW | Normal | 1.1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A60 | A60 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A61 | A61 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62D | A62D | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A63 | A63 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A64D | A64D | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A65 | A65 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A66 | A66 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A67 | A67 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A68 | A68 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A70 | A70 | 12/01/2023 | MW | Normal | <1 | <1 | <1 | <1 | <0.3 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A71 | A71 | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A72 | A72 | 11/01/2023 | MW | Normal | <1 | <1 | <1 | <1 | <0.3 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A7R | A7R | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 15/06/2022 | MW | Normal | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <10 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| A8 | A8 | 23/09/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A8 | A8 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 2/12/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A9 | A9 | 27/10/2022 | MW | Normal | - | <5 | - | - | <5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 28/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| C1R | C1R | 11/01/2023 | MW | Normal | <1 | <1 | <1 | <1 | <0.3 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | <1 | <1 | <1 | <1 | <0.3 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | 1.2 | 13 | <1 | <1 | <1 |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | - | <5 | - | - | <5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| T1A | T1A | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| | | | | | SVOCs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 1,2,3,4-tetrachlorobenzene | 1,2,3,5-Tetrachlorobenzene | 1,2,4,5-tetrachlorobenzene | 1,3,5-Trichlorobenzene | 1-Chloronaphthalene | 1-Methylnaphthalene | 1-naphthylamine | 2-naphthylamine | 2-nitroaniline | 3,3-Dichlorobenzidine | 3-nitroaniline | 4-(dimethylamino) azobenzene | 4-bromophenyl phenyl ether | 4-chloroaniline | 4-chlorophenyl phenyl ether | Aniline | Azobenzene | Benzyl alcohol | Benzyl chloride | Bis(2-chloroethoxy) methane | Bis(2-chloroethyl)ether | Bis(2-chloroisopropyl) ether | Dibenz(a,j)acridine | Dibenzofuran | Diphenylamine | Hexachlorocyclopentadiene | Hexachloroethane | N-nitrosodi-n-butylamine | N-nitrosodi-n-propylamine | n-Nitrosodiphenylamine | N-nitrosopiperidine | Pentachlorobenzene |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 5 | 5 | 5 | 5 | 5 | 0.06 | 5 | 5 | 0.5 | 0.5 | 0.3 | 5 | 0.3 | 0.5 | 0.3 | 5 | 0.3 | 0.3 | 5 | 0.3 | 0.3 | 0.3 | 5 | 0.3 | 5 | 0.3 | 0.3 | 5 | 0.3 | 0.3 | 5 | 5 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | 10 | 10 | 9 | 30 | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A6 | A6 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| A60 | A60 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | <0.06 | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| A61 | A61 | 27/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62D | A62D | 11/01/2023 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 28/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 11/01/2023 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A63 | A63 | 25/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A64D | A64D | 25/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A65 | A65 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| A66 | A66 | 27/10/2022 | MW | Normal | - | - | - | - | - | 28 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A67 | A67 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| A68 | A68 | 27/10/2022 | MW | Normal | - | - | - | - | - | 35 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A70 | A70 | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | <0.5 | <0.5 | <0.3 | - | <0.3 | <0.5 | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | <0.3 | - | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | - | - |
| A71 | A71 | 12/01/2023 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A72 | A72 | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | <0.5 | <0.5 | <0.3 | - | <0.3 | <0.5 | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | <0.3 | - | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | - | - |
| A7R | A7R | 11/01/2023 | MW | Normal | - | - | - | - | - | 18 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 15/06/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 23/09/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 27/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 2/12/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| A9 | A9 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C1R | C1R | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | <0.5 | <0.5 | <0.3 | - | <0.3 | <0.5 | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | <0.3 | - | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | - | - |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | <0.5 | <0.5 | <0.3 | - | <0.3 | <0.5 | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | <0.3 | - | <0.3 | - | <0.3 | <0.3 | - | <0.3 | <0.3 | - | - |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | <5 | <5 | - | <5 | <5 | - | - | <5 | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 |
| T1A | T1A | 27/10/2022 | MW | Normal | - | - | - | - | - | <0.06 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.
[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val
[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L
[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | OC Pesticides | | | | | | | | | | | | | | | | | | | | | | | OP Pesticides | | | | | MAH | | | | | | | | | Halogenated Hydrocarbons | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2,4-DDT | 4,4'-DDE | a-BHC | Aldrin | b-BHC | Chlordane | Chlordane (cis) | Chlordane (trans) | d-BHC | 4,4 DDD | 4,4 DDT | Dieldrin | Endosulfan I (alpha) | Endosulfan II (beta) | Endosulfan Sulfate | Endrin | Endrin aldehyde | Endrin ketone | g-BHC (Lindane) | Heptachlor | Heptachlor epoxide | Hexachlorobenzene | Methoxychlor | Ethyl methanesulfonate | Methyl methanesulfonate | 2,4 DDD | 2,4 DDE | trans-Nonachlor | 1,2,4-trimethylbenzene | 1,3,5-trimethylbenzene | Isopropylbenzene | Styrene | n-butylbenzene | n-propylbenzene | sec-butylbenzene | tert-butylbenzene | p-isopropyltoluene | Bromomethane | Dichlorodifluoromethane |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.00125 | 0.0013 | 0.0013 | 0.00125 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.00125 | 10 | 0.3 | 0.0013 | 0.0013 | 0.0013 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | 0.02 | | | | | | 0.3 | | | | | | | | | 70 | | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field_ID | Location_Code | Sampled_Date_Time | Location_Type | Sample_Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A19R | A19R | 26/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | - | - | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A20R | A20R | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A22 | A22 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A23 | A23 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 27/10/2022 | MW | Normal | - | <0.5 | <0.5 | <0.5 | - | - | - | - | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1 | <1 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 28/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | - | - | <0.0013 | <0.0013 | <0.0013 | 37 | 1.3 | 3.3 | <1 | <1 | 8.6 | <1 | <1 | 1.9 | <1 | <1 |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A30 | A30 | 26/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | - | - | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A40 | A40 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A41 | A41 | 17/02/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 13/06/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| A41 | A41 | 22/09/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A41 | A41 | 31/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 2/12/2022 | MW | Normal | - | <0.3 | <0.3 | <0.5 | <0.3 | - | <0.3 | <0.5 | <0.3 | <0.5 | <1 | <0.5 | <1 | <1 | <0.5 | <1 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <0.3 | <10 | <0.3 | - | - | - | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A51 | A51 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A52 | A52 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A53 | A53 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A54 | A54 | 26/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | - | - | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A54D | A54D | 12/01/2023 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <10 | <0.3 | <0.0013 | <0.0013 | <0.0013 | 50 | 8.4 | <1 | 19 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A55 | A55 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A55D | A55D | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A56 | A56 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A57 | A57 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A58 | A58 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | OC Pesticides | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2,4-DDT | 4,4'-DDE | a-BHC | Aldrin | b-BHC | Chlordane | Chlordane (cis) | Chlordane (trans) | d-BHC | 4,4 DDD | 4,4 DDT | Dieldrin | Endosulfan I (alpha) | Endosulfan II (beta) | Endosulfan Sulfate | Endrin | Endrin aldehyde | Endrin ketone | g-BHC (Lindane) | Heptachlor | Heptachlor epoxide | Hexachlorobenzene | Methoxychlor |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.00125 | 0.0013 | 0.0013 | 0.00125 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.0013 | 0.00125 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | 0.02 | | | | | | 0.3 | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A6 | A6 | 27/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | 0.0014 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| A60 | A60 | 27/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| A61 | A61 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62D | A62D | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A63 | A63 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A64D | A64D | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A65 | A65 | 27/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| A66 | A66 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A67 | A67 | 27/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| A68 | A68 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A70 | A70 | 12/01/2023 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| A71 | A71 | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A72 | A72 | 11/01/2023 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| A7R | A7R | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 15/06/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 23/09/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 2/12/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 27/10/2022 | MW | Normal | - | <0.5 | <0.5 | <0.5 | - | - | - | - | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1 | <1 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| A9 | A9 | 28/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | 0.0013 |
| C1R | C1R | 11/01/2023 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.3 - 0.0015 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 - 0.37 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 | <0.0013 |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | - | <0.5 | <0.5 | <0.5 | - | - | - | - | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <1 | <1 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| T1A | T1A | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

| | | | | | OP Pesticides | | | | | MAH | | | | | | | | | Halogenated Hydrocarbons | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Ethyl methanesulfonate | Methyl methanesulfonate | 2,4 DDD | 2,4 DDE | trans-Nonachlor | 1,2,4-trimethylbenzene | 1,3,5-trimethylbenzene | Isopropylbenzene | Styrene | n-butylbenzene | n-propylbenzene | sec-butylbenzene | tert-butylbenzene | p-isopropyltoluene | Bromomethane | Dichlorodifluoromethane |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 10 | 0.3 | 0.0013 | 0.0013 | 0.0013 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | 70 | | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A6 | A6 | 27/10/2022 | MW | Normal | - | - | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A60 | A60 | 27/10/2022 | MW | Normal | - | - | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A61 | A61 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62D | A62D | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A63 | A63 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A64D | A64D | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A65 | A65 | 27/10/2022 | MW | Normal | - | - | <0.0013 | <0.0013 | <0.0013 | 4.4 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A66 | A66 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A67 | A67 | 27/10/2022 | MW | Normal | - | - | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A68 | A68 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A70 | A70 | 12/01/2023 | MW | Normal | <10 | <0.3 | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A71 | A71 | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A72 | A72 | 11/01/2023 | MW | Normal | <10 | <0.3 | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A7R | A7R | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 15/06/2022 | MW | Normal | - | - | - | - | - | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| A8 | A8 | 23/09/2022 | MW | Normal | - | - | - | - | - | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A8 | A8 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 2/12/2022 | MW | Normal | - | - | - | - | - | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| A9 | A9 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 28/10/2022 | MW | Normal | - | - | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| C1R | C1R | 11/01/2023 | MW | Normal | <10 | <0.3 | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | - | - | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | <10 | <0.3 | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | - | - | <0.0013 | <0.0013 | <0.0013 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| T1A | T1A | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

## Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | PCBs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2,3,7,8-TCDD TEQ | PCB-121 | PCB-128 & PCB-167 2,2',3,3',4,4'- | PCB-141 | PCB-149 | PCB-151 | PCB-159 | PCB-170 | PCB-18 | PCB-187 2,2',3,4',5,5',6-Heptachl | PCB-194 | PCB-195 2,2',3,3',4,4',5,6-Octachl | PCB-206 | PCB-28 & PCB-31 PCB-28 & PCB | PCB-3 4-Chlorobiphenyl | PCB-4 2,2'-Dichlorobiphenyl | PCB-44 | PCB-49 | PCB-60 | PCB-66 2,3',4,4'-Tetrachlorobiph | PCB-8 2,4'-Dichlorobiphenyl | PCB-86 | Decachlorobiphenyl | PCB-189 | PCB-156 | PCB-157 | PCB-169 | PCB-101 | PCB-118 | PCB-138 | PCB-153 | PCB-180 | PCB-52 | PCB-105 | PCB-114 | PCB-123 | PCB-126 | PCB-77 | PCB-81 |
| | | | | | g/m3 | µg/L | g/m3 | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | g/m3 | µg/L | g/m3 | µg/L | g/m3 | g/m3 | g/m3 | µg/L | µg/L | µg/L | g/m3 | g/m3 | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.000002 | 0.005 | 0.000005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.01 | 0.00001 | 0.005 | 0.000005 | 0.005 | 0.00001 | 0.00001 | 0.00001 | 0.005 | 0.01 | 0.005 | 0.000005 | 0.00001 | 0.005 | 0.01 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.01 | 0.005 | 0.005 | 0.005 | 0.01 | 0.005 | 0.005 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field_ID | Location_Code | Sampled_Date_Time | Location_Type | Sample_Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A19R | A19R | 26/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A20R | A20R | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A22 | A22 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A23 | A23 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 28/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A30 | A30 | 26/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A40 | A40 | 28/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A41 | A41 | 17/02/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 13/06/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A41 | A41 | 22/09/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A41 | A41 | 31/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 2/12/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A51 | A51 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A52 | A52 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A53 | A53 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A54 | A54 | 26/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A54D | A54D | 12/01/2023 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A55 | A55 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A55D | A55D | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A56 | A56 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A57 | A57 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A58 | A58 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
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# Table C5
# NZAS Landfill Groundwater Ecological Screening Values

| | | | | | PCBs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2,3,7,8-TCDD TEQ | PCB-121 | PCB-128 & PCB-167 2,2',3,3',4,4'- | PCB-141 | PCB-149 | PCB-151 | PCB-159 | PCB-170 | PCB-18 | PCB-187 2,2',3,4',5,5',6-Heptachl | PCB-194 | PCB-195 2,2',3,3',4,4',5,6-Octachl | PCB-206 | PCB-28 & PCB-31 PCB-28 & PCB | PCB-3 4-Chlorobiphenyl | PCB-4 2,2'-Dichlorobiphenyl | PCB-44 | PCB-49 | PCB-60 | PCB-66 2,3',4,4'-Tetrachlorobiphe | PCB-8 2,4'-Dichlorobiphenyl | PCB-86 | Decachlorobiphenyl | PCB-189 | PCB-156 | PCB-157 | PCB-169 | PCB-101 | PCB-118 | PCB-138 | PCB-153 | PCB-180 | PCB-52 | PCB-105 | PCB-114 | PCB-123 | PCB-126 | PCB-77 | PCB-81 |
| | | | | | g/m3 | µg/L | g/m3 | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | g/m3 | µg/L | g/m3 | µg/L | g/m3 | g/m3 | g/m3 | µg/L | µg/L | µg/L | g/m3 | g/m3 | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.000002 | 0.005 | 0.000005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.01 | 0.00001 | 0.005 | 0.000005 | 0.005 | 0.00001 | 0.00001 | 0.00001 | 0.005 | 0.01 | 0.005 | 0.000005 | 0.00001 | 0.005 | 0.01 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.01 | 0.005 | 0.005 | 0.005 | 0.01 | 0.005 | 0.005 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A6 | A6 | 27/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A60 | A60 | 27/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A61 | A61 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62D | A62D | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A63 | A63 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A64D | A64D | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A65 | A65 | 27/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A66 | A66 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A67 | A67 | 27/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A68 | A68 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A70 | A70 | 12/01/2023 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A71 | A71 | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A72 | A72 | 11/01/2023 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A7R | A7R | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 15/06/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A8 | A8 | 23/09/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A8 | A8 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 2/12/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| A9 | A9 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 28/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| C1R | C1R | 11/01/2023 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | 0.057 | <0.00001 | <0.005 | <0.000005 | <0.005 | 0.000019 | <0.00001 | 0.000084 | 0.0097 | <0.01 | <0.005 | 0.0000067 | 0.000045 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | 0.011 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| T1A | T1A | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*
[1] DGV may not protect key test species from acute (and chronic) toxicity.
[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val
[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L
[4] No marine water guideline available; freshwater value adopted for asessment

*References*
ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

## Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | Herbicides | | | Chlorinated Hydrocarbons | | | | | | | | | | | | | | | | | | | | | | | | | | Explosives | | | oaromatics and Keyto | | | | Phthalates | | | | | | | Solvents | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2-Methyl-4,6-dinitrophenol | Pronamide | Trifluralin | 1,1,1,2-tetrachloroethane | 1,1,1-trichloroethane | 1,1,2,2-tetrachloroethane | 1,1,2-trichloroethane | 1,1-dichloroethene | 1,1-dichloropropene | 1,2,4-trichlorobenzene | 1,2-dibromo-3-chloropropane | 1,2-dichlorobenzene | 1,2-dichloroethane | 1,2-dichloropropane | 1,3-dichloropropane | 1,4-dichlorobenzene | 2,2-dichloropropane | 2-chloronaphthalene | 2-chlorotoluene | 4-chlorotoluene | Bromobenzene | Carbon tetrachloride | Chlorobenzene | Chloroform | Chloromethane | cis-1,2-dichloroethene | Methylene chloride | Hexachlorobutadiene | Vinyl chloride | 2,4-Dinitrotoluene | 2,6-dinitrotoluene | Nitrobenzene | 2-Picoline | 4-aminobiphenyl | Acetophenone | Pentachloronitrobenzene | Bis(2-ethylhexyl) phthalate | Butyl benzyl phthalate | Di(2-ethylhexyl)adipate | Diethylphthalate | Dimethyl phthalate | Di-n-butyl phthalate | Di-n-octyl phthalate | 2-hexanone (MBK) | Carbon disulfide | Isophorone | Vinyl acetate |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 30 | 5 | 5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.3 | 0.5 | 0.5 | 0.5 | 0.3 | 0.5 | 0.3 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.3 | 0.5 | 1 | 1 | 0.3 | 5 | 5 | 5 | 5 | 5 | 1 | 5 | 2 | 0.3 | 5 | 0.5 | 0.5 | 0.5 | 0.3 | 0.5 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | 650 | 900 | 18000 | 1300 | | 240 | | | 4000 | 1800 | | | | | | | | 460 | 190 | 1900 | | | 7000 | | 200 | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A19R | A19R | 26/10/2022 | MW | Normal | <30 | <5 | <5 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | <8 | <1 | - | <1 |
| A20R | A20R | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A22 | A22 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A23 | A23 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 27/10/2022 | MW | Normal | <30 | <5 | <5 | - | - | - | - | - | - | <5 | - | <5 | - | - | - | <5 | - | <5 | - | - | - | - | - | - | - | - | - | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | - | - | - |
| A24 | A24 | 28/10/2022 | MW | Normal | - | - | - | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <8 | <1 | - | <1 |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A30 | A30 | 26/10/2022 | MW | Normal | <30 | <5 | <5 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | <8 | <1 | - | <1 |
| A40 | A40 | 28/10/2022 | MW | Normal | - | - | - | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <8 | <1 | - | <1 |
| A41 | A41 | 17/02/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 13/06/2022 | MW | Normal | - | - | - | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | - | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <0.5 | <0.5 | - | <0.5 |
| A41 | A41 | 22/09/2022 | MW | Normal | - | - | - | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <8 | <1 | - | <1 |
| A41 | A41 | 31/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 2/12/2022 | MW | Normal | - | - | - | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <0.3 | <1 | <1 | <1 | <0.3 | <1 | <0.3 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <0.3 | <1 | <1 | <1 | <0.3 | - | - | - | - | <6.3 | <1 | <5 | <2 | <0.3 | <10 | <0.5 | <8 | <1 | <0.3 | <1 |
| A51 | A51 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A52 | A52 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A53 | A53 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A54 | A54 | 26/10/2022 | MW | Normal | <30 | <5 | <5 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | <8 | <1 | - | <1 |
| A54D | A54D | 12/01/2023 | MW | Normal | - | - | - | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <0.3 | <1 | <1 | <1 | <0.3 | <1 | <0.3 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | 1.2 | <1 | <0.3 | <1 | <1 | <1 | <0.3 | - | - | - | - | <6.3 | <1 | <5 | <2 | <0.3 | <10 | <0.5 | <8 | <1 | <0.3 | <1 |
| A55 | A55 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A55D | A55D | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A56 | A56 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A57 | A57 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A58 | A58 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
## Table C5
## NZAS Landfill Groundwater Ecological Screening Values

| | | | | | Herbicides | | | Chlorinated Hydrocarbons | | | | | | | | | | | | | | | | | | | | | | | | | | Explosives | | | oaromatics and Keyto | | | | Phthalates | | | | | | | Solvents | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2-Methyl-4,6-dinitrophenol | Pronamide | Trifluralin | 1,1,1,2-tetrachloroethane | 1,1,1-trichloroethane | 1,1,2,2-tetrachloroethane | 1,1,2-trichloroethane | 1,1-dichloroethene | 1,1-dichloropropene | 1,2,4-trichlorobenzene | 1,2-dibromo-3-chloropropane | 1,2-dichlorobenzene | 1,2-dichloroethane | 1,2-dichloropropane | 1,3-dichloropropane | 1,4-dichlorobenzene | 2,2-dichloropropane | 2-chloronaphthalene | 2-chlorotoluene | 4-chlorotoluene | Bromobenzene | Carbon tetrachloride | Chlorobenzene | Chloroform | Chloromethane | cis-1,2-dichloroethene | Methylene chloride | Hexachlorobutadiene | Vinyl chloride | 2,4-Dinitrotoluene | 2,6-dinitrotoluene | Nitrobenzene | 2-Picoline | 4-aminobiphenyl | Acetophenone | Pentachloronitrobenzene | Bis(2-ethylhexyl) phthalate | Butyl benzyl phthalate | Di(2-ethylhexyl)adipate | Diethylphthalate | Dimethyl phthalate | Di-n-butyl phthalate | Di-n-octyl phthalate | 2-hexanone (MBK) | Carbon disulfide | Isophorone | Vinyl acetate |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 30 | 5 | 5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.3 | 0.5 | 0.5 | 0.5 | 0.3 | 0.5 | 0.3 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.3 | 0.5 | 1 | 1 | 0.3 | 5 | 5 | 5 | 5 | 5 | 1 | 5 | 2 | 0.3 | 5 | 0.5 | 0.5 | 0.5 | 0.3 | 0.5 |
| ANZG (2018) - MW - 80%  species protection (updated 1/10/2021) | | | | | | | | | 650 | 900 | 18000 | 1300 | | 240 | | | 4000 | 1800 | | | | | | | | 460 | 190 | 1900 | | | 7000 | | 200 | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A6 | A6 | 27/10/2022 | MW | Normal | <30 | <5 | <5 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | <8 | <1 | - | <1 |
| A60 | A60 | 27/10/2022 | MW | Normal | <30 | <5 | <5 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | <8 | <1 | - | <1 |
| A61 | A61 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62D | A62D | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A63 | A63 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A64D | A64D | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A65 | A65 | 27/10/2022 | MW | Normal | <30 | <5 | <5 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | <8 | <1 | - | <1 |
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| A68 | A68 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A70 | A70 | 12/01/2023 | MW | Normal | - | - | - | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <0.3 | <1 | <1 | <1 | <0.3 | <1 | <0.3 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <0.3 | <1 | <1 | <1 | <0.3 | - | - | - | - | <6.3 | <1 | <5 | <2 | <0.3 | <10 | <0.5 | <8 | <1 | <0.3 | <1 |
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| A8 | A8 | 2/12/2022 | MW | Normal | - | - | - | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <8 | <1 | - | <1 |
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| A9 | A9 | 28/10/2022 | MW | Normal | - | - | - | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | - | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | <8 | <1 | - | <1 |
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| C2-1 | C2-1 | 27/10/2022 | MW | Normal | <30 | <5 | <5 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | <8 | <1 | - | <1 |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | - | - | - | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <0.3 | <1 | <1 | <1 | <0.3 | <1 | <0.3 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <0.3 | <1 | <1 | <1 | <0.3 | - | - | - | - | <6.3 | <1 | <5 | <2 | <0.3 | <10 | <0.5 | <8 | <1 | <0.3 | <1 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | <30 | <5 | <5 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | <8 | <1 | - | <1 |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | <30 | <5 | <5 | - | - | - | - | - | - | <5 | - | <5 | - | - | - | <5 | - | <5 | - | - | - | - | - | - | - | - | - | <5 | - | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | <5 | <5 | <5 | <5 | - | - | - | - |
| T1A | T1A | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

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US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
# Table C5
# NZAS Landfill Groundwater Ecological Screening Values

| | | | | | PFAS - Perfluoroalkyl Carboxylic Acids | | | | | | | | | | | PFAS - Perfluoroalkyl Sulfonic Acids | | | | | | | | | | | | | PFAS - Perfluoroalkyl Sulfonamide | | | | | | | - Fluorotelomer Sulfonic | | | PFAS - Sums | | | | | PFAS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Perfluorobutanoic acid (PFBA) | Perfluoropentanoic acid (PFPeA) | Perfluorohexanoic acid (PFHxA) | Perfluoroheptanoic acid (PFHpA) | Perfluorooctanoic acid (PFOA) | Perfluorononanoic acid (PFNA) | Perfluorodecanoic acid (PFDA) | Perfluoroundecanoic acid (PFUn | Perfluorododecanoic acid (PFDo | Perfluorotridecanoic acid (PFTrD | Perfluorotetradecanoic acid (PFT | PFHxS (di-branched) | PFHxS (mono-branched) | PFHxS (Total) | PFOS (di-branched) | PFOS (mono-branched) | PFOS (Total) | Perfluoropropanesulfonic acid (P | Perfluorobutane sulfonic acid (P | Perfluoropentane sulfonic acid ( | Perfluorohexane sulfonic acid (P | Perfluoroheptane sulfonic acid ( | Perfluorooctane sulfonic acid (P | Perfluorodecanesulfonic acid (P | Perfluorooctane sulfonamide (FO | N-Methyl perfluorooctane sulfon | N-Ethyl perfluorooctane sulfona | N-Methyl perfluorooctane sulfon | N-Methyl perfluorooctane sulfon | N-Ethyl perfluorooctane sulfona | N-Ethyl perfluorooctane sulfona | 4:2 Fluorotelomer sulfonic acid ( | 6:2 Fluorotelomer Sulfonate (6:2 | 8:2 Fluorotelomer sulfonic acid ( | Sum (PFHxS (Total) + PFOS (Tota | Sum (PFHxS (Total) + PFOS (Tota | Sum (PFOS (Total) + PFOA (Tota | Sum of PFAS (n=10)* | Sum of PFAS (n=31)* | Hexafluoropropylene oxide dime | PFNS (68259-12-1) |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | ug/L |
| EQL | | | | | 0.001 | 0.0005 | 0.0004 | 0.0003 | 0.0002 | 0.0002 | 0.0002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | 0.0001 | 0.0002 | 0.0001 | 0.001 | 0.0002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.001 | 0 | 0 | 0 | 0 | 0 | 0.001 | 0.001 |
| ANZG (2018) - MW - 80%  species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | 1824 | | | | | | | | | | | | 31 | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A10 | A10 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A19R | A19R | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A20R | A20R | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A22 | A22 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A23 | A23 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A24 | A24 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_GWDup1 | A24 | 28/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A30 | A30 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A40 | A40 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 17/02/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 13/06/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 22/09/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 31/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A41 | A41 | 2/12/2022 | MW | Normal | <0.001 | <0.0005 | <0.0004 | <0.0003 | <0.0002 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | <0.0002 | <0.0002 | <0.0002 | <0.0001 | <0.0002 | <0.0001 | <0.001 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | - | - | - | - | - | <0.001 | <0.001 |
| A51 | A51 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A52 | A52 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A53 | A53 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A54 | A54 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A54D | A54D | 12/01/2023 | MW | Normal | <0.05 | <0.01 | <0.0004 | 0.002 | 0.0033 | 0.0008 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | 0.00045 | <0.0001 | 0.0031 | 0.0085 | <0.0002 | 0.00091 | <0.0002 | 0.00045 | <0.0002 | 0.0054 | <0.001 | 0.00022 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.012 | 0.009 | 0.012 | 0.015 | 0.016 | <0.001 | <0.001 |
| A55 | A55 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A55D | A55D | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A56 | A56 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A57 | A57 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A58 | A58 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
# Table C5
# NZAS Landfill Groundwater Ecological Screening Values

| | | | | | PFAS - Perfluoroalkyl Carboxylic Acids | | | | | | | | | | | PFAS - Perfluoroalkyl Sulfonic Acids | | | | | | | | | | | | | PFAS - Perfluoroalkyl Sulfonamide | | | | | | | - Fluorotelomer Sulfonic | | | PFAS - Sums | | | | | PFAS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Perfluorobutanoic acid (PFBA) | Perfluoropentanoic acid (PFPeA) | Perfluorohexanoic acid (PFHxA) | Perfluoroheptanoic acid (PFHpA | Perfluorooctanoic acid (PFOA) | Perfluorononanoic acid (PFNA) | Perfluorodecanoic acid (PFDA) | Perfluoroundecanoic acid (PFUn | Perfluorododecanoic acid (PFDo | Perfluorotridecanoic acid (PFTrD | Perfluorotetradecanoic acid (PFT | PFHxS (di-branched) | PFHxS (mono-branched) | PFHxS (Total) | PFOS (di-branched) | PFOS (mono-branched) | PFOS (Total) | Perfluoropropanesulfonic acid (P | Perfluorobutane sulfonic acid (P | Perfluoropentane sulfonic acid ( | Perfluorohexane sulfonic acid (P | Perfluoroheptane sulfonic acid ( | Perfluorooctane sulfonic acid (P | Perfluorodecanesulfonic acid (P | Perfluorooctane sulfonamide (FO | N-Methyl perfluorooctane sulfon | N-Ethyl perfluorooctane sulfona | N-Methyl perfluorooctane sulfon | N-Methyl perfluorooctane sulfon | N-Ethyl perfluorooctane sulfona | N-Ethyl perfluorooctane sulfona | 4:2 Fluorotelomer sulfonic acid ( | 6:2 Fluorotelomer Sulfonate (6:2 | 8:2 Fluorotelomer sulfonic acid ( | Sum (PFHxS (Total) + PFOS (Tot | Sum (PFHxS (Total) + PFOS (Tot | Sum (PFOS (Total) + PFOA (Tota | Sum of PFAS (n=10)* | Sum of PFAS (n=31)* | Hexafluoropropylene oxide dime | PFNS (68259-12-1) |
| | | | | | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | ug/L |
| EQL | | | | | 0.001 | 0.0005 | 0.0004 | 0.0003 | 0.0002 | 0.0002 | 0.0002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | 0.0001 | 0.0002 | 0.0001 | 0.001 | 0.0002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.005 | 0.001 | 0 | 0 | 0 | 0 | 0 | 0.001 | 0.001 |
| ANZG (2018) - MW - 80%  species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - low reliability trigger value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZECC (2000) Background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| BE MoE (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| US EPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2022) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME (2007) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| van dam et al. (2018) 80% Marine | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Golding et al. (2022) 80% species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HEPA (2020) - 80 % Marine Species | | | | | | | | | 1824 | | | | | | | | | | | | 31 | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A5AR | A5AR | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A6 | A6 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A60 | A60 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A61 | A61 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62D | A62D | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A62S | A62S | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A63 | A63 | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A64D | A64D | 25/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A65 | A65 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A66 | A66 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A67 | A67 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A68 | A68 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A70 | A70 | 12/01/2023 | MW | Normal | <0.01 | <0.005 | 0.0026 | 0.0015 | 0.0056 | 0.0011 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | 0.00046 | <0.0001 | 0.0013 | 0.0023 | <0.0002 | 0.00049 | <0.0002 | 0.00046 | <0.0002 | 0.00098 | <0.001 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.0083 | 0.0027 | 0.0079 | 0.013 | 0.014 | <0.001 | <0.001 |
| A71 | A71 | 12/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A72 | A72 | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A7R | A7R | 11/01/2023 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 15/06/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 23/09/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A8 | A8 | 2/12/2022 | MW | Normal | 0.0026 | <0.0005 | <0.0004 | <0.0003 | 0.00052 | <0.0002 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | <0.0001 | <0.0001 | 0.00019 | 0.00045 | <0.0002 | 0.00034 | <0.0002 | <0.0001 | <0.0002 | 0.00025 | <0.001 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.00097 | 0.00045 | 0.00097 | 0.0039 | 0.0039 | <0.001 | <0.001 |
| A9 | A9 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A9 | A9 | 28/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C1R | C1R | 11/01/2023 | MW | Normal | <0.4 | <0.02 | <0.0004 | 0.00086 | 0.0035 | 0.00029 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | 0.00019 | <0.0001 | 0.00098 | 0.0023 | <0.0002 | 0.00043 | <0.0002 | 0.00019 | <0.0002 | 0.0014 | <0.001 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.0061 | 0.0025 | 0.0059 | 0.0074 | 0.0077 | <0.001 | <0.001 |
| C2-1 | C2-1 | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_GWdup2 | C2-1 | 27/10/2022 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C3R | C3R | 11/01/2023 | MW | Normal | <0.1 | <0.02 | 0.021 | 0.018 | 0.021 | 0.0036 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.0001 | <0.0001 | 0.0014 | 0.0004 | 0.0032 | 0.0088 | 0.00064 | 0.0013 | 0.00059 | 0.0014 | 0.00028 | 0.0052 | <0.001 | <0.0002 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.005 | <0.001 | 0.031 | 0.01 | 0.03 | 0.071 | 0.076 | <0.001 | <0.001 |
| LF_GWDUP4 | C3R | 11/01/2023 | MW | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| C4 | C4 | 26/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_33_1.0-1.2 | LF_TP_33 | 28/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP33_1.0-1.2 | LF_TP_33 | 27/10/2022 | TP | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| T1A | T1A | 27/10/2022 | MW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*Notes*

[1] DGV may not protect key test species from acute (and chronic) toxicity.

[2] ANZG (2018) does not provide guidelines for total chromium in marine water. Therefore, the marine water trigger val

[3] Typical concentrations in marine water range from ~0.8 to 1.4 mg/L

[4] No marine water guideline available; freshwater value adopted for asessment

*References*

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality
ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality
British Colombia MoE (2022) Water Quality Ambient Water Quality Criteria for Fluoride
US EPA (2006) EPA Region III BTAG FRESHWATER SCREENING BENCHMARKS 7/2006 and EPA Region III BTA
CCME (2022) Canadian Environmental Quality Guidelines - Water Quality Guidelines for the Protection of Aquatic Life (
CCME (2007) CANADIAN GUIDANCE FRAMEWORK FOR THE MANAGEMENT OF NUTRIENTS IN NEARSHORE
van dam et al. (2018) Water quality guideline values for aluminium, gallium and molybdenum in marine environments, E
Golding et al. (2022) Toxicity of arsenic(V) to temperate and tropical marine biota and the derivation of chronic marine w
HEPA (2020) PFAS National Environmental Management Plan

# Appendix C
# Table C6
# Beach groundwater results

| Field_ID | Area | Adjacent CMA Sample | Sampled Dat | Location_Type | Sample Type | Minor ions | Inorganics | | | Nutrients | | | | Organic Indicators |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Cyanide (Total) | Cyanide (WAD) | Sulfate (Filtered) | Ammonia as N (Filtered) | Nitrate (as NO3-) (Filtered) | Nitrite (as NO2-) (Filtered) | Reactive Phosphorus as P (Filte | Carbonaceous Biochemical Oxy |
| | | | | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | g/m3 |
| EQL | | | | | | 0.02 | 0.001 | 0.001 | 0.15 | 0.005 | 0.002 | 0.001 | 0.002 | 1 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | 0.014 | | | 1.7 | | | | |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | | 0.004 | | | 0.91 | | | | |
| ANZG (2018) - MW - 99% species protection (updated 1/10/2021) | | | | | | | | | | | | | | |
| ANZG (2018) - MW - Unknown level of species protection | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | 1.5 | | | 2712 | | | | | |
| Typical background level in marine water | | | | | | | | | | | | | | |
| Scientific literature value | | | | | | | | | | | | | 0.1 | |
| PFAs NEMP 95% | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | |
| Beach_GW_12 | South Drain discharge point | CMA_SD_SED4 / OCS5 | 29/09/2022 | Seep | Normal | 4.8 | <0.001 | <0.001 | 216 | 0.01 | 0.141 | <0.001 | 0.003 | <1 |
| Beach_GW_13 | Landill north coast | CMA_SED13 / CMA_OC13 | 1/10/2022 | Seep | Normal | 0.93 | <0.001 | <0.001 | 2410 | 0.14 | 0.0366 | 0.0015 | 0.04 | <1 |
| Beach_GW_14 | Landill north coast | CMA_SED14 / CMA_OC14 | 1/10/2022 | Seep | Normal | 0.87 | <0.001 | <0.001 | 2530 | <0.005 | 0.0829 | <0.001 | 0.03 | <1 |
| Beach_GW_15 | Landill north coast | CMA_SED15 / CMA_OC15 | 1/10/2022 | Seep | Normal | 0.2 | <0.001 | <0.001 | 582 | 0.71 | <0.002 | <0.001 | 0.005 | <1 |
| Beach_GW_16 | Landfill west coast | CMA_SED16/CMA_OC16 | 1/10/2022 | Seep | Normal | 0.4 | <0.001 | <0.001 | 915 | 0.04 | 0.009 | 0.0019 | 0.006 | <1 |
| Beach_GW_17 | Landfill west coast | CMA_SED17/CMA_OC17 | 30/09/2022 | Seep | Normal | 10.9 | <0.001 | <0.001 | 513 | 0.21 | <0.002 | 0.0196 | 0.073 | <1 |
| Beach_GW_18 | Landfill west coast | CMA_SED18/CMA_OC18 | 30/09/2022 | Seep | Normal | 0.73 | <0.001 | <0.001 | 773 | 0.16 | <0.002 | 0.0112 | 0.053 | <1 |
| Beach_GW_19 | Landfill west coast | CMA_SED19/CMA_OC19 | 30/09/2022 | Seep | Normal | 5.1 | <0.001 | <0.001 | 372 | 0.02 | 0.0275 | 0.0336 | 0.053 | <1 |
| Beach_GW_20 | Landfill west coast | CMA_SED20/CMA_OC20 | 30/09/2022 | Seep | Normal | 0.75 | <0.001 | <0.001 | 2160 | 0.01 | 0.163 | 0.0015 | 0.042 | <1 |
| Beach_GW_21 | Landfill south east | CMA_SED21/CMA_OC21 | 19/09/2022 | Seep | Normal | 0.89 | <0.001 | <0.001 | 2440 | 0.14 | 0.071 | <0.001 | 0.012 | <1 |
| Beach_GW_22 | Landfill south east | CMA_SED22/CMA_OC22 | 19/09/2022 | Seep | Normal | 0.89 | <0.001 | <0.001 | 2500 | <0.005 | 0.0472 | <0.001 | 0.011 | <1 |
| Beach_GW_31 | Landfill south east | CMA_SED31/CMA_OC31 | 28/09/2022 | Seep | Normal | 0.86 | <0.001 | <0.001 | 2610 | 0.14 | 0.269 | 0.0363 | 0.027 | 2.58 |
| Beach_GW_32 | Landfill south east | CMA_SED32/CMA_OC32 | 28/09/2022 | Seep | Normal | 0.84 | <0.001 | <0.001 | 2580 | 0.13 | 0.362 | 0.0165 | 0.022 | <1 |
| Beach_GW_33 | Landfill south east | CMA_SED33/CMA_OC33 | 28/09/2022 | Seep | Normal | 0.87 | <0.001 | <0.001 | 2520 | <0.005 | 0.0652 | <0.001 | 0.011 | <1 |
| Beach_GW_34 | Landfill south east | CMA_SED34/CMA_OC34 | 28/09/2022 | Seep | Normal | 0.9 | <0.001 | <0.001 | 2580 | <0.005 | 0.0677 | <0.001 | 0.009 | <1 |
| Beach_GW_35 | Landfill south east | CMA_SED35/CMA_OC35 | 29/09/2022 | Seep | Normal | 0.9 | <0.001 | <0.001 | 2420 | <0.005 | 0.0616 | <0.001 | 0.012 | <1 |
| Beach_GW_36 | Landfill south east | CMA_SED36/CMA_OC36 | 29/09/2022 | Seep | Normal | 0.88 | <0.001 | <0.001 | 2590 | <0.005 | 0.0316 | <0.001 | 0.009 | <1 |
| Beach_GW_37 | Landfill south east | CMA_SED37/CMA_OC37 | 28/09/2022 | Seep | Normal | 0.86 | <0.001 | <0.001 | 2490 | <0.005 | 0.0696 | <0.001 | 0.011 | <1 |
| Beach_GW_38 | Landfill south east | CMA_SED38/CMA_OC38 | 28/09/2022 | Seep | Normal | 0.86 | <0.001 | <0.001 | 2570 | <0.005 | 0.0489 | <0.001 | 0.01 | <1 |
| Beach_GW_39 | Landfill south east | CMA_SED39/CMA_OC39 | 28/09/2022 | Seep | Normal | 0.89 | <0.001 | <0.001 | 2530 | 0.007 | 0.0328 | <0.001 | 0.014 | <1 |
| Beach_GW_40 | Landfill south east | CMA_SED40/CMA_OC40 | 28/09/2022 | Seep | Normal | 0.88 | <0.001 | <0.001 | 2520 | <0.005 | 0.0357 | <0.001 | 0.009 | <1 |

| Field_ID | Metals | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aluminium | Aluminium (Filtered) | Arsenic | Arsenic (Filtered) | Barium | Barium (Filtered) | Beryllium | Beryllium (Filtered) | Boron | Boron (Filtered) | Cadmium | Cadmium (Filtered) | Chromium (III+VI) | Chromium (III+VI) (Filtered) | Cobalt | Cobalt (Filtered) | Copper | Copper (Filtered) |
| | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | 0.003 | 0.003 | 0.0005 | 0.0005 | 0.0001 | 0.0002 | 0.00001 | 0.00001 | 0.005 | 0.01 | 0.00002 | 0.00002 | 0.0002 | 0.0002 | 0.00001 | 0.00001 | 0.0002 | 0.0002 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | 0.036 | | 0.085 | | 0.15 | | 0.008 |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | | | | | | | 0.0055 | | 0.0044 | | 0.001 | | 0.0013 |
| ANZG (2018) - MW - 99% species protection (updated 1/10/2021) | | | | | | | | | | | | 0.0007 | | | | | | |
| ANZG (2018) - MW - Unknown level of species protection | | | | | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | 0.006 | | 0.0001 | | | | | | | | | | |
| Typical background level in marine water | | | | | | | | | | 5.1 | | | | | | | | |
| Scientific literature value | | 0.056 | | 0.012 | | | | | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | | | |
| Beach_GW_12 | 7.09 | 1.97 | <0.005 | <0.005 | 0.006 | 0.0027 | 0.0001 | <0.0001 | 0.4 | 0.4 | <0.0002 | <0.0002 | 0.0038 | <0.002 | 0.0005 | <0.0001 | 0.0036 | <0.002 |
| Beach_GW_13 | 0.395 | 0.05 | 0.0054 | <0.005 | 0.0098 | 0.0104 | <0.0001 | <0.0001 | 3.91 | 4.67 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.00013 | 0.0001 | <0.002 | <0.002 |
| Beach_GW_14 | 8.19 | 0.054 | <0.005 | <0.005 | 0.0153 | 0.0089 | 0.00012 | <0.0001 | 3.89 | 4.69 | <0.0002 | <0.0002 | 0.0086 | <0.002 | 0.00151 | <0.0001 | 0.0063 | <0.002 |
| Beach_GW_15 | 0.641 | 0.157 | 0.0701 | 0.111 | 0.0114 | 0.0119 | <0.0001 | <0.0001 | 0.855 | 0.906 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.00039 | <0.0001 | <0.002 | <0.002 |
| Beach_GW_16 | 0.945 | 0.083 | <0.005 | <0.005 | 0.006 | 0.006 | <0.0001 | <0.0001 | 1.11 | 1.29 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.00011 | 0.00014 | <0.002 | <0.002 |
| Beach_GW_17 | 0.45 | 0.319 | 0.021 | 0.014 | 0.0029 | 0.0031 | <0.0001 | <0.0001 | 1.43 | 1.34 | <0.0002 | <0.0002 | <0.002 | 0.0022 | 0.00018 | <0.0001 | <0.002 | <0.002 |
| Beach_GW_18 | 0.63 | 0.538 | 0.017 | 0.017 | 0.0044 | 0.0051 | <0.0001 | <0.0001 | 1.23 | 1.28 | <0.0002 | <0.0002 | 0.0059 | 0.0045 | 0.00012 | <0.0001 | <0.002 | <0.002 |
| Beach_GW_19 | 1.48 | 1.39 | <0.005 | <0.005 | 0.0066 | 0.0073 | <0.0001 | <0.0001 | 0.778 | 0.77 | <0.0002 | <0.0002 | <0.002 | 0.0025 | 0.00096 | 0.00102 | <0.002 | <0.002 |
| Beach_GW_20 | 0.899 | <0.03 | 0.0088 | 0.0064 | 0.0092 | 0.0079 | <0.0001 | <0.0001 | 2.98 | 3.19 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.0007 | 0.00019 | 0.0029 | <0.002 |
| Beach_GW_21 | 0.047 | 0.0049 | <0.005 | <0.0005 | 0.0055 | 0.0057 | <0.0001 | <0.00001 | 3.54 | 4.06 | <0.0002 | <0.00002 | <0.002 | <0.0002 | <0.0001 | <0.00001 | <0.002 | <0.0002 |
| Beach_GW_22 | 0.3 | 0.0064 | <0.005 | <0.0005 | 0.0102 | 0.0062 | <0.0001 | <0.00001 | 4.15 | 4.46 | <0.0002 | <0.00002 | <0.002 | <0.0002 | 0.00066 | <0.00001 | <0.002 | <0.0002 |
| Beach_GW_31 | 0.338 | 0.042 | 0.0053 | 0.006 | 0.0148 | 0.008 | <0.0001 | <0.0001 | 3.87 | 4.34 | <0.0002 | <0.0002 | 0.0024 | <0.002 | 0.00025 | <0.0001 | 0.0743 | <0.002 |
| Beach_GW_32 | 0.032 | 0.032 | <0.005 | <0.005 | 0.0067 | 0.0077 | <0.0001 | <0.0001 | 3.76 | 4.3 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.0001 | <0.0001 | 0.0067 | <0.002 |
| Beach_GW_33 | 0.061 | 0.035 | <0.005 | <0.005 | 0.0088 | 0.0079 | <0.0001 | <0.0001 | 3.86 | 4.53 | <0.0002 | <0.0002 | <0.002 | 0.0025 | <0.0001 | <0.0001 | 0.0067 | <0.002 |
| Beach_GW_34 | 0.366 | 0.038 | <0.005 | <0.005 | 0.0107 | 0.008 | <0.0001 | <0.0001 | 3.92 | 4.48 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.00016 | <0.0001 | 0.0073 | <0.002 |
| Beach_GW_35 | <0.03 | <0.03 | <0.005 | <0.005 | 0.0071 | 0.0067 | <0.0001 | <0.0001 | 4.19 | 4.52 | <0.0002 | <0.0002 | <0.002 | <0.002 | <0.0001 | <0.0001 | <0.002 | <0.002 |
| Beach_GW_36 | 0.37 | <0.03 | <0.005 | <0.005 | 0.0073 | 0.007 | <0.0001 | <0.0001 | 4.18 | 4.78 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.00031 | <0.0001 | <0.002 | <0.002 |
| Beach_GW_37 | 0.05 | <0.03 | <0.005 | <0.005 | 0.0073 | 0.007 | <0.0001 | <0.0001 | 3.9 | 4.16 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.00011 | <0.0001 | 0.0067 | <0.002 |
| Beach_GW_38 | 0.22 | <0.03 | <0.005 | <0.005 | 0.0091 | 0.0076 | <0.0001 | <0.0001 | 3.92 | 4.09 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.0003 | <0.0001 | 0.0074 | <0.002 |
| Beach_GW_39 | 0.034 | <0.03 | <0.005 | <0.005 | 0.0072 | 0.007 | <0.0001 | <0.0001 | 3.92 | 4.29 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.00011 | <0.0001 | 0.0059 | <0.002 |
| Beach_GW_40 | 0.341 | 0.03 | <0.005 | <0.005 | 0.008 | 0.0099 | <0.0001 | <0.0001 | 3.71 | 4.85 | <0.0002 | <0.0002 | <0.002 | <0.002 | 0.0005 | <0.0001 | 0.0066 | <0.002 |

| Field_ID | Metals | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Iron | Iron (Filtered) | Lead | Lead (Filtered) | Lithium | Lithium (Filtered) | Manganese (Filtered) | Mercury | Mercury (Filtered) | Nickel | Nickel (Filtered) | Titanium | Titanium (Filtered) | Vanadium | Vanadium (Filtered) | Zinc |
| | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | 0.005 | 0.005 | 0.00005 | 0.00005 | 0.00001 | 0.00001 | 0.0005 | 0.001 | 0.00008 | 0.0002 | 0.0002 | 0.002 | 0.002 | 0.0005 | 0.0005 | 0.003 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | 0.012 | | | | | 0.0014 | | 0.56 | | | | 0.28 | |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | 0.0044 | | | | | 0.0004 | | 0.07 | | | | 0.1 | |
| ANZG (2018) - MW - 99% species protection (updated 1/10/2021) | | | | | | | | | 0.0001 | | 0.007 | | | | | |
| ANZG (2018) - MW - Unknown level of species protection | | | | | | | 0.08 | | | | | | | | | |
| 80th percentile of background location data | | 0.05 | | | | | | | | | | | 0.02 | | | |
| Typical background level in marine water | | | | | | | | | | | | | | | | |
| Scientific literature value | | | | | | | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | |
| Beach_GW_12 | 1.77 | 0.056 | <0.0005 | <0.0005 | 0.0238 | 0.0197 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | 0.0713 | <0.02 | 0.008 | <0.005 | <0.03 |
| Beach_GW_13 | 0.53 | 0.17 | <0.0005 | <0.0005 | 0.202 | 0.203 | 0.0081 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.011 | 0.0094 | <0.03 |
| Beach_GW_14 | 3.85 | <0.05 | 0.0022 | <0.0005 | 0.22 | 0.199 | 0.0065 | <0.001 | <0.0008 | 0.0062 | <0.002 | 0.252 | <0.02 | 0.015 | <0.005 | <0.03 |
| Beach_GW_15 | 1.64 | 1.08 | <0.0005 | <0.0005 | 0.0324 | 0.0333 | 0.062 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.0092 | <0.005 | <0.03 |
| Beach_GW_16 | 1.21 | 0.895 | <0.0005 | <0.0005 | 0.0703 | 0.0738 | 0.01 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.0078 | <0.005 | <0.03 |
| Beach_GW_17 | 1.93 | 0.693 | <0.0005 | <0.0005 | 0.0615 | 0.0514 | 0.0085 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.014 | 0.0099 | <0.03 |
| Beach_GW_18 | 1.28 | 0.542 | <0.0005 | <0.0005 | 0.0746 | 0.0671 | 0.017 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.03 | 0.028 | <0.03 |
| Beach_GW_19 | 0.981 | 0.913 | 0.00054 | <0.0005 | 0.0287 | 0.0264 | 0.046 | <0.001 | <0.0008 | 0.0082 | 0.0089 | <0.02 | <0.02 | 0.0073 | 0.0058 | <0.03 |
| Beach_GW_20 | 1.13 | <0.05 | 0.0011 | <0.0005 | 0.161 | 0.145 | 0.016 | <0.001 | <0.0008 | <0.002 | <0.002 | 0.038 | <0.02 | 0.01 | <0.005 | <0.03 |
| Beach_GW_21 | <0.05 | <0.005 | 0.00074 | <0.00005 | 0.163 | 0.186 | <0.0005 | <0.001 | <0.00008 | <0.002 | 0.00063 | <0.02 | 0.0098 | <0.005 | <0.0005 | <0.03 |
| Beach_GW_22 | 0.48 | <0.005 | 0.00081 | <0.00005 | 0.163 | 0.204 | <0.0005 | <0.001 | <0.00008 | <0.002 | <0.0002 | <0.02 | 0.0092 | 0.0092 | 0.00086 | <0.03 |
| Beach_GW_31 | 0.44 | <0.05 | <0.0005 | <0.0005 | 0.197 | 0.268 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.0054 | <0.005 | <0.03 |
| Beach_GW_32 | <0.05 | <0.05 | <0.0005 | <0.0005 | 0.193 | 0.276 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.005 | <0.03 |
| Beach_GW_33 | <0.05 | <0.05 | <0.0005 | <0.0005 | 0.196 | 0.295 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.005 | <0.03 |
| Beach_GW_34 | 0.36 | <0.05 | <0.0005 | <0.0005 | 0.2 | 0.288 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.0068 | <0.005 | <0.03 |
| Beach_GW_35 | <0.05 | <0.05 | <0.0005 | <0.0005 | 0.184 | 0.207 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.005 | <0.03 |
| Beach_GW_36 | 0.49 | <0.05 | <0.0005 | <0.0005 | 0.19 | 0.21 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.0067 | <0.005 | <0.03 |
| Beach_GW_37 | <0.05 | <0.05 | <0.0005 | <0.0005 | 0.197 | 0.273 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.005 | <0.03 |
| Beach_GW_38 | 0.24 | <0.05 | 0.00083 | <0.0005 | 0.202 | 0.264 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.0059 | <0.005 | <0.03 |
| Beach_GW_39 | <0.05 | <0.05 | <0.0005 | <0.0005 | 0.198 | 0.276 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | <0.005 | <0.005 | <0.03 |
| Beach_GW_40 | 0.46 | <0.05 | 0.00084 | <0.0005 | 0.182 | 0.323 | <0.005 | <0.001 | <0.0008 | <0.002 | <0.002 | <0.02 | <0.02 | 0.0065 | <0.005 | <0.03 |

# Appendix C
## Table C6
## Beach groundwater results

| | | | | | | | BTEXN | | | | | | TPH | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Zinc (Filtered) | Naphthalene (BTEXN suite) | Benzene | Toluene | Ethylbenzene | Xylene (o) | Xylene (m & p) | C7-C9 | C10-C14 | C15-C36 | C7-C36 (Total) |
| | | | | | | mg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | | 0.001 | 1 | 1 | 1 | 1 | 1 | 1 | 200 | 200 | 300 | 500 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | 0.021 | 120 | 1300 | 330 | 160 | | | | | | |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | 0.008 | 70 | 700 | 180 | 80 | | | | | | |
| ANZG (2018) - MW - 99% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - Unknown level of species protection | | | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | | | | | | | | | | | |
| Typical background level in marine water | | | | | | | | | | | | | | | | |
| Scientific literature value | | | | | | | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | |
| Field_ID | Area | Adjacent CMA Sample | Sampled Dat | Location_Type | Sample Type | | | | | | | | | | | |
| Beach_GW_12 | South Drain discharge point | CMA_SD_SED4 / OCS5 | 29/09/2022 | Seep | Normal | 0.017 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_13 | Landill north coast | CMA_SED13 / CMA_OC13 | 1/10/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_14 | Landill north coast | CMA_SED14 / CMA_OC14 | 1/10/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_15 | Landill north coast | CMA_SED15 / CMA_OC15 | 1/10/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_16 | Landfill west coast | CMA_SED16/CMA_OC16 | 1/10/2022 | Seep | Normal | 0.011 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_17 | Landfill west coast | CMA_SED17/CMA_OC17 | 30/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_18 | Landfill west coast | CMA_SED18/CMA_OC18 | 30/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_19 | Landfill west coast | CMA_SED19/CMA_OC19 | 30/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_20 | Landfill west coast | CMA_SED20/CMA_OC20 | 30/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_21 | Landfill south east | CMA_SED21/CMA_OC21 | 19/09/2022 | Seep | Normal | <0.001 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_22 | Landfill south east | CMA_SED22/CMA_OC22 | 19/09/2022 | Seep | Normal | <0.001 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_31 | Landfill south east | CMA_SED31/CMA_OC31 | 28/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_32 | Landfill south east | CMA_SED32/CMA_OC32 | 28/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_33 | Landfill south east | CMA_SED33/CMA_OC33 | 28/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_34 | Landfill south east | CMA_SED34/CMA_OC34 | 28/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_35 | Landfill south east | CMA_SED35/CMA_OC35 | 29/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_36 | Landfill south east | CMA_SED36/CMA_OC36 | 29/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_37 | Landfill south east | CMA_SED37/CMA_OC37 | 28/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_38 | Landfill south east | CMA_SED38/CMA_OC38 | 28/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_39 | Landfill south east | CMA_SED39/CMA_OC39 | 28/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |
| Beach_GW_40 | Landfill south east | CMA_SED40/CMA_OC40 | 28/09/2022 | Seep | Normal | <0.01 | <1 | <1 | <1 | <1 | <1 | <1 | <200 | <200 | <300 | <500 |

| | PAHs - standard 16 | | | | | | | | | | | | | | | | | | PAHs - extended |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero | Total 8 PAHs (as BaP TEQ)(full L | 2-methylnaphthalene |
| | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.06 | 0.03 | 0.02 | 0.02 | 0.05 | 0.06 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | 0.7 | | | | | | 2 | | | 120 | 8 | | | | |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | 0.2 | | | | | | 1.4 | | | 70 | 2 | | | | |
| ANZG (2018) - MW - 99% species protection (updated 1/10/2021) | | | | | 0.1 | | | | | | 1 | | | 50 | 0.6 | | | | |
| ANZG (2018) - MW - Unknown level of species protection | | | | | | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | | | | | | | | | | | | | | |
| Typical background level in marine water | | | - | | | | | | | | | | | | | | | | |
| Scientific literature value | | | | 0.02 | | | | | | | | 3 | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | | | | |
| Field_ID | | | | | | | | | | | | | | | | | | | |
| Beach_GW_12 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_13 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_14 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_15 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_16 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_17 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_18 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_19 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_20 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_21 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_22 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_31 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_32 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_33 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_34 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_35 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_36 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_37 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_38 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_39 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |
| Beach_GW_40 | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 |

| | VOCs | | | | | | | | | | | | | | | | | | | | | SVOCs | MAH | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1,1-dichloroethane | 1,2,3-trichlorobenzene | 1,2,3-trichloropropane | 1,2-dibromoethane | 1,3-dichlorobenzene | 1,4-Dioxane | 2-Chloroethylvinyl ether | 4-methyl-2-pentanone (MIBK) | Bromodichloromethane | Bromoform | Chlorodibromomethane | Chloroethane | cis-1,3-dichloropropene | Dibromomethane | Iodomethane | MTBE | Trichloroethene | Tetrachloroethene | trans-1,3-dichloropropene | trans-1,2-dichloroethene | Trichlorofluoromethane | 1-Methylnaphthalene | 1,2,4-trimethylbenzene | 1,3,5-trimethylbenzene | Isopropylbenzene | Styrene | n-butylbenzene | n-propylbenzene | sec-butylbenzene | tert-butylbenzene | p-isopropyltoluene |
| | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | 1 | 1 | 1 | 1 | 1 | 20 | 8 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0.06 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - 99% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - Unknown level of species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Typical background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Scientific literature value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field_ID | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Beach_GW_12 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_13 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_14 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_15 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_16 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_17 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_18 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_19 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_20 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_21 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_22 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_31 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_32 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_33 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_34 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_35 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_36 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_37 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_38 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_39 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_40 | <1 | <1 | <1 | <1 | <1 | <20 | <8 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <0.06 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 |

# Appendix C
## Table C6
## Beach groundwater results

| | | | | | | Halogenated | | PCBs | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Bromomethane | Dichlorodifluoromethane | 2,3,7,8-TCDD TEQ | PCB-121 | PCB-128 & PCB-167 2,2',3,3',4,4' | PCB-141 | PCB-149 | PCB-151 | PCB-159 | PCB-170 | PCB-18 | PCB-187 2,2',3,4',5,5',6-Heptachl | PCB-194 | PCB-195 2,2',3,3',4,4',5,6-Octach | PCB-206 | PCB-28 & PCB-31 PCB-28 & PCB | PCB-3 4-Chlorobiphenyl | PCB-4 2,2'-Dichlorobiphenyl | PCB-44 | PCB-49 | PCB-60 | PCB-66 2,3',4,4'-Tetrachlorobiph | PCB-8 2,4'-Dichlorobiphenyl | PCB-86 | Decachlorobiphenyl | PCB-189 | PCB-156 | PCB-157 | PCB-169 | PCB-101 | PCB-118 | PCB-138 | PCB-153 | PCB-180 | PCB-52 | PCB-105 | PCB-114 | PCB-123 | PCB-126 | PCB-77 | PCB-81 | 1,1,1,2-tetrachloroethane | 1,1,1-trichloroethane | 1,1,2,2-tetrachloroethane | 1,1,2-trichloroethane | 1,1-dichloroethene | 1,1-dichloropropene | 1,2,4-trichlorobenzene | 1,2-dibromo-3-chloropropane | 1,2-dichlorobenzene |
| | | | | | | μg/L | μg/L | g/m3 | μg/L | g/m3 | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | g/m3 | μg/L | g/m3 | μg/L | g/m3 | g/m3 | g/m3 | μg/L | μg/L | μg/L | g/m3 | g/m3 | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L | μg/L |
| EQL | | | | | | 1 | 1 | 0.000002 | 0.005 | 0.000005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.01 | 0.00001 | 0.005 | 0.000005 | 0.005 | 0.00001 | 0.00001 | 0.00001 | 0.005 | 0.01 | 0.005 | 0.000005 | 0.00001 | 0.005 | 0.01 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.01 | 0.005 | 0.005 | 0.005 | 0.01 | 0.005 | 0.005 | 1 | 1 | 5 | 1 | 1 | 1 | 1 | 1 | 1 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - 99% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - Unknown level of species protection | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Typical background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Scientific literature value | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field_ID | Area | Adjacent CMA Sample | Sampled Dat | Location_Type | Sample Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Beach_GW_12 | South Drain discharge point | CMA_SD_SED4 / OCS5 | 29/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_13 | Landill north coast | CMA_SED13 / CMA_OC13 | 1/10/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_14 | Landill north coast | CMA_SED14 / CMA_OC14 | 1/10/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_15 | Landill north coast | CMA_SED15 / CMA_OC15 | 1/10/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_16 | Landfill west coast | CMA_SED16/CMA_OC16 | 1/10/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_17 | Landfill west coast | CMA_SED17/CMA_OC17 | 30/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_18 | Landfill west coast | CMA_SED18/CMA_OC18 | 30/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_19 | Landfill west coast | CMA_SED19/CMA_OC19 | 30/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_20 | Landfill west coast | CMA_SED20/CMA_OC20 | 30/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_21 | Landfill south east | CMA_SED21/CMA_OC21 | 19/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_22 | Landfill south east | CMA_SED22/CMA_OC22 | 19/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_31 | Landfill south east | CMA_SED31/CMA_OC31 | 28/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_32 | Landfill south east | CMA_SED32/CMA_OC32 | 28/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_33 | Landfill south east | CMA_SED33/CMA_OC33 | 28/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_34 | Landfill south east | CMA_SED34/CMA_OC34 | 28/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_35 | Landfill south east | CMA_SED35/CMA_OC35 | 29/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_36 | Landfill south east | CMA_SED36/CMA_OC36 | 29/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_37 | Landfill south east | CMA_SED37/CMA_OC37 | 28/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_38 | Landfill south east | CMA_SED38/CMA_OC38 | 28/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_39 | Landfill south east | CMA_SED39/CMA_OC39 | 28/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |
| Beach_GW_40 | Landfill south east | CMA_SED40/CMA_OC40 | 28/09/2022 | Seep | Normal | <1 | <1 | <0.000002 | <0.005 | <0.000005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.00001 | <0.005 | <0.000005 | <0.005 | <0.00001 | <0.00001 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.000005 | <0.00001 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <0.005 | <0.01 | <0.005 | <0.005 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <1 | <1 |

# Appendix C
## Table C6
## Beach groundwater results

| | | | | | | Chlorinated Hydrocarbons | | | | | | | | | | | | | | | | Solvents | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1,2-dichloroethane | 1,2-dichloropropane | 1,3-dichloropropane | 1,4-dichlorobenzene | 2,2-dichloropropane | 2-chlorotoluene | 4-chlorotoluene | Bromobenzene | Carbon tetrachloride | Chlorobenzene | Chloroform | Chloromethane | cis-1,2-dichloroethene | Methylene chloride | Hexachlorobutadiene | Vinyl chloride | 2-hexanone (MBK) | Carbon disulfide | Vinyl acetate |
| | | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 5 | 1 | 1 | 1 | 1 | 8 | 1 | 1 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - 99% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | | | | | | | | | |
| ANZG (2018) - MW - Unknown level of species protection | | | | | | | | | | | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | | | | | | | | | | | | | | | | | | | |
| Typical background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | |
| Scientific literature value | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | | | | | | | | | |
| Field_ID | Area | Adjacent CMA Sample | Sampled Dat | Location_Type | Sample Type | | | | | | | | | | | | | | | | | | | |
| Beach_GW_12 | South Drain discharge point | CMA_SD_SED4 / OCS5 | 29/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_13 | Landill north coast | CMA_SED13 / CMA_OC13 | 1/10/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_14 | Landill north coast | CMA_SED14 / CMA_OC14 | 1/10/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_15 | Landill north coast | CMA_SED15 / CMA_OC15 | 1/10/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_16 | Landfill west coast | CMA_SED16/CMA_OC16 | 1/10/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_17 | Landfill west coast | CMA_SED17/CMA_OC17 | 30/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_18 | Landfill west coast | CMA_SED18/CMA_OC18 | 30/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_19 | Landfill west coast | CMA_SED19/CMA_OC19 | 30/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_20 | Landfill west coast | CMA_SED20/CMA_OC20 | 30/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_21 | Landfill south east | CMA_SED21/CMA_OC21 | 19/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_22 | Landfill south east | CMA_SED22/CMA_OC22 | 19/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_31 | Landfill south east | CMA_SED31/CMA_OC31 | 28/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_32 | Landfill south east | CMA_SED32/CMA_OC32 | 28/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_33 | Landfill south east | CMA_SED33/CMA_OC33 | 28/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_34 | Landfill south east | CMA_SED34/CMA_OC34 | 28/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_35 | Landfill south east | CMA_SED35/CMA_OC35 | 29/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_36 | Landfill south east | CMA_SED36/CMA_OC36 | 29/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_37 | Landfill south east | CMA_SED37/CMA_OC37 | 28/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_38 | Landfill south east | CMA_SED38/CMA_OC38 | 28/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_39 | Landfill south east | CMA_SED39/CMA_OC39 | 28/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |
| Beach_GW_40 | Landfill south east | CMA_SED40/CMA_OC40 | 28/09/2022 | Seep | Normal | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <1 | <5 | <1 | <1 | <1 | <1 | <8 | <1 | <1 |

# Appendix C
## Table C7
## NZAS Landfill Surface Water Ecological Screening Values

| | | | | | Minor ions | Inorganics | | | | | | | Acidity & Alkalinity | Major Ions | | | | | | | | Nutrients | | | | Organic Indicators |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Fluoride | EC/10* (EC/10) | pH (Lab) | Electrical conductivity (lab) | COD | Cyanide (Total) | Cyanide (Total) (Filtered) | Cyanide (WAD) | Alkalinity (total as CaCO3) | Calcium (Filtered) | Magnesium (Filtered) | Potassium (Filtered) | Sodium (Filtered) | Chloride (Filtered) | Sulfate (Filtered) | Cations Total | Anions Total | Ammoniacal N (Filtered) | Nitrate (as NO3-) (Filtered) | Nitrite (as NO2-) (Filtered) | Reactive Phosphorus as P (Filter | Carbonaceous Biochemical Oxyg |
| | | | | | mg/L | (mS/m)/10 | pH Units | µS/cm | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | meq/L | meq/L | mg/L | mg/L | mg/L | mg/L | g/m3 |
| EQL | | | | | 0.04 | 0.002 | 1 | 0.2 | 10 | 0.001 | 0.01 | 0.001 | 1 | 0.05 | 0.01 | 0.05 | 0.01 | 0.5 | 0.15 | 0.01 | 0.01 | 0.005 | 0.002 | 0.001 | 0.002 | 1 |
| ANZG (2018) - MW - 80%  species protection (updated 1/10/2021) | | | | | | | | | | 0.014 | | | | | | | | | | | | 1.7 | | | | |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | | | | | 0.004 | | | | | | | | | | | | 0.91 | | | | |
| ANZG (2018) - Unknown level of species protection | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | | | | | | | | | | | | | | 2712 | | | | | | | |
| Typical background level in marine water | | | | | 1.5 | | | | | | | | | | | | | | | | | | | | | |
| Scientific literature value | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | |
| LF_SW_1 | LF_SW_1 | 4/11/2022 | SW | Normal | 10.4 | 1.25 | 6.7 | 125 | 40 | <0.001 | - | <0.001 | 6.2 | 3.1 | 3.29 | 0.7 | 17.4 | 17.5 | 3.86 | 1.2 | 0.71 | 0.04 | 0.104 | 0.0013 | <0.002 | <1 |
| LF_SW_10 | LF_SW_10 | 4/11/2022 | SW | Normal | 51.4 | 2.95 | 6.4 | 295 | 199 | <0.001 | - | <0.001 | 6.5 | 1.9 | 2.03 | 1.4 | 58.2 | 33 | 20.7 | 2.84 | 1.5 | <0.005 | 0.118 | <0.001 | <0.002 | <1 |
| LF_SW_11 | LF_SW_11 | 4/11/2022 | SW | Normal | 4 | 8.94 | 6.5 | 894 | 194 | 0.003 | - | 0.001 | 27.4 | 6.8 | 8.45 | 5.78 | 170 | 151 | 188 | 8.71 | 8.74 | 0.04 | 0.474 | 0.0441 | 0.026 | <1 |
| LF_SW_12 | LF_SW_12 | 4/11/2022 | SW | Normal | 7 | 13.85 | 7.5 | 1380 | 184 | 0.006 | - | 0.001 | 118 | 5.72 | 13.4 | 13.9 | 279 | 129 | 443 | 13.99 | 15.24 | 0.05 | 0.0087 | 0.0489 | 0.029 | <1 |
| LF_SW_14 | LF_SW_14 | 5/12/2022 | SW | Normal | 35.6 | 20.32 | 7.7 | 2030 | 1476 | 0.002 | - | 0.002 | 977 | 45.1 | 31.8 | 69.4 | 519 | 98.3 | 20.4 | 29.62 | 22.89 | 0.03 | <0.002 | 0.0137 | 0.002 | 3.67 |
| LF_SW_18 | LF_SW_18 | 2/12/2022 | SW | Normal | 34.1 | 11.72 | 7.2 | 1170 | 300 | 0.006 | - | 0.006 | 178 | 6.64 | 8.15 | 13 | 195 | 195 | 27.9 | 11.11 | 9.89 | 17.5 | 3.58 | 0.552 | 0.13 | 3.96 |
| LF_SW_19 | LF_SW_19 | 2/12/2022 | SW | Normal | 5.8 | 1.66 | 6.4 | 166 | <10 | <0.001 | - | <0.001 | 10.8 | 11.1 | 2.25 | 0.91 | 23 | 24.5 | 12.1 | 1.77 | 1.16 | 0.01 | 0.0501 | <0.001 | <0.002 | <1 |
| LF_SW_2 | LF_SW_2 | 4/11/2022 | SW | Normal | 34.7 | 10.7 | 7.7 | 1070 | 242 | 0.008 | - | 0.002 | 187 | 6.71 | 9.02 | 11.1 | 183 | 186 | 27.2 | 10.89 | 9.95 | 21.5 | 5.08 | 0.282 | 0.19 | 3.71 |
| LF_SW_20 | LF_SW_20 | 2/12/2022 | SW | Normal | 4.3 | 2.35 | 6.1 | 235 | 50 | 0.002 | - | 0.001 | 12.6 | 7.6 | 4.94 | 0.83 | 41.6 | 54.8 | 7.08 | 2.72 | 1.95 | <0.005 | 0.0129 | 0.0042 | <0.002 | 3.4 |
| LF_SW_3 | LF_SW_2 | 4/11/2022 | SW | Normal | 35.9 | 3.94 | 7.4 | 394 | 54 | 0.003 | - | 0.001 | 57.6 | 4.3 | 4.7 | 3.4 | 78.9 | 57.6 | 11 | 4.27 | 3.1 | 1.85 | 1.32 | 0.0722 | 0.007 | <1 |
| LF_SW_4 | LF_SW_4 | 4/11/2022 | SW | Normal | 165 | 12.54 | 8.1 | 1250 | 165 | 0.008 | - | 0.003 | 314 | 4.9 | 19.5 | 17 | 255 | 109 | 42.2 | 13.4 | 10.97 | 0.08 | 8.6 | 0.115 | 0.042 | <1 |
| LF_SW_5 | LF_SW_5 | 4/11/2022 | SW | Normal | 26.4 | 8.75 | 7.8 | 875 | 116 | 0.004 | - | 0.002 | 245 | 37.4 | 15 | 10.7 | 160 | 115 | 7.99 | 10.63 | 8.34 | 0.77 | 0.021 | <0.001 | <0.002 | 9.42 |
| LF_SW_6 | LF_SW_6 | 4/11/2022 | SW | Normal | 27.1 | 8.63 | 7.6 | 863 | 3890 | 0.006 | - | 0.003 | 334 | 259 | 30.4 | 13.7 | 154 | 68.6 | 4.08 | 23.66 | 8.75 | 1.68 | 0.185 | 0.0205 | <0.002 | 17.1 |
| LF_SW_7 | LF_SW_7 | 4/11/2022 | SW | Normal | 19.6 | 3.15 | 6.4 | 315 | 236 | 0.003 | - | 0.002 | 25.2 | 12.7 | 4.78 | 3.3 | 57 | 60.9 | 21.1 | 3.63 | 2.66 | 0.06 | <0.002 | 0.0615 | 0.255 | <1 |
| LF_SW_8 | LF_SW_8 | 4/11/2022 | SW | Normal | 8.7 | 5.93 | 6.1 | 593 | 256 | 0.002 | - | 0.002 | 31.1 | 10.7 | 10.8 | 4.5 | 93.8 | 162 | 8.71 | 5.7 | 5.37 | 0.07 | 0.0753 | 0.0378 | 0.287 | 7.22 |
| LF_SW_9 | LF_SW_9 | 4/11/2022 | SW | Normal | 59.9 | 4.27 | 6.9 | 427 | 64 | <0.001 | - | <0.001 | 28.9 | 3 | 5.84 | 2 | 80.6 | 19.7 | 52.4 | 4.19 | 2.32 | <0.005 | 1.35 | 0.0023 | <0.002 | <1 |
| LF_SW21 | LF_SW_21 | 30/11/2022 | SW | Normal | 119 | 22.08 | 6.3 | 2210 | 1045 | 0.001 | <0.01 | 0.002 | 37.9 | 14 | 2.91 | 5.27 | 344 | 37 | 824 | 16.55 | 18.95 | 1.99 | 0.0337 | 0.0039 | <0.002 | - |
| LF_SW22 | LF_SW_22 | 5/12/2022 | SW | Normal | 20.5 | 10.94 | 5 | 1090 | 834 | 0.002 | - | 0.003 | 4.8 | 7.94 | 11.8 | 4.1 | 248 | 174 | 179 | 12.55 | 8.73 | 0.14 | <0.002 | 0.127 | 0.081 | 2.98 |

# Appendix C
# Table C7
# NZAS Landfill Surface Water Ecological Screening Values

| | | | | | Metals | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Aluminium | Aluminium (Filtered) | Arsenic | Arsenic (Filtered) | Barium | Barium (Filtered) | Beryllium | Beryllium (Filtered) | Boron | Boron (Filtered) | Cadmium | Cadmium (Filtered) | Chromium (III+VI) | Chromium (III+VI) (Filtered) | Chromium (hexavalent) (Filtered) | Chromium (Trivalent) (Filtered) | Cobalt | Cobalt (Filtered) | Copper | Copper (Filtered) |
| | | | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | | 0.003 | 0.003 | 0.0005 | 0.0005 | 0.0001 | 0.0002 | 0.00001 | 0.00001 | 0.005 | 0.01 | 0.00002 | 0.00002 | 0.0002 | 0.0002 | 0.002 | 0.002 | 0.00001 | 0.00001 | 0.0002 | 0.0002 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | 0.036 | | 0.085 | | | | 0.15 | | 0.008 |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | | | | | | | | | | | 0.0055 | | 0.0044 | | | | 0.001 | | 0.0013 |
| ANZG (2018) - Unknown level of species protection | | | | | | | | | | | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | | | | | 0.0062 | | 0.0001 | | | | | | | | | | | | |
| Typical background level in marine water | | | | | | | | | | | | | | 5.1 | | | | | | | | | | |
| Scientific literature value | | | | | | 0.056 | | 0.012 | | | | | | | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | |
| LF_SW_1 | LF_SW_1 | 4/11/2022 | SW | Normal | 7.25 | 0.467 | 0.0027 | <0.0005 | 0.0188 | 0.001 | 0.00017 | 0.000036 | <0.005 | <0.01 | 0.000053 | <0.00002 | 0.0377 | 0.0002 | - | - | 0.0162 | 0.000059 | 0.0096 | 0.00054 |
| LF_SW_10 | LF_SW_10 | 4/11/2022 | SW | Normal | 17.3 | 7.14 | 0.014 | <0.0005 | 0.0208 | 0.0018 | 0.0013 | 0.00088 | 0.012 | 0.016 | 0.00037 | 0.000057 | 0.034 | 0.00037 | - | - | 0.00629 | 0.00018 | 0.0371 | 0.0011 |
| LF_SW_11 | LF_SW_11 | 4/11/2022 | SW | Normal | 2.72 | 2.94 | 0.002 | 0.0019 | 0.0062 | 0.0064 | 0.000055 | 0.000063 | 0.11 | 0.12 | 0.000028 | 0.000032 | 0.0021 | 0.0021 | - | - | 0.00063 | 0.0006 | 0.0018 | 0.0016 |
| LF_SW_12 | LF_SW_12 | 4/11/2022 | SW | Normal | 2.26 | 2.29 | 0.0022 | 0.0019 | 0.0048 | 0.0045 | 0.000058 | 0.000064 | 0.23 | 0.24 | 0.000027 | 0.000029 | 0.0028 | 0.0024 | - | - | 0.00055 | 0.00046 | 0.0013 | 0.00082 |
| LF_SW_14 | LF_SW_14 | 5/12/2022 | SW | Normal | 9.67 | 1.21 | 0.0098 | 0.0016 | 0.0377 | 0.0112 | 0.0009 | 0.00018 | 1.64 | 1.6 | 0.00129 | <0.00002 | 0.012 | 0.0062 | - | - | 0.00207 | 0.00041 | 0.0246 | 0.00043 |
| LF_SW_18 | LF_SW_18 | 2/12/2022 | SW | Normal | 13.2 | 4.69 | 0.0064 | 0.0054 | 0.0097 | 0.0073 | 0.00054 | 0.0005 | 1.29 | 1.1 | 0.000064 | 0.000045 | 0.019 | 0.0094 | - | - | 0.00112 | 0.00047 | 0.017 | 0.008 |
| LF_SW_19 | LF_SW_19 | 2/12/2022 | SW | Normal | 1.8 | 1.02 | 0.001 | 0.00067 | 0.0143 | 0.0156 | 0.000073 | 0.00007 | <0.005 | <0.01 | 0.000082 | 0.000068 | 0.00031 | 0.00027 | - | - | 0.00015 | 0.00017 | 0.0018 | 0.00063 |
| LF_SW_2 | LF_SW_2 | 4/11/2022 | SW | Normal | 18.2 | 9.01 | 0.0085 | 0.0059 | 0.0164 | 0.0099 | 0.00049 | 0.00046 | 1.08 | 1.12 | 0.000083 | 0.000058 | 0.0233 | 0.012 | - | - | 0.00144 | 0.00068 | 0.0253 | 0.011 |
| LF_SW_20 | LF_SW_20 | 2/12/2022 | SW | Normal | 2.34 | 1.78 | 0.003 | 0.0025 | 0.0102 | 0.0119 | 0.000085 | 0.00011 | 0.0062 | <0.01 | 0.00013 | 0.0001 | 0.0019 | 0.0023 | - | - | 0.00059 | 0.00061 | 0.0079 | 0.0078 |
| LF_SW_3 | LF_SW_2 | 4/11/2022 | SW | Normal | 7.19 | 1.61 | 0.0035 | 0.0012 | 0.0116 | 0.0032 | 0.00025 | 0.00015 | 0.38 | 0.4 | 0.000073 | 0.000028 | 0.015 | 0.0013 | - | - | 0.00602 | 0.00026 | 0.011 | 0.0035 |
| LF_SW_4 | LF_SW_4 | 4/11/2022 | SW | Normal | 3.87 | 3.87 | 0.0034 | 0.0036 | 0.004 | 0.0029 | 0.00025 | 0.00028 | 2.88 | 3.15 | 0.000057 | 0.000052 | 0.0059 | 0.0058 | - | - | 0.00045 | 0.00039 | 0.011 | 0.01 |
| LF_SW_5 | LF_SW_5 | 4/11/2022 | SW | Normal | 7.97 | 1.1 | 0.0049 | 0.00057 | 0.116 | 0.0201 | 0.00058 | 0.00024 | 0.42 | 0.676 | 0.00008 | <0.00002 | 0.006 | 0.0007 | - | - | 0.00021 | 0.00012 | 0.0014 | <0.0002 |
| LF_SW_6 | LF_SW_6 | 4/11/2022 | SW | Normal | 675 | 159 | 0.0622 | <0.005 | 1.2 | 0.825 | 0.0289 | 0.0076 | 0.993 | 0.858 | 0.00182 | 0.00071 | 0.153 | <0.002 | - | - | 0.00839 | 0.00312 | 0.31 | <0.002 |
| LF_SW_7 | LF_SW_7 | 4/11/2022 | SW | Normal | 0.881 | 6.6 | 0.0033 | 0.0028 | 0.0151 | 0.0113 | 0.00024 | 0.00023 | 0.06 | 0.059 | 0.00056 | 0.00033 | 0.00082 | 0.0016 | - | - | 0.00154 | 0.00126 | 0.0057 | 0.0043 |
| LF_SW_8 | LF_SW_8 | 4/11/2022 | SW | Normal | 4.79 | 3.62 | 0.0023 | 0.0017 | 0.0144 | 0.0075 | 0.00018 | 0.00016 | 0.058 | 0.063 | 0.00014 | 0.000075 | 0.0014 | 0.0015 | - | - | 0.00358 | 0.00118 | 0.0023 | 0.0016 |
| LF_SW_9 | LF_SW_9 | 4/11/2022 | SW | Normal | 8.52 | 5.38 | 0.0035 | <0.0005 | 0.0071 | 0.0012 | 0.00099 | 0.00094 | 0.014 | 0.018 | 0.000078 | 0.000023 | 0.0096 | 0.00034 | - | - | 0.00216 | 0.00023 | 0.012 | 0.00081 |
| LF_SW21 | LF_SW_21 | 30/11/2022 | SW | Normal | 56.1 | 41.8 | 0.018 | 0.0069 | 0.0237 | 0.0121 | 0.00731 | 0.00575 | 0.092 | 0.067 | 0.00018 | 0.000093 | 0.0067 | 0.0014 | <0.002 | <0.002 - 0.007 | 0.00976 | 0.00554 | 0.016 | 0.004 |
| LF_SW22 | LF_SW_22 | 5/12/2022 | SW | Normal | 12.3 | 12.4 | 0.0072 | 0.004 | 0.0113 | 0.0076 | 0.00068 | 0.00051 | 0.053 | 0.031 | 0.00019 | 0.00007 | 0.0076 | 0.003 | - | - | 0.00217 | 0.00143 | 0.0049 | 0.0011 |

## Appendix C
## Table C7
## NZAS Landfill Surface Water Ecological Screening Values

| | | | | | Metals | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Iron | Iron (Filtered) | Lead | Lead (Filtered) | Lithium | Lithium (Filtered) | Manganese | Manganese (Filtered) | Mercury | Mercury (Filtered) | Molybdenum | Molybdenum (Filtered) | Nickel | Nickel (Filtered) | Titanium | Titanium (Filtered) | Tin | Tin (Filtered) | Vanadium | Vanadium (Filtered) | Zinc | Zinc (Filtered) |
| | | | | | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L | mg/L |
| EQL | | | | | 0.005 | 0.005 | 0.00005 | 0.00005 | 0.00001 | 0.00001 | 0.0005 | 0.0005 | 0.0001 | 0.00008 | 0.0002 | 0.0002 | 0.0002 | 0.0002 | 0.002 | 0.002 | 0.0005 | 0.0002 | 0.0005 | 0.0005 | 0.003 | 0.001 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | 0.012 | | | | | | 0.0014 | | | | 0.56 | | | | | | 0.28 | | 0.021 |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | | | 0.0044 | | | | | | 0.0004 | | | | 0.07 | | | | | | 0.1 | | 0.008 |
| ANZG (2018) - Unknown level of species protection | | | | | | | | | | | | 0.08 | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | 0.05 | | | | 0.192 | | | | | | | | | | 0.02 | | 0.002 | | | | |
| Typical background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Scientific literature value | | | | | | | | | | | | | | | | 10.7 | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | |
| LF_SW_1 | LF_SW_1 | 4/11/2022 | SW | Normal | 9.98 | 0.014 | 0.0044 | <0.00005 | 0.0048 | 0.00141 | - | 0.011 | <0.0001 | <0.00008 | - | - | 0.137 | 0.00099 | 0.157 | <0.002 | - | - | 0.018 | 0.00091 | 0.044 | 0.0024 |
| LF_SW_10 | LF_SW_10 | 4/11/2022 | SW | Normal | 20.2 | 0.15 | 0.0138 | 0.000056 | 0.00567 | 0.00338 | - | 0.03 | <0.0001 | <0.00008 | - | - | 0.173 | 0.026 | 0.0996 | <0.002 | - | - | 0.0885 | 0.0015 | 0.045 | 0.0019 |
| LF_SW_11 | LF_SW_11 | 4/11/2022 | SW | Normal | 3.72 | 3.62 | 0.00078 | 0.00057 | 0.00124 | 0.00119 | - | 0.11 | <0.0001 | <0.00008 | - | - | 0.0056 | 0.0051 | 0.025 | 0.027 | - | - | 0.0058 | 0.0055 | 0.013 | 0.024 |
| LF_SW_12 | LF_SW_12 | 4/11/2022 | SW | Normal | 5.1 | 3.29 | 0.00058 | 0.00036 | 0.00075 | 0.00072 | - | 0.126 | <0.0001 | <0.00008 | - | - | 0.01 | 0.0089 | 0.038 | 0.031 | - | - | 0.0061 | 0.0045 | 0.005 | 0.0036 |
| LF_SW_14 | LF_SW_14 | 5/12/2022 | SW | Normal | 36.8 | 10.3 | 0.0141 | 0.00013 | 0.0549 | 0.056 | - | 0.736 | 0.00018 | <0.00008 | - | - | 0.0388 | 0.0043 | 0.0771 | 0.0086 | - | - | 0.031 | 0.0035 | 0.326 | 0.0015 |
| LF_SW_18 | LF_SW_18 | 2/12/2022 | SW | Normal | 1.87 | 0.643 | 0.002 | 0.00073 | 0.00235 | 0.00123 | - | 0.033 | <0.0001 | <0.00008 | - | - | 0.014 | 0.0057 | 0.257 | 0.145 | - | - | 0.792 | 0.848 | 0.019 | 0.0093 |
| LF_SW_19 | LF_SW_19 | 2/12/2022 | SW | Normal | 0.16 | 0.034 | 0.00049 | 0.000075 | 0.00228 | 0.00209 | - | 0.016 | <0.0001 | <0.00008 | - | - | 0.0075 | 0.0085 | 0.0032 | <0.002 | - | - | 0.0023 | 0.0019 | 0.114 | 0.135 |
| LF_SW_2 | LF_SW_2 | 4/11/2022 | SW | Normal | 2.32 | 0.948 | 0.0035 | 0.001 | 0.00275 | 0.00182 | - | 0.039 | <0.0001 | <0.00008 | - | - | 0.0215 | 0.01 | 0.316 | 0.175 | - | - | 0.944 | 0.846 | 0.034 | 0.024 |
| LF_SW_20 | LF_SW_20 | 2/12/2022 | SW | Normal | 3.88 | 2.72 | 0.0007 | 0.00047 | 0.00132 | 0.00118 | - | 0.0611 | <0.0001 | <0.00008 | - | - | 0.0095 | 0.011 | 0.0054 | <0.002 | - | - | 0.0074 | 0.0055 | 0.183 | 0.233 |
| LF_SW_3 | LF_SW_2 | 4/11/2022 | SW | Normal | 4.51 | 0.36 | 0.0035 | 0.00021 | 0.00477 | 0.00293 | - | 0.0549 | <0.0001 | <0.00008 | - | - | 0.0588 | 0.0048 | 0.126 | 0.023 | - | - | 0.128 | 0.0895 | 0.033 | 0.0053 |
| LF_SW_4 | LF_SW_4 | 4/11/2022 | SW | Normal | 0.781 | 0.753 | 0.00073 | 0.00056 | 0.0115 | 0.0115 | - | 0.014 | <0.0001 | <0.00008 | - | - | 0.0063 | 0.0054 | 0.123 | 0.137 | - | - | 0.926 | 0.83 | 0.005 | 0.0066 |
| LF_SW_5 | LF_SW_5 | 4/11/2022 | SW | Normal | 118 | 6.32 | 0.00086 | <0.00005 | 0.033 | 0.0537 | - | 0.696 | <0.0001 | <0.00008 | - | - | 0.0032 | 0.00081 | 0.0038 | <0.002 | - | - | 0.019 | 0.00097 | 0.0095 | <0.001 |
| LF_SW_6 | LF_SW_6 | 4/11/2022 | SW | Normal | 3110 | 24.7 | 0.0972 | <0.0005 | 0.0416 | 0.0416 | - | 4.83 | 0.00048 | <0.0008 | - | - | 0.102 | 0.0303 | 0.624 | <0.02 | - | - | 1.29 | <0.005 | 0.5 | 0.215 |
| LF_SW_7 | LF_SW_7 | 4/11/2022 | SW | Normal | 0.669 | 0.776 | 0.0024 | 0.0022 | 0.0544 | 0.0516 | - | 0.034 | <0.0001 | <0.00008 | - | - | 0.017 | 0.015 | 0.037 | 0.017 | - | - | 0.0642 | 0.0632 | 0.011 | 0.012 |
| LF_SW_8 | LF_SW_8 | 4/11/2022 | SW | Normal | 3.1 | 1.95 | 0.0011 | 0.00064 | 0.00194 | 0.0019 | - | 0.176 | <0.0001 | <0.00008 | - | - | 0.0336 | 0.0224 | 0.013 | 0.012 | - | - | 0.0055 | 0.0045 | 0.014 | 0.011 |
| LF_SW_9 | LF_SW_9 | 4/11/2022 | SW | Normal | 5.56 | 0.086 | 0.0028 | <0.00005 | 0.00345 | 0.00275 | - | 0.035 | <0.0001 | <0.00008 | - | - | 0.0639 | 0.018 | 0.029 | <0.002 | - | - | 0.021 | 0.0013 | 0.012 | <0.001 |
| LF_SW21 | LF_SW_21 | 30/11/2022 | SW | Normal | 19.8 | 8.47 | 0.0088 | 0.0015 | 0.065 | 0.0428 | 2.38 | 1.31 | <0.0001 | <0.00008 | 0.0081 | 0.0033 | 0.484 | 0.29 | 0.016 | 0.0061 | 0.00094 | <0.0002 | 0.0692 | 0.019 | 0.024 | 0.023 |
| LF_SW22 | LF_SW_22 | 5/12/2022 | SW | Normal | 5.92 | 7.53 | 0.00632 | 0.0015 | 0.00503 | 0.00504 | - | 0.254 | <0.0001 | <0.00008 | - | - | 0.128 | 0.0853 | 0.09 | 0.035 | - | - | 0.022 | 0.011 | 0.018 | 0.023 |

# Appendix C
## Table C7
## NZAS Landfill Surface Water Ecological Screening Values

| | | | | | PAHs - standard 16 | | | | | | | | | | | | | | | | | | | PAHs - extended | SVOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero l | Total 8 PAHs (as BaP TEQ)(full L | 2-methylnaphthalene | 1-Methylnaphthalene |
| | | | | | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L | µg/L |
| EQL | | | | | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.06 | 0.06 | 0.03 | 0.02 | 0.02 | 0.05 | 0.06 | 0.06 |
| ANZG (2018) - MW - 80% species protection (updated 1/10/2021) | | | | | | | | | 0.7 | | | | | | 2 | | | 120 | | 8 | | | | | |
| ANZG (2018) - MW - 95% species protection (updated 1/10/2021) | | | | | | | | | 0.2 | | | | | | 1.4 | | | 70 | | 2 | | | | | |
| ANZG (2018) - Unknown level of species protection | | | | | | | | | | | | | | | | | | | | | | | | | |
| 80th percentile of background location data | | | | | | | | | | | | | | | | | | | | | | | | | |
| Typical background level in marine water | | | | | | | | | | | | | | | | | | | | | | | | | |
| Scientific literature value | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 95% | | | | | | | | | | | | | | | | | | | | | | | | | |
| PFAs NEMP 99% | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | |
| LF_SW_1 | LF_SW_1 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_10 | LF_SW_10 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_11 | LF_SW_11 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_12 | LF_SW_12 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_14 | LF_SW_14 | 5/12/2022 | SW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.06 |
| LF_SW_18 | LF_SW_18 | 2/12/2022 | SW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.06 |
| LF_SW_19 | LF_SW_19 | 2/12/2022 | SW | Normal | 0.027 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.06 |
| LF_SW_2 | LF_SW_2 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_20 | LF_SW_20 | 2/12/2022 | SW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | - | <0.06 | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.06 |
| LF_SW_3 | LF_SW_2 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_4 | LF_SW_4 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_5 | LF_SW_5 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_6 | LF_SW_6 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_7 | LF_SW_7 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_8 | LF_SW_8 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW_9 | LF_SW_9 | 4/11/2022 | SW | Normal | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SW21 | LF_SW_21 | 30/11/2022 | SW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.06 |
| LF_SW22 | LF_SW_22 | 5/12/2022 | SW | Normal | <0.02 | <0.02 | <0.02 | <0.03 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.03 | <0.06 | - | <0.03 | <0.02 | <0.02 | 0.05 | <0.06 | <0.06 |

## Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | | | | | Nutrients | | | | Organic Indicators |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Calcium | Magnesium | Potassium | Sodium | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Total Organic Carbon |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | % |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 12.5 | 5 | 5 | 125 | 3 | 2.9 | 5 | 2.4 | 1 | 2 | 0.1 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | 240 | | | | | | | | | | | | |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | 1500 | | | | | | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | 780 | 2000 | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | >10000 | >10000 | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | | | | |
| CCME Recreational | | | | | | 400 | | | | | | | | | | | | | | | |
| CCME Industrial | | | | | | 2000 | | | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | <6 | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | >8 | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 600 | 5 | 5.5 | <0.2 | <0.2 | 3530 | 7590 | 350 | 150 | 16.5 | <3 | <5 | <2.5 | <1 | - | 2.1 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 260 | 8 | 4.6 | <0.2 | <0.2 | 2030 | 972 | 200 | <130 | 14.9 | <3.1 | 5.82 | <2.6 | <1 | - | 3.3 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 1000 | 12 | 5.1 | <0.2 | 0.89 | 3120 | 1860 | 270 | 200 | 20.7 | <3.2 | 14.8 | 6.38 | 1.36 | <2.1 | 8.2 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 470 | 6 | 6.4 | <0.2 | <0.2 | 11,700 | 3050 | 290 | 230 | 11.1 | <3.2 | <5 | <2.7 | <1 | <2 | 2.7 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | 990 | 9 | 6.3 | <0.2 | 0.22 | 14,100 | 2630 | 240 | 260 | 21.7 | <3.1 | <5 | <2.6 | <1 | <2 | - |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 1200 | 7 | 6.8 | <0.2 | <0.2 | 20,800 | 9850 | 240 | 390 | 32.1 | <3.2 | 5.33 | <2.7 | <1 | <2 | 5.1 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 1100 | 9 | 7.1 | <0.03 | <0.2 | 22,100 | 1450 | 240 | 420 | 5.8 | <3 | <5 | <2.5 | <1 | <2 | 8.7 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | 340 | 19 | 7 | <0.2 | 0.42 | 11,500 | 1770 | 300 | 220 | 19.3 | <2.9 | 6.52 | <2.4 | <1 | 4.87 | 2.2 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 200 | 56 | 3.5 | - | <0.4 | 560 | 250 | 140 | 420 | 238.1 | 26.6 | 5.4 | <2.6 | <1 | - | 4.2 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | 120 | 58 | - | - | <0.5 | - | - | - | - | 225.5 | 23.8 | 5.62 | <2.6 | <1 | - | - |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 200 | 86 | 3.3 | - | 1.8 | 1100 | 935 | 140 | 750 | 289.7 | 11.6 | 14.5 | <2.6 | <1 | - | 14 |
| EHS-S2 | EHS_S2 | 0-0.1 | 29/11/2022 | HA | Normal | 110 | 7 | 6.7 | - | <0.2 | 156,000 | 1440 | 140 | 1500 | 13.7 | <3.1 | <5 | <2.6 | <1 | - | <0.2 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 170 | 36 | 3.7 | - | 1.3 | 670 | 260 | 210 | 560 | 310.6 | 15.2 | 16.3 | <2.7 | <1 | - | 7.1 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs calculated as per MfE's Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (2011)

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values

| | | | | | | Metals | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Aluminium | Antimony | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Iron | Lead | Lithium | Manganese | Mercury | Molybdenum | Nickel | Titanium | Tin | Vanadium | Zinc |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 2.5 | 0.025 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.125 | 0.025 | 0.125 | 0.05 | 0.075 | 0.25 | 0.125 | 0.05 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | 90 | | | | | | 300 | | | | | 19000 | | | 1200 | | | | 30000 |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | 500 | | | | | | 4000 | | | | | 60000 | | | 6000 | | | | 400000 |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | 80 | | | >10,000 | 400 | 2700 | 2700 | | | >10,000 | | 880 | | | 1800 | | | | | | |
| NES Commercial / Industrial | | | | | | | | 70 | | | >10,000 | 1300 | 6300 | 6300 | | | >10,000 | | 3300 | | | 4200 | | | | | | |
| CCME Recreational | | | | | | | | | 500 | | | | | | | | | | | | | | | | | | 130 | |
| CCME Industrial | | | | | | | | | 2000 | | | | | | | | | | | | | | | | | | 130 | |
| CCME pH Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | 77,000 | | | | | | | | | | | | 55,000 | | 160 | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | 1,100,000 | | | | | | | | | | | | 820,000 | | 2300 | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | 7700 | | | | | | | | | | | | 5500 | | 16 | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | 110,000 | | | | | | | | | | | | 82,000 | | 230 | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 8910 | 0.075 | 4.4 | 16.1 | 0.22 | 1.9 | 0.091 | 8.8 | <0.4 | 8.81 | 5.83 | 6.5 | 9740 | 6.62 | 6.14 | 159 | <0.025 | 0.2 | 41.3 | 439 | 0.4 | 24.5 | 50.6 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 3910 | 0.045 | 8.3 | 5.69 | 0.11 | <1.3 | 0.043 | 4.1 | <0.5 | 4.11 | 1.4 | 1.4 | 6350 | 2.8 | 2 | 91.6 | <0.025 | 0.21 | 3.3 | 270 | <0.25 | 22.6 | 9.39 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 16,100 | - | 4 | 12 | 0.28 | 10 | 0.13 | 6.6 | - | - | 1.8 | 8.22 | 5500 | 5 | 4.5 | 252 | <0.025 | - | 10.4 | 325 | - | 63.5 | 32.8 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 7720 | - | 6.1 | 9.44 | 0.2 | 2 | 0.074 | 6.4 | - | - | 2.91 | 10.6 | 7350 | 8.15 | 5.88 | 125 | <0.025 | - | 17.8 | 334 | - | 27.1 | 20.5 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | 6330 | - | 6.1 | 8.5 | 0.17 | 4.1 | 0.082 | 6.1 | - | - | 2.84 | 9.68 | 7440 | 7.09 | 5.68 | 117 | <0.025 | - | 13.8 | 245 | - | 25.3 | 19.9 |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 8730 | - | 7.6 | 7.66 | 0.23 | 1.3 | 0.092 | 8.5 | - | - | 6.26 | 5.8 | 8860 | 3.9 | 4.83 | 169 | <0.025 | - | 62.9 | 316 | - | 25.4 | 21.2 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 6840 | - | 9.8 | 6.87 | 0.21 | 1.7 | 0.31 | 5.2 | - | - | 2 | 4.3 | 6860 | 2.2 | 3.96 | 186 | 0.042 | - | 10.8 | 290 | - | 22.9 | 15.1 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | 7860 | - | 6.5 | 14.7 | 0.18 | 3.4 | 0.058 | 6.7 | - | - | 2.54 | 5.2 | 8210 | 3.8 | 6.26 | 117 | <0.025 | - | 7.06 | 378 | - | 27 | 17.4 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 917 | - | 0.51 | 2.5 | 0.021 | <1.3 | 0.005 | 1.5 | - | - | 0.12 | 0.59 | 490 | 1.2 | 0.3 | 5.8 | 0.027 | - | 0.87 | 104 | - | 2.7 | 2.2 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | 860 | - | 0.46 | 2.2 | 0.023 | <1.3 | <0.005 | 1.7 | - | - | 0.075 | 0.35 | 390 | 1 | 0.29 | - | <0.025 | - | 0.63 | 98.3 | - | 2.3 | 0.95 |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 1840 | - | 0.55 | 3.37 | 0.019 | 2.1 | 0.012 | 4 | - | - | 0.15 | 1.2 | 880 | 3.9 | 0.08 | 3 | 0.041 | - | 3.6 | 29.3 | - | 3.3 | 3.8 |
| EHS-S2 | EHS_S2 | 0-0.1 | 29/11/2022 | HA | Normal | 2390 | - | 12 | 5.34 | 0.088 | <1.3 | 0.017 | 2.9 | - | - | 1.4 | 1.4 | 5150 | 1.3 | 3.29 | 78 | <0.025 | - | 3 | 183 | - | 14.9 | 6.23 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 2270 | - | 0.9 | 3.87 | 0.035 | 1.4 | 0.018 | 1.6 | - | - | 0.22 | 0.73 | 1320 | 2 | 0.49 | 9.2 | <0.025 | - | 0.83 | 69.4 | - | 4.8 | 1.5 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and
Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs calculated as per MfE's

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

## Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values

| | | | | | | PAHs - standard 16 | | | | | | | | | | | | | | | | | | PAHs - extended | SVOCs | Phthalates |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | Benzo(b)fluoranthene | Dibenzofuran | Bis(2-ethylhexyl) phthalate |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.1 | 0.3 | 0.5 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | 160 | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | 7.2/70 | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | 190/230' | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | | 40 | 40 | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | | | | | 35 | 35 | | | |
| CCME Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | <0.01 | <0.01 | <0.1 - 0.025 | 0.13 - 0.45 | 0.17 - 0.73 | 0.23 | 0.083 - 0.28 | 0.12 - 0.49 | 0.21 - 0.4 | 0.016 - 0.1 | 0.32 - 0.67 | <0.01 | 0.089 - 0.57 | <0.01 | 0.094 - 0.21 | 0.32 - 0.64 | 0.24 - 1.1 | 0.24 - 1.1 | 0.85 | <0.3 | <0.5 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | <0.1 - 0.021 | <0.01 | 0.058 - 0.1 | 0.32 - 0.94 | 0.41 - 1.4 | 0.54 | 0.22 - 0.47 | 0.28 - 0.88 | 0.48 - 1 | 0.043 - 0.19 | 0.75 - 1.2 | <0.01 | 0.24 - 1.1 | <0.01 | 0.22 - 0.33 | 0.76 - 1.2 | 0.6 - 2 | 0.6 - 2 | 1.7 | <0.3 | <0.5 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 0.053 - 0.19 | <0.01 | 0.17 - 2.6 | 1.8 - 20 | 2.5 - 20 | 3.2 | 1 - 20 | 1.5 - 19 | 1.7 - 20 | 0.34 - 8.5 | <0.1 - 2.2 | 0.029 - 0.16 | 1.8 - 20 | <0.01 | 0.54 - 16 | <0.2 - 2.1 | 3.7 - 37 | 3.7 - 37 | >20 | <0.3 | <0.5 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | <0.1 - 0.068 | <0.01 | 0.13 - 0.15 | 1.2 - 1.6 | 2 - 2.3 | 2.4 | 0.78 - 0.86 | 1.2 - 1.5 | 1.1 - 1.3 | 0.31 - 0.36 | 1.5 - 1.8 | <0.1 - 0.029 | 1.5 - 1.9 | <0.01 | 0.42 - 0.5 | 1.4 - 1.7 | 2.9 - 3.3 | 2.9 - 3.3 | 2.4 | <0.3 | <0.5 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | <0.1 - 0.05 | <0.01 | <0.1 - 0.11 | 0.49 - 1 | 0.83 - 1.3 | 1.6 | <0.1 - 0.56 | 0.57 - 0.85 | 0.56 - 0.95 | 0.12 - 0.21 | 0.65 - 1.2 | <0.1 - 0.026 | 0.58 - 1.1 | <0.01 | 0.23 - 0.37 | 0.61 - 1.2 | 1.2 - 2 | 1.2 - 2 | 1.1 | <0.3 | <0.5 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | <0.1 - 0.011 | <0.01 | <0.1 - 0.026 | 0.24 - 0.38 | 0.33 - 0.66 | 0.4 | 0.13 - 0.28 | 0.21 - 0.44 | 0.21 - 0.42 | <0.1 - 0.055 | 0.29 - 0.55 | <0.01 | 0.27 - 0.55 | <0.01 | 0.098 - 0.16 | 0.26 - 0.51 | 0.5 - 0.9 | 0.5 - 1 | 1.1 | <0.3 | <0.5 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | <0.1 - 0.011 | <0.01 | <0.1 - 0.025 | 0.13 - 0.27 | 0.18 - 0.41 | 0.49 | <0.1 - 0.17 | 0.15 - 0.27 | 0.14 - 0.27 | <0.1 - 0.062 | 0.18 - 0.34 | <0.01 | 0.12 - 0.33 | <0.01 | <0.1 - 0.097 | <0.2 - 0.32 | 0.2 - 0.61 | 0.3 - 0.61 | 0.33 | <0.3 | <0.5 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | <0.1 - 0.012 | <0.01 | 0.029 - 0.1 | 0.19 - 0.29 | 0.25 - 0.45 | 0.26 | 0.093 - 0.26 | <0.1 - 0.074 | 0.17 - 0.21 | 0.019 - 0.43 | 0.36 - 0.39 | <0.01 | 0.1 - 0.52 | <0.01 | 0.12 - 0.15 | 0.35 - 0.37 | 0.34 - 1 | 0.34 - 1 | 0.56 | <0.3 | 0.5 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 0.26 - 0.27 | <0.026 | 0.47 - 0.48 | 3.5 - 3.9 | 5.1 - 5.4 | 5.7 | 2 - 2.2 | 1.6 - 2.6 | 3.5 - 4.3 | 0.47 - 1.8 | 3.8 - 6.1 | 0.13 - 0.28 | 2.2 - 4.5 | <0.24 - 0.03 | 1.5 - 1.9 | 3.5 - 5.8 | 7.4 - 8.8 | 7.4 - 8.8 | 7.4 | 0.34 | 1.5 |
| EHS-S2 | EHS_S2 | 0-0.1 | 29/11/2022 | HA | Normal | <0.01 | <0.01 | <0.01 | 0.08 | 0.13 | 0.14 | 0.041 | 0.047 | 0.088 | 0.011 | 0.12 | <0.01 | 0.056 | <0.01 | 0.038 | 0.12 | 0.17 | 0.17 | - | - | - |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | <0.1 - 0.042 | <0.01 | 0.1 - 0.12 | 0.67 - 0.72 | 1.1 - 1.2 | 1.1 | 0.37 - 0.43 | 0.35 - 0.62 | 0.57 - 0.76 | <0.1 - 0.077 | 0.91 - 1.3 | <0.1 - 0.018 | 0.44 - 1 | <0.01 | 0.28 - 0.37 | 0.87 - 1.3 | 1.5 | 1.5 - 1.6 | 1.3 | <0.3 | <0.5 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and
Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs calculated as per MfE's

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | Nutrients | | | | Metals | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Aluminium | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Cobalt | Copper | Iron | Lead | Lithium | Mercury | Nickel | Titanium | Vanadium | Zinc |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 3 | 2.9 | 5 | 2.5 | 1 | 2 | 2.5 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.025 | 0.05 | 0.075 | 0.125 | 0.05 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | 90 | | | | | 300 | | | | | | 1200 | | | 30000 |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | | | | | | | | | | | 500 | | | | | 4000 | | | | | | 6000 | | | 400000 |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | 780 | 2000 | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | >10000 | >10000 | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | 80 | | | >10,000 | 400 | 2700 | 2700 | | >10,000 | | 880 | | 1800 | | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | 70 | | | >10,000 | 1300 | 6300 | 6300 | | >10,000 | | 3300 | | 4200 | | | | |
| CCME Recreational | | | | | | 400 | | | | | | | | | | | | | 500 | | | | | | | | | | | | | | 130 | |
| CCME Industrial | | | | | | 2000 | | | | | | | | | | | | | 2000 | | | | | | | | | | | | | | 130 | |
| CCME pH Low | | | | | | | | <6 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | >8 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | 77,000 | | | | | | | | | | 55,000 | | 160 | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | 1,100,000 | | | | | | | | | | 820,000 | | 2300 | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | 7700 | | | | | | | | | | 5500 | | 16 | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | 110,000 | | | | | | | | | | 82,000 | | 230 | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A19R 0-1.5m | A19R | 0-1.5 | 13/10/2022 | MW | Normal | 700 | - | 6.1 | - | <0.1 | - | - | - | - | - | - | 10,900 | 3 | - | <0.2 | <20 | <0.1 | 7 | - | - | 9 | - | 4.2 | - | <0.1 | 8 | - | <100 | 48 |
| A40D 0-2.5m | A40D | 0-2.5 | 27/10/2022 | MW | Normal | 89 | - | 6 | - | <0.1 | - | - | - | - | - | - | 4100 | 8 | - | <0.2 | <20 | <0.1 | 4 | - | - | 33 | - | 1.9 | - | <0.1 | 7 | - | <100 | 14 |
| A40D 17.5-20m | A40D | 17.5-20 | 27/10/2022 | MW | Normal | - | - | 9 | - | - | - | - | - | - | - | - | 2100 | <2 | - | <0.2 | <20 | <0.1 | 7 | - | - | 23 | - | 1.1 | - | <0.1 | 7 | - | <100 | 7 |
| A54D 1-2m | A54 | 1-2 | 12/12/2022 | MW | Normal | - | - | 8.9 | - | - | - | - | - | - | - | - | 2200 | 4 | - | <0.2 | <20 | <0.1 | 3 | - | - | <2 | - | 0.8 | - | <0.1 | <2 | - | <100 | 18 |
| A54D 4.5-5m | A54 | 4.5-5 | 12/12/2022 | MW | Normal | - | - | 9.4 | - | - | - | - | - | - | - | - | 2400 | 6 | - | <0.2 | <20 | <0.1 | 7 | - | - | 13 | - | 0.9 | - | <0.1 | 8 | - | <100 | 12 |
| A55D 7-8m | A55 | 7-8 | 15/12/2022 | MW | Normal | - | - | 9.3 | - | - | - | - | - | - | - | - | 2200 | 4 | - | <0.2 | <20 | <0.1 | 16 | - | - | 49 | - | 0.7 | - | <0.1 | 11 | - | <100 | 12 |
| A55D 2.6-3m | A55D | 2.6-3 | 15/12/2022 | MW | Normal | - | - | 9.1 | - | - | - | - | - | - | - | - | 2700 | 6 | - | <0.2 | <20 | <0.1 | 4 | - | - | <2 | - | 1.6 | - | <0.1 | 3 | - | <100 | 200 |
| A5AR 1-2m | A5AR | 1-2 | 8/12/2022 | MW | Normal | 12,200 | - | 7.6 | - | <0.1 | - | - | - | - | - | - | 22,000 | 3 | - | 0.7 | <20 | 0.18 | 24 | - | - | 39 | - | 9.5 | - | <0.1 | 34 | - | <100 | 121 |
| A5AR 8-8.6m | A5AR | 8-8.6 | 8/12/2022 | MW | Normal | 300 | - | 8.1 | - | <0.1 | - | - | - | - | - | - | 3900 | 4 | - | <0.2 | <20 | <0.1 | 6 | - | - | 4 | - | 1.4 | - | <0.1 | 5 | - | <100 | 29 |
| A60 0-3m | A60 | 0-3 | 10/10/2022 | MW | Normal | - | - | 5.9 | - | - | - | - | - | - | - | - | 3700 | 6 | - | <0.2 | <20 | <0.1 | 13 | - | - | 2 | - | 1.4 | - | <0.1 | 11 | - | <100 | 12 |
| A60 4.5-6m | A60 | 4.5-6 | 10/10/2022 | MW | Normal | - | - | 6 | - | - | - | - | - | - | - | - | 3600 | 5 | - | <0.2 | <20 | <0.1 | 10 | - | - | 2 | - | 1.3 | - | <0.1 | 8 | - | <100 | 12 |
| A61 0-3m | A61 | 0-3 | 10/10/2022 | MW | Normal | 89 | - | 7.8 | - | <0.1 | - | - | - | - | - | - | 5400 | <2 | - | <0.2 | <20 | <0.1 | 33 | - | - | 5 | - | 1.4 | - | <0.1 | 210 | - | <100 | 13 |
| A61 3-4.5m | A61 | 3-4.5 | 10/10/2022 | MW | Normal | 86 | - | 7.5 | - | <0.1 | - | - | - | - | - | - | 4600 | 2 | - | <0.2 | <20 | <0.1 | 10 | - | - | 4 | - | 1 | - | <0.1 | 50 | - | <100 | 11 |
| A63 2.0-3.0m | A63 | 2-3 | 26/10/2022 | MW | Normal | 106 | - | 6.8 | - | <0.1 | - | - | - | - | - | - | 15,800 | 2 | - | 0.3 | <20 | <0.1 | 19 | - | - | 86 | - | 0.7 | - | <0.1 | 18 | - | 360 | 80 |
| A64D 5.5-4.8m | A64D | 4.8-5.5 | 3/10/2022 | MW | Normal | - | - | 8 | - | - | - | - | - | - | - | - | 3900 | <2 | - | <0.2 | <20 | <0.1 | 4 | - | - | 75 | - | 0.7 | - | <0.1 | 3 | - | <100 | 18 |
| A65 3.0-4.5m | A65 | 3-4.5 | 26/10/2022 | MW | Normal | - | - | 8.3 | - | - | - | - | - | - | - | - | 3200 | 5 | - | <0.2 | <20 | <0.1 | 6 | - | - | 4 | - | 1.3 | - | <0.1 | 11 | - | <100 | 10 |
| A66 0-1.5m | A66 | 0-1.5 | 26/10/2022 | MW | Normal | - | - | 7.3 | - | - | - | - | - | - | - | - | 3600 | 4 | - | <0.2 | <20 | <0.1 | 17 | - | - | 4 | - | 7.6 | - | <0.1 | 74 | - | <100 | 12 |
| A66 4.5-6.0m | A66 | 4.5-6 | 26/10/2022 | MW | Normal | - | - | 8.3 | - | - | - | - | - | - | - | - | 3400 | 9 | - | <0.2 | <20 | <0.1 | 5 | - | - | 2 | - | 1.3 | - | <0.1 | 4 | - | <100 | 10 |
| A67 0-1.5m | A67 | 0-1.5 | 26/10/2022 | MW | Normal | 185 | - | 6 | - | <0.1 | - | - | - | - | - | - | 5600 | 9 | - | <0.2 | <20 | <0.1 | 6 | - | - | <2 | - | 1.8 | - | <0.1 | 9 | - | <100 | 10 |
| A67 5.5-6.0m | A67 | 5.5-6 | 26/10/2022 | MW | Normal | 109 | - | 7.3 | - | <0.1 | - | - | - | - | - | - | 3200 | 6 | - | <0.2 | <20 | <0.1 | 4 | - | - | <2 | - | 1.2 | - | <0.1 | 3 | - | <100 | 10 |
| A70S 1-2m | A70 | 1-2 | 13/12/2022 | MW | Normal | - | - | 8.7 | - | - | - | - | - | - | - | - | 2400 | 6 | - | <0.2 | <20 | 0.16 | 4 | - | - | <2 | - | 1 | - | <0.1 | 4 | - | <100 | 11 |
| A70S 4-5m | A70 | 4-5 | 13/12/2022 | MW | Normal | - | - | 8.4 | - | - | - | - | - | - | - | - | 2100 | 5 | - | <0.2 | <20 | <0.1 | 4 | - | - | 2 | - | 1 | - | <0.1 | 3 | - | <100 | 8 |
| A70D 6-7m | A70D | 6-7 | 12/12/2022 | MW | Normal | - | - | 8.5 | - | - | - | - | - | - | - | - | 3100 | 2 | - | <0.2 | <20 | <0.1 | 6 | - | - | 2 | - | 1.1 | - | <0.1 | 4 | - | <100 | 13 |
| A70D 2-2.4m | A70D | 2-2.4 | 12/12/2022 | MW | Normal | - | - | 9.2 | - | - | - | - | - | - | - | - | 1620 | 4 | - | <0.2 | <20 | <0.1 | 3 | - | - | <2 | - | 0.7 | - | <0.1 | 4 | - | <100 | 7 |
| A71S 1-2m | A71 | 1-2 | 16/12/2022 | MW | Normal | - | - | 8.3 | - | - | - | - | - | - | - | - | 2600 | 3 | - | <0.2 | <20 | <0.1 | 6 | - | - | 2 | - | 1.1 | - | <0.1 | 10 | - | <100 | 13 |
| A71S 5.6-6m | A71 | 5.6-6 | 16/12/2022 | MW | Normal | - | - | 9 | - | - | - | - | - | - | - | - | 2600 | 4 | - | <0.2 | <20 | <0.1 | 5 | - | - | 2 | - | 0.9 | - | <0.1 | 5 | - | <100 | 15 |
| A71D 3-4m | A71D | 3-4 | 14/12/2022 | MW | Normal | - | - | 8.6 | - | - | - | - | - | - | - | - | 2800 | 4 | - | <0.2 | <20 | <0.1 | 5 | - | - | <2 | - | 0.9 | - | <0.1 | 6 | - | <100 | 14 |
| A71D 11-12m | A71D | 11-12 | 14/12/2022 | MW | Normal | - | - | 8.7 | - | - | - | - | - | - | - | - | 3100 | 6 | - | <0.2 | <20 | <0.1 | 5 | - | - | 2 | - | 1.1 | - | <0.1 | 4 | - | <100 | 11 |
| A7R 1-2m | A7R | 1-2 | 8/12/2022 | MW | Normal | 3700 | - | 6.2 | - | <0.1 | - | - | - | - | - | - | 26,000 | 6 | - | 0.2 | 25 | <0.1 | 6 | - | - | 5 | - | 3.4 | - | <0.1 | 5 | - | <100 | 12 |
| A7R 6.2-7m | A7R | 6.2-7 | 8/12/2022 | MW | Normal | 260 | - | 8.3 | - | <0.1 | - | - | - | - | - | - | 8100 | 3 | - | <0.2 | <20 | <0.1 | 3 | - | - | 60 | - | 0.7 | - | <0.1 | 5 | - | <100 | 34 |
| CIR 1-2m | C1R | 1-2 | 5/12/2022 | MW | Normal | 18,600 | - | 7.8 | - | <0.1 | - | - | - | - | - | - | 8800 | 4 | - | 0.2 | <20 | <0.1 | 5 | - | - | 3 | - | 2.5 | - | <0.1 | 11 | - | <100 | 22 |
| CIR 5-6m | C1R | 5-6 | 5/12/2022 | MW | Normal | 370 | - | 7.5 | - | <0.1 | - | - | - | - | - | - | 4200 | <2 | - | <0.2 | <20 | <0.1 | 6 | - | - | 3 | - | 1.5 | - | <0.1 | 4 | - | <100 | 13 |
| C3R 2-3m | C3R | 2-3 | 6/12/2022 | MW | Normal | 9300 | - | 7.7 | - | 1.33 | - | - | - | - | - | - | 51,000 | 5 | - | 1.3 | 51 | 0.31 | 156 | - | - | 97 | - | 15.3 | - | <0.1 | 62 | - | 164 | 115 |
| C3R 8-9m | C3R | 8-9 | 6/12/2022 | MW | Normal | 6000 | - | 8 | - | 0.15 | - | - | - | - | - | - | 14,400 | 3 | - | 0.4 | <20 | <0.1 | 8 | - | - | 6 | - | 3 | - | <0.1 | 14 | - | <100 | 111 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial
MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)
NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health
NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs
USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020
CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | Nutrients | | | | Metals | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Aluminium | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Cobalt | Copper | Iron | Lead | Lithium | Mercury | Nickel | Titanium | Vanadium | Zinc |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 3 | 2.9 | 5 | 2.5 | 1 | 2 | 2.5 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.025 | 0.05 | 0.075 | 0.125 | 0.05 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | 90 | | | | | 300 | | | | | | 1200 | | | 30000 |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | | | | | | | | | | | 500 | | | | | 4000 | | | | | | 6000 | | | 400000 |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | 780 | 2000 | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | >10000 | >10000 | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | 80 | | | >10,000 | 400 | 2700 | 2700 | | >10,000 | | 880 | | 1800 | | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | 70 | | | >10,000 | 1300 | 6300 | 6300 | | >10,000 | | 3300 | | 4200 | | | | |
| CCME Recreational | | | | | | 400 | | | | | | | | | | | | | 500 | | | | | | | | | | | | | | 130 | |
| CCME Industrial | | | | | | 2000 | | | | | | | | | | | | | 2000 | | | | | | | | | | | | | | 130 | |
| CCME pH Low | | | | | | | | <6 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | >8 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | 77,000 | | | | | | | | | | 55,000 | | 160 | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | 1,100,000 | | | | | | | | | | 820,000 | | 2300 | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | 7700 | | | | | | | | | | 5500 | | 16 | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | 110,000 | | | | | | | | | | 82,000 | | 230 | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TP1 0.2 | LF_TP_1 | 0.2 | 7/06/2022 | TP | Normal | 5400 | 13 | - | <0.03 | <0.3 | 13.2 | 8 | <5 | <2.6 | <1 | <2 | 32,900 | 19.5 | 62.1 | 1 | 20 | 1.98 | 33.8 | <0.5 | 6.76 | 578 | 19,500 | 67.9 | 15.3 | 0.045 | 133 | 440 | 135 | 317 |
| TP1 2.0 | LF_TP_1 | 2 | 7/06/2022 | TP | Normal | 610 - 1100 | 16 - 17 | - | <0.03 | <0.2 | 5.6 - 6.1 | <3 | <5 | <2.5 | <1 | <2 | 5430 - 6830 | 8.4 - 10 | 10.5 - 10.9 | 0.18 - 0.19 | 3.1 - 4.6 | 0.09 - 0.12 | 8.2 - 8.4 | <0.5 | 1.8 - 2 | 6 - 7.67 | 6750 - 7170 | 2.4 - 3.6 | 8.37 - 8.76 | <0.025 | 6.54 - 7.88 | 399 - 462 | 51.7 - 55.8 | 24.3 - 28.2 |
| TP1 3.0 | LF_TP_1 | 3 | 7/06/2022 | TP | Normal | 1800 | 19 | - | <0.03 | <0.2 | 14.9 | 5.3 | <5 | <2.5 | <1 | <2 | 11,700 | 16.7 | 17.7 | 0.32 | 10 | 0.26 | 15.2 | <0.5 | 2.84 | 26.5 | 12,400 | 15.1 | 10.4 | <0.025 | 25.8 | 451 | 100 | 57.5 |
| TP2 0.3 | LF_TP_2 | 0.3 | 7/06/2022 | TP | Normal | 2400 | 10 | - | <0.03 | 0.7 | 10.8 | <3 | <5 | 2.51 | <1 | <2 | 25,500 | 5.9 | 13.7 | 0.39 | 26 | 0.19 | 11 | <0.4 | 2 | 22.1 | 7240 | 20.9 | 5.96 | <0.025 | 10.4 | 520 | 110 | 44.1 |
| TP2 0.8 | LF_TP_2 | 0.8 | 7/06/2022 | TP | Normal | 2700 - 4900 | 9 - 12 | - | <0.03 | 0.69 - 1.4 | 19 - 27.3 | 5.5 - 7.5 | <5 | <2.5 - 2.57 | <1 | <2 | 25,200 - 32,100 | 15 - 17.3 | 46.4 - 49.6 | 0.58 - 0.76 | 19 - 21 | 0.39 - 0.45 | 20.1 - 25.3 | <0.4 | 3.38 - 3.62 | 51.5 - 79.3 | 13,300 - 16,300 | 49.7 - 68.3 | 7.94 - 9.03 | <0.025 | 26.3 - 30.4 | 479 - 533 | 68.5 - 83.1 | 185 - 224 |
| TP2 2.0 | LF_TP_2 | 2 | 7/06/2022 | TP | Normal | 5000 | 10 | - | <0.03 | 1.5 | 25.5 | 59.1 | <5 | 5.71 | <1 | <2 | 57,800 | 10 | 29.3 | 0.66 | 51 | 0.31 | 17.7 | <0.4 | 3.27 | 51.3 | 13,400 | 28.5 | 6.88 | <0.025 | 26.9 | 512 | 214 | 139 |
| TP3 0.25 | LF_TP_3 | 0.25 | 7/06/2022 | TP | Normal | 2300 | 22 | - | <0.03 | 0.97 | 16.1 | 4.7 | 8.08 | 3.21 | <1 | <2 | 27,300 | 8 | 25.4 | 0.43 | 20 | 0.29 | 15.8 | <0.5 | 3.77 | 24.9 | 11,100 | 30.2 | 6.81 | <0.025 | 25.5 | 505 | 95.3 | 209 |
| TP3 0.65 | LF_TP_3 | 0.65 | 7/06/2022 | TP | Normal | 16,000 | 16 | - | <0.03 | <0.3 | 36 | 108.4 | <5 | 2.89 | <1 | <2 | 114,000 | 12 | 60.2 | 2.31 | 15 | 0.26 | 11 | <0.5 | 22.9 | 29.7 | 4140 | 44.3 | 5.03 | <0.025 | 1470 | 175 | 323 | 364 |
| TP3 1.4 | LF_TP_3 | 1.4 | 7/06/2022 | TP | Normal | 5900 | 8 | - | <0.03 | 41.2 | 14.5 | 32.7 | 6.98 | <2.6 | <1 | <2 | 22,500 | 6.1 | 14 | 0.5 | 43 | 0.14 | 15.9 | <0.5 | 2.54 | 10.8 | 12,200 | 5.33 | 5.89 | <0.025 | 13.4 | 493 | 146 | 226 |
| TP3 3.8 | LF_TP_3 | 3.8 | 7/06/2022 | TP | Normal | 11,000 | 13 | - | <0.03 | 6.01 | 114.4 | 102.2 | 6.46 | <2.6 | <1 | <2 | 64,200 | 16 | 33.8 | 1.58 | 210 | 0.44 | 58.6 | <0.5 | 3.88 | 47.6 | 18,000 | 23.1 | 10.2 | <0.025 | 63.7 | 558 | 342 | 136 |
| TP4 0.2 | LF_TP_4 | 0.2 | 7/06/2022 | TP | Normal | 2200 | 8 | - | <0.03 | 0.22 | 31 | 3.3 | <5 | <2.5 | <1 | <2 | 17,600 | 4.1 | 25.9 | 0.45 | 9.3 | 0.095 | 14.7 | <0.4 | 8.44 | 10.1 | 13,400 | 13.9 | 10.4 | <0.025 | 64.1 | 749 | 54.1 | 73.1 |
| TP4 0.5 | LF_TP_4 | 0.5 | 7/06/2022 | TP | Normal | 6800 | 9 | - | <0.03 | 2.16 | 36.3 | 15.4 | 13.4 | <2.6 | <1 | <2 | 29,400 | 7.1 | 27.2 | 0.67 | 49 | 0.32 | 17.3 | <0.5 | 3.48 | 33.1 | 10,700 | 97.4 | 9.19 | 0.057 | 25.9 | 671 | 159 | 70.1 |
| TP4 3.5 | LF_TP_4 | 3.5 | 7/06/2022 | TP | Normal | 12,000 | 17 | - | <0.03 | 17.4 | 66.5 | 91.9 | 6.92 | <2.6 | <1 | <2 | 81,500 | 15.2 | 51.2 | 2.55 | 228 | 0.884 | 59.9 | <0.5 | 9.01 | 602 | 31,700 | 101 | 22.5 | 0.026 | 230 | 401 | 536 | 1580 |
| LF_TP_5_0.2-0.3 | LF_TP_5 | 0.2-0.3 | 25/10/2022 | TP | Normal | - | 9 | 6.7 | - | - | - | <3.1 | <5 | - | - | - | 13,600 | 6.2 | 87.6 | 0.33 | 5.2 | 4.87 | 38.2 | - | 29.3 | 53.4 | 30,100 | 112 | 9.6 | 0.037 | 287 | 580 | 173 | 197 |
| LF_TP_5_0.9-1.0 | LF_TP_5 | 0.9-1 | 25/10/2022 | TP | Normal | - | 16 | 6.8 | - | - | - | 9.7 | <5 | - | - | - | 22,100 | 14.4 | 89.7 | 0.46 | 11 | 5.44 | 43.4 | - | 19.2 | 590 | 35,900 | 114 | 7.6 | 0.063 | 189 | 444 | 147 | 468 |
| LF_TP_6_0.2-0.3 | LF_TP_6 | 0.2-0.3 | 25/10/2022 | TP | Normal | - | 10 | 6.1 | - | - | - | 5.4 | <5 | - | - | - | 30,300 | 4.2 | 12.3 | 0.4 | 35 | 0.14 | 12.7 | - | 1.9 | 16.8 | 5790 | 22.4 | 4.94 | <0.025 | 14.2 | 481 | 191 | 33.4 |
| LF_TP_6_1.8-2.0 | LF_TP_6 | 1.8-2 | 25/10/2022 | TP | Normal | - | 31 | 5.9 | - | - | - | 101.4 | 7.07 | - | - | - | 6650 | 1.1 | 21.3 | 0.16 | 5.4 | 0.2 | 13.6 | - | 2 | 17.8 | 4400 | 10.8 | 3.5 | <0.025 | 37.4 | 254 | 83.3 | 19.1 |
| LF_TP_7_0.2-0.3 | LF_TP_7 | 0.2-0.3 | 28/10/2022 | TP | Normal | 1200 | 10 | 7.2 | <0.03 | 0.3 | - | 5.4 | 6.93 | - | - | - | 12,900 | 5.7 | 24.7 | 0.27 | 3.3 | 0.083 | 12 | - | 4.01 | 7.4 | 13,300 | 5.63 | 9.17 | <0.025 | 11.9 | 742 | 38.4 | 25.7 |
| LF_TP_7_1.4-1.5 | LF_TP_7 | 1.4-1.5 | 28/10/2022 | TP | Normal | 540 | 12 | 6.8 | <0.03 | 0.46 | - | 12.8 | 33.5 | - | - | - | 11,800 | 5.7 | 11.7 | 0.12 | <1.3 | 0.056 | 8.8 | - | 2.55 | 6.2 | 10,500 | 8.03 | 5.58 | 0.041 | 8.99 | 319 | 39.5 | 20 |
| LF_soil_DUP_8 | LF_TP_7 | 1.4-1.5 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 12,600 | 6.6 | - | 0.13 | 1.3 | 0.064 | 8.1 | - | - | 6.3 | 10,800 | 8.34 | - | <0.025 | 8.5 | - | - | 21 |
| LF_TP_8_0.2-0.3 | LF_TP_8 | 0.2-0.3 | 26/10/2022 | TP | Normal | 630 | 11 | 7 | <0.03 | 0.27 | - | <3.1 | <5 | - | - | - | 3270 | 4.5 | 19.5 | 0.49 | 36 | 0.582 | 13.7 | - | 3.01 | 23.3 | 10,700 | 37.5 | 11.3 | <0.025 | 35.2 | 551 | 140 | 68.8 |
| LF_TP_8_1.8-2.0 | LF_TP_8 | 1.8-2 | 26/10/2022 | TP | Normal | 4000 | 18 | 7.9 | <0.03 | 142 | - | 23 | 18 | - | - | - | 135,000 | 6.4 | 25.4 | 0.55 | 149 | 2.17 | 29.3 | - | 4.15 | 50.8 | 25,700 | 132 | 92.4 | <0.025 | 106 | 331 | 350 | 363 |
| LF_TP_8_1.0-1.2 | LF_TP_8 | 1-1.2 | 26/10/2022 | TP | Normal | 11,000 | 17 | 6.8 | <0.03 | 36.6 | - | 17.1 | 11.8 | - | - | - | 119,000 | 12 | 71.3 | 0.93 | 49 | 1.77 | 172 | - | 6.68 | 144 | 43,600 | 80.7 | 15.1 | <0.025 | 146 | 258 | 165 | 436 |
| LF_TP_9_0.2-0.3 | LF_TP_9 | 0.2-0.3 | 26/10/2022 | TP | Normal | 1300 | 6 | 6.7 | <0.03 | <0.2 | - | <3 | 8.2 | - | - | - | 8540 | 4.2 | 10.5 | 0.2 | 14 | 0.16 | 7.6 | - | 3.11 | 6.8 | 7040 | 3.6 | 6.13 | <0.025 | 18.4 | 299 | 35.7 | 35.8 |
| LF_TP_9_1.8-2.0 | LF_TP_9 | 1.8-2 | 26/10/2022 | TP | Normal | 760 | 6 | 6.6 | <0.03 | <0.2 | - | 6.3 | 6.67 | - | - | - | 11,500 | 5.5 | 13.2 | 0.27 | 10 | 0.15 | 8.8 | - | 3.56 | 43.5 | 9710 | 6.32 | 5.78 | <0.025 | 16.7 | 369 | 31 | 119 |
| LF_TP_9_1.0-1.2 | LF_TP_9 | 1-1.2 | 26/10/2022 | TP | Normal | 1600 | 7 | 6.5 | <0.03 | <0.2 | - | 4.9 | 8.82 | - | - | - | 8700 | 3.8 | 11 | 0.2 | 6.1 | 0.16 | 8.2 | - | 2.91 | 6.7 | 7810 | 4 | 5.07 | <0.025 | 13.5 | 339 | 23 | 142 |
| LF_TP_10_0.3-0.4 | LF_TP_10 | 0.3-0.4 | 26/10/2022 | TP | Normal | 1800 | 17 | 6.6 | <0.03 | 0.92 | - | 12.1 | 7.71 | - | - | - | 68,100 | 7.3 | 45.9 | 1.7 | 11 | 2.01 | 41.3 | - | 6.66 | 85.6 | 24,800 | 47.7 | 17.1 | 0.034 | 137 | 492 | 69 | 277 |
| LF_TP_10_1.8-2.0 | LF_TP_10 | 1.8-2 | 26/10/2022 | TP | Normal | 12,000 | 12 | 7.2 | <0.03 | 1.6 | - | 19.2 | <5 | - | - | - | 32,900 | 9.9 | 23 | 0.87 | 11 | 0.973 | 30.6 | - | 4.64 | 2990 | 16,300 | 168 | 8.28 | 0.066 | 59.8 | 365 | 50.4 | 393 |
| LF_TP_10_1.0-1.2 | LF_TP_10 | 1-1.2 | 26/10/2022 | TP | Normal | 15,000 | 16 | 7.2 | <0.03 | 2.8 | - | 43.9 | <5 | - | - | - | 92,900 | 5.4 | 48.8 | 1.42 | 10 | 0.9 | 45 | - | 5.24 | 109 | 23,500 | 29.9 | 15.1 | 0.036 | 70.3 | 367 | 50.1 | 493 |
| LF_TP_11_0.3-0.4 | LF_TP_11 | 0.3-0.4 | 26/10/2022 | TP | Normal | 9700 | 9 | 6.6 | <0.03 | 5.9 | - | <3 | 5.07 | - | - | - | 39,300 | 5.3 | 11.9 | 0.5 | 49 | 0.18 | 10 | - | 2 | 19.3 | 6420 | 29.9 | 7.52 | <0.025 | 11.2 | 457 | 156 | 34.2 |
| LF_TP_11_0.9-1.0 | LF_TP_11 | 0.9-1 | 26/10/2022 | TP | Normal | 5200 | 14 | 7.3 | <0.03 | 0.96 | - | 3.2 | 6.35 | - | - | - | 39,300 | 7.3 | 38.5 | 0.8 | 20 | 0.782 | 17.9 | - | 3.83 | 106 | 10,500 | 140 | 8.7 | 0.27 | 46.9 | 535 | 58 | 170 |
| LF_TP_11_1.8-2.0 | LF_TP_11 | 1.8-2 | 26/10/2022 | TP | Normal | 300 | 5 | 6.5 | <0.03 | 0.28 | - | <2.9 | <5 | - | - | - | 3900 | 5.1 | 2.59 | 0.13 | 2 | 0.03 | 5.8 | - | 1.9 | 1.7 | 6230 | 1.6 | 5.06 | <0.025 | 3.1 | 355 | 20.2 | 9.29 |
| LF_TP_12_0.2-0.3 | LF_TP_12 | 0.2-0.3 | 1/11/2022 | TP | Normal | 13,000 | 13 | 6.3 | <0.03 | 1.1 | - | 8.2 | 37.1 | - | - | - | 25,300 | 28.4 | 66 | 1.34 | 31 | 3.23 | 70.2 | - | 10.9 | 1070 | 40,200 | 107 | 10.8 | 0.06 | 67 | 376 | 50.7 | 893 |
| LF_TP_12_0.8-1.0 | LF_TP_12 | 0.8-1 | 1/11/2022 | TP | Normal | 330 | 18 | 5 | <0.03 | 0.35 | - | <3.2 | 17.2 | - | - | - | 5080 | 4.2 | 2.88 | 0.083 | <1.3 | 0.058 | 7.9 | - | 1.3 | 1.7 | 7150 | 2.9 | 2.4 | <0.025 | 2.5 | 463 | 30.1 | 8.4 |
| LF_TP_13_0.2-0.3 | LF_TP_13 | 0.2-0.3 | 26/10/2022 | TP | Normal | 39,000 | 11 | 6.5 | <0.03 | 0.73 | - | 6.8 | 7.1 | - | - | - | 67,300 | 77.2 | 95.6 | 2.38 | 61 | 12.8 | 83.1 | - | 6.76 | 2150 | 29,300 | 212 | 17.5 | 0.038 | 91.2 | 514 | 103 | 2310 |
| LF_TP_13_0.8-1.0 | LF_TP_13 | 0.8-1 | 26/10/2022 | TP | Normal | 39,000 | 21 | 7 | <0.03 | 3.84 | - | 34.8 | 9.57 | - | - | - | 193,000 | 180 | 124 | 6.32 | 90 | 8.38 | 157 | - | 6.91 | 2360 | 31,000 | 213 | 52.2 | 0.1 | 105 | 485 | 67.1 | 1540 |
| LF_TP_13_1.8-2.0 | LF_TP_13 | 1.8-2 | 26/10/2022 | TP | Normal | 40,000 | 23 | 7.5 | <0.03 | 4.64 | - | 70.3 | <5 | - | - | - | 109,000 | 143 | 113 | 4.56 | 144 | 28.1 | 182 | - | 7.91 | 2600 | 72,900 | 204 | 43.2 | 0.35 | 182 | 468 | 63.6 | 2500 |
| LF_TP_14_0.2-0.3 | LF_TP_14 | 0.2-0.3 | 27/10/2022 | TP | Normal | 59,000 | 15 | 6.2 | <0.03 | 0.59 | - | 10.9 | <5 | - | - | - | 79,900 | 6.9 | 75.2 | 2.02 | 8.1 | 2.12 | 20.9 | - | 5.43 | 38.3 | 16,500 | 183 | 14.9 | 0.06 | 111 | 583 | 102 | 283 |
| LF_TP_14_0.8-1.0 | LF_TP_14 | 0.8-1 | 27/10/2022 | TP | Normal | 8400 | 18 | 6.8 | <0.03 | 2.61 | - | 36.3 | <5 | - | - | - | 24,600 | 10 | 105 | 0.53 | 6.4 | 1.75 | 165 | - | 9.95 | 459 | 88,900 | 384 | 5.74 | 0.043 | 90.2 | 477 | 37.6 | 1480 |
| LF_TP_15_0.2-0.3 | LF_TP_15 | 0.2-0.3 | 26/10/2022 | TP | Normal | 940 | 7 | 5.7 | <0.03 | <0.2 | - | <3 | <5 | - | - | - | 12,100 | 4 | 16 | 0.26 | 1.7 | 0.23 | 7.6 | - | 3.14 | 6.1 | 8240 | 11.3 | 6.88 | <0.025 | 14.4 | 310 | 25.5 | 98.5 |
| LF_TP_15_0.8-1.0 | LF_TP_15 | 0.8-1 | 26/10/2022 | TP | Normal | 2000 | 6 | 6.4 | <0.03 | <0.2 | - | 4.9 | 6.45 | - | - | - | 19,100 | 3.4 | 18.5 | 0.26 | 3.8 | 0.18 | 7.2 | - | 2.79 | 13.4 | 6840 | 11.3 | 8.13 | <0.025 | 16.3 | 331 | 25.4 | 109 |
| LF_TP_15_1.8-2.0 | LF_TP_15 | 1.8-2 | 26/10/2022 | TP | Normal | 1400 | 9 | 7.2 | <0.03 | <0.2 | - | 15.9 | <5 | - | - | - | 7920 | 3 | 27.6 | 0.25 | 3.9 | 0.38 | 12.6 | - | 2.92 | 14.8 | 15,600 | 42.2 | 4.87 | <0.025 | 34.3 | 231 | 36.8 | 798 |
| LF_TP_16_1.0-2.0 | LF_TP_16 | 1-2 | 2/11/2022 | TP | Normal | 610 | 92 | 3.7 | <0.26 | 7.34 | - | 380.3 | 169 | - | - | - | 3480 | 0.67 | 5.25 | 0.055 | 10 | 0.054 | 1.8 | - | 0.29 | 1.5 | 760 | 4.8 | 0.5 | 0.058 | 2.9 | 54.3 | 5.1 | 11.1 |
| LF_TP_16_0.2-0.3 | LF_TP_16 | 0.2-0.3 | 2/11/2022 | TP | Normal | 360 | 88 | 3.4 | <0.18 | 7.92 | - | 110.3 | 29.2 | - | - | - | 1200 | 0.56 | 5.47 | 0.049 | 5.4 | 0.068 | 1 | - | 0.25 | 1.2 | 860 | 11.6 | 0.16 | 0.063 | 3.8 | 24.1 | 4.8 | 6.87 |
| LF_TP_17_0.2-0.3 | LF_TP_17 | 0.2-0.3 | 26/10/2022 | TP | Normal | 23,000 | 12 | 6.3 | <0.03 | 1.7 | - | 4.5 | 8.72 | - | - | - | 51,200 | 5.2 | 33.8 | 1.65 | 13 | 0.532 | 26.8 | - | 5.59 | 80.3 | 24,000 | 29.6 | 30.9 | 0.14 | 85.8 | 462 | 87.1 | 171 |
| LF_TP_17_1.8-2.0 | LF_TP_17 | 1.8-2 | 26/10/2022 | TP | Normal | 34,000 | 22 | 7.1 | 0.56 | 210 | - | 145 | <5 | - | - | - | 164,000 | 6.3 | 43.8 | 5.36 | 358 | 0.553 | 90 | - | 3.26 | 133 | 35,500 | 47.3 | 83.8 | 2 | 115 | 708 | 886 | 506 |
| LF_TP_17_1.0-1.2 | LF_TP_17 | 1-1.2 | 26/10/2022 | TP | Normal | 28,000 | 22 | 6.8 | <0.03 | 2.6 | - | 63.7 | <5 | - | - | - | 127,000 | 9 | 47.3 | 5.59 | 17 | 0.4 | 462 | - | 10.9 | 111 | 127,000 | 18.5 | 74 | 0.029 | 188 | 176 | 204 | 124 |
| LF_TP_18_0.2-0.3 | LF_TP_18 | 0.2-0.3 | 27/10/2022 | TP | Normal | 750 | 6 | 5.7 | <0.03 | 0.49 | - | <3.1 | 20.8 | - | - | - | 7170 | 4.9 | 8.6 | 0.1 | <1.3 | 0.044 | 7.1 | - | 2.55 | 5 | 8920 | 5.96 | 2.52 | 0.037 | 14 | 430 | 24.8 | 22 |
| LF_TP_18_1.8-2.0 | LF_TP_18 | 1.8-2 | 27/10/2022 | TP | Normal | 7200 | 12 | 6.3 | <0.03 | 0.53 | - | 20.9 | <5 | - | - | - | 24,200 | 6.5 | 30.2 | 0.67 | 3.4 | 9.66 | 46.1 | - | 8.35 | 42 | 29,200 | 32.1 | 8 | 0.031 | 62 | 510 | 42.9 | 208 |
| LF_TP_19_0.2-0.3 | LF_TP_19 | 0.2-0.3 | 26/10/2022 | TP | Normal | - | 86 | 3.5 | - | - | - | 137.6 | 14.1 | - | - | - | 1600 | 0.46 | 6.37 | 0.045 | 7.3 | 0.033 | 7.9 | - | 0.32 | 1.7 | 650 | 8.73 | 1.6 | 0.077 | 4.2 | 65.5 | 2.9 | 3.3 |
| LF_TP_19_1.3-1.5 | LF_TP_19 | 1.3-1.5 | 26/10/2022 | TP | Normal | - | 83 | 4 | - | - | - | 9.7 | 6.93 | - | - | - | 3800 | 0.9 | 6.26 | 0.11 | 5.4 | 0.16 | 11 | - | 0.4 | 5.1 | 590 | 6.26 | 0.56 | 0.26 | 4.4 | 132 | 13.2 | 1.4 |
| LF_TP_20_0.2-0.3 | LF_TP_20 | 0.2-0.3 | 27/10/2022 | TP | Normal | 7700 | 7 | 5.7 | <0.03 | 0.27 | - | <3.1 | <5 | - | - | - | 27,000 | 3.6 | 27.7 | 0.86 | 2.1 | 0.12 | 10 | - | 4.14 | 11 | 8670 | 25 | 6.96 | 0.028 | 50.8 | 471 | 49.3 | 72.5 |
| LF_TP_20_1.8-2.0 | LF_TP_20 | 1.8-2 | 27/10/2022 | TP | Normal | 5900 | 12 | 6.7 | <0.03 | 0.23 | - | 49.2 | <5 | - | - | - | 2820 | 7.1 | 41.5 | 0.48 | 9.8 | 0.871 | 21.5 | - | 4.89 | 131 | 16,400 | 91.9 | 9.37 | 0.028 | 26.7 | 65.8 | 59.8 | 131 |
| LF_TP_21_0.2-0.3 | LF_TP_21 | 0.2-0.3 | 2/11/2022 | TP | Normal | 140 | 92 | 3.4 | <0.25 | 10.4 | - | 35.8 | 33.3 | - | - | - | 1130 | 0.7 | 2.1 | 0.017 | 2 | 0.023 | 0.96 | - | 0.2 | 1.2 | 1200 | 4.4 | 0.062 | 0.036 | 3.4 | 23.2 | 3.3 | 4 |
| LF_TP_21_1.0-1.2 | LF_TP_21 | 1-1.2 | 2/11/2022 | TP | Normal | 130 | 83 | 3.8 | <0.12 | 8.43 | - | 75.3 | 12 | - | - | - | 1560 | 0.43 | 4.64 | 0.022 | 4.1 | 0.044 | 0.93 | - | 0.23 | 1 | 700 | 0.35 | 0.038 | 0.037 | 0.49 | 43.8 | 3.7 | 1.5 |
| LF_TP_22_0.2-0.3 | LF_TP_22 | 0.2-0.3 | 2/11/2022 | TP | Normal | 250 | 49 | 4 | <0.04 | 2.15 | - | 7 | <5 | - | - | - | 2510 | 2.6 | 2.85 | 0.06 | 2.4 | 0.03 | 3.5 | - | 0.25 | 0.5 | 4040 | 3.3 | 0.5 | 0.03 | 1.4 | 139 | 12 | 2.5 |
| LF_TP_22_0.8-1.0 | LF_TP_22 | 0.8-1 | 2/11/2022 | TP | Normal | 170 | 27 | 4.5 | <0.03 | <0.3 | - | 4.1 | <5 | - | - | - | 5970 | 2.9 | 5.04 | 0.14 | <1.3 | 0.077 | 6.2 | - | 1.4 | 1.7 | 4590 | 1.6 | 7.79 | <0.025 | 2.7 | 382 | 16.8 | 8.22 |
| LF_TP_23_0.1-0.3 | LF_TP_23 | 0.1-0.3 | 2/11/2022 | TP | Normal | 3000 | 85 | 5.7 | <0.14 | 3.24 | - | 19.1 | 57.4 | - | - | - | 12,300 | 23.3 | 18 | 0.53 | 6.3 | 0.38 | 8.6 | - | 2.5 | 9.68 | 20,900 | 6.45 | 2.3 | 0.086 | 102 | 203 | 42.3 | 22.1 |
| LF_TP_23_0.7-1.1 | LF_TP_23 | 0.7-1.1 | 2/11/2022 | TP | Normal | 270 | 37 | 5 | <0.04 | <0.3 | - | 37.6 | <5 | - | - | - | 4290 | 1.7 | 6.37 | 0.14 | 2.2 | 0.22 | 3.2 | - | 0.57 | 1.2 | 2580 | 1.5 | 2.4 | 0.025 | 1.9 | 272 | 12 | 4.9 |
| LF_TP_24_0.3-0.4 | LF_TP_24 | 0.3-0.4 | 2/11/2022 | TP | Normal | 86,000 | 27 | 5.9 | <0.03 | <0.3 | - | 16.1 | <5 | - | - | - | 53,400 | 41.7 | 49.7 | 4.46 | 3.2 | 0.16 | 35.6 | - | 10.9 | 78.5 | 43,500 | 12.5 | 19.2 | <0.025 | 319 | 115 | 103 | 88 |
| LF_TP_24_1.4-1.6 | LF_TP_24 | 1.4-1.6 | 2/11/2022 | TP | Normal | 180,000 | 10 | 5.8 | <0.03 | <0.2 | - | 504.6 | <5 | - | - | - | 20,200 | 26.6 | 38.2 | 4.83 | <1.3 | 0.024 | 29.9 | - | 7.22 | 63 | 34,700 | 9.58 | 13.2 | <0.025 | 340 | 17.6 | 95.4 | 22.5 |
| LF_TP_25_1.0-1.2 | LF_TP_25 | 1-1.2 | 1/11/2022 | TP | Normal | 100,000 | 17 | 6.4 | <0.03 | <0.2 | - | 138.2 | 25.8 | - | - | - | 50,700 | 40.3 | 25.8 | 3.22 | <1.3 | 1.32 | 36.9 | - | 11.2 | 99.4 | 57,500 | 29.6 | 8.76 | <0.025 | 503 | 47.8 | 148 | 106 |
| LF_soil_DUP_9 | LF_TP_25 | 1-1.2 | 1/11/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 42,400 | 41.4 | - | 5.15 | 3.5 | 1.24 | 40.9 | - | - | 97.9 | 59,700 | 33.2 | - | <0.025 | 494 | - | - | 99.2 |
| LF_TP_26_0.2-0.3 | LF_TP_26 | 0.2-0.3 | 27/10/2022 | TP | Normal | 5300 | 12 | 6.2 | <0.03 | 0.36 | - | 3.2 | <5 | - | - | - | 1910 | 3.7 | 35.9 | 0.44 | 5.1 | 0.23 | 8.8 | - | 6.6 | 23.4 | 9820 | 28.5 | 9.26 | <0.025 | 47.9 | 43.4 | 48.4 | 125 |
| LF_TP_26_1.8-2.0 | LF_TP_26 | 1.8-2 | 27/10/2022 | TP | Normal | 1700 | 12 | 6.8 | <0.03 | 0.5 | - | 13.1 | <5 | - | - | - | 6680 | 3.2 | 20.9 | 0.21 | 3.6 | 0.14 | 8.7 | - | 2.96 | 22.2 | 6440 | 10.6 | 4.42 | 0.044 | 12.9 | 318 | 23.7 | 53.5 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial
MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)
NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health
NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs
USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020
CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
# Table C1
# NZAS Landfill Soil Human Health Screening Values

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | Nutrients | | | | Metals | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Aluminium | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Cobalt | Copper | Iron | Lead | Lithium | Mercury | Nickel | Titanium | Vanadium | Zinc |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 3 | 2.9 | 5 | 2.5 | 1 | 2 | 2.5 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.025 | 0.05 | 0.075 | 0.125 | 0.05 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | 90 | | | | | 300 | | | | | | 1200 | | | 30000 |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | | | | | | | | | | | 500 | | | | | 4000 | | | | | | 6000 | | | 400000 |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | 780 | 2000 | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | >10000 | >10000 | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | 80 | | | >10,000 | 400 | 2700 | 2700 | | >10,000 | | 880 | | 1800 | | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | 70 | | | >10,000 | 1300 | 6300 | 6300 | | >10,000 | | 3300 | | 4200 | | | | |
| CCME Recreational | | | | | | 400 | | | | | | | | | | | | | 500 | | | | | | | | | | | | | | 130 | |
| CCME Industrial | | | | | | 2000 | | | | | | | | | | | | | 2000 | | | | | | | | | | | | | | 130 | |
| CCME pH Low | | | | | | | | <6 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | >8 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | 77,000 | | | | | | | | | | 55,000 | | 160 | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | 1,100,000 | | | | | | | | | | 820,000 | | 2300 | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | 7700 | | | | | | | | | | 5500 | | 16 | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | 110,000 | | | | | | | | | | 82,000 | | 230 | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LF_TP_27_0.2-0.3 | LF_TP_27 | 0.2-0.3 | 27/10/2022 | TP | Normal | 3100 | 9 | 6.6 | <0.03 | 0.26 | - | <2.9 | <5 | - | - | - | 7000 | 4.2 | 30.6 | 0.28 | 1.7 | 0.47 | 11 | - | 4.58 | 21.8 | 5730 | 9.43 | 6.8 | <0.025 | 72 | 199 | 111 | 57 |
| LF_TP_27_1.8-2.0 | LF_TP_27 | 1.8-2 | 27/10/2022 | TP | Normal | 2600 | 30 | 6.9 | <0.03 | 0.53 | - | 130.2 | <5 | - | - | - | 151,000 | 0.43 | 12.6 | 0.23 | 16 | 0.45 | 14.7 | - | 4.68 | 472 | 20,900 | 43.9 | 2.9 | <0.025 | 53.9 | 25.3 | 15.2 | 315 |
| LF_TP_28_0.2-0.3 | LF_TP_28 | 0.2-0.3 | 27/10/2022 | TP | Normal | 43,000 | 15 | 6.3 | <0.03 | 0.23 | - | 118.7 | <5 | - | - | - | 54,900 | 75.9 | 22.8 | 2.5 | <1.3 | 0.4 | 40.4 | - | 15.8 | 100 | 47,800 | 14.7 | 3.58 | <0.025 | 280 | 133 | 101 | 131 |
| LF_TP_28_1.3-1.5 | LF_TP_28 | 1.3-1.5 | 27/10/2022 | TP | Normal | 43,000 | 16 | 6.2 | <0.03 | <0.2 | - | 101 | <5 | - | - | - | 5990 | 38.5 | 23.8 | 3.38 | <1.3 | 0.32 | 46.8 | - | 15.3 | 154 | 58,100 | 21.1 | 5.44 | <0.025 | 361 | 15.1 | 216 | 140 |
| LF_TP_29_0.2-0.3 | LF_TP_29 | 0.2-0.3 | 27/10/2022 | TP | Normal | 8900 | 11 | 5.9 | <0.03 | 0.31 | - | 4.6 | <5 | - | - | - | 4610 | 4.8 | 54.7 | 0.9 | 2.6 | 0.25 | 25.7 | - | 5.68 | 25.3 | 19,900 | 59.2 | 10.7 | <0.025 | 54.2 | 96.8 | 60.6 | 249 |
| LF_soil_DUP_1 | LF_TP_29 | 0.2-0.3 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 28,300 | 4 | - | 1.1 | 5 | 0.21 | 27.7 | - | - | 14.7 | 19,100 | 55.3 | - | <0.025 | 47.4 | - | - | 204 |
| LF_TP_29_1.0-1.1 | LF_TP_29 | 1-1.1 | 27/10/2022 | TP | Normal | 18,000 | 18 | 6.8 | <0.03 | 0.27 | - | 377.2 | <5 | - | - | - | 128,000 | 14.3 | 66.3 | 2.23 | 26 | 0.903 | 77.6 | - | 22.1 | 149 | 93,100 | 49.5 | 15.5 | 0.028 | 89.3 | 268 | 74.5 | 488 |
| LF_TP_30_0.2-0.3 | LF_TP_30 | 0.2-0.3 | 27/10/2022 | TP | Normal | 2500 | 6 | 6.8 | <0.03 | <0.2 | - | <3.1 | <5 | - | - | - | 19,700 | 4.8 | 24.1 | 0.33 | 3.1 | 0.695 | 14.3 | - | 9.85 | 10.9 | 12,600 | 12 | 6.78 | <0.025 | 72.2 | 394 | 46.6 | 71.7 |
| LF_TP_30_1.0-1.1 | LF_TP_30 | 1-1.1 | 27/10/2022 | TP | Normal | 10,000 | 9 | 6.9 | <0.03 | <0.2 | - | 8.4 | <5 | - | - | - | 56,000 | 12 | 31.7 | 0.53 | 4.1 | 2.43 | 18.9 | - | 9.46 | 22.4 | 14,800 | 46.7 | 8.52 | 0.047 | 91.9 | 456 | 81.1 | 167 |
| LF_TP_31_0.1-0.2 | LF_TP_31 | 0.1-0.2 | 2/11/2022 | TP | Normal | 700 | 26 | 5 | <0.03 | <0.2 | - | 6.5 | <5 | - | - | - | 22,600 | 4.6 | 24.9 | 0.27 | 3.9 | 0.25 | 16.2 | - | 4.32 | 11.3 | 16,800 | 7.05 | 23 | 0.034 | 11.6 | 834 | 54.7 | 40.2 |
| LF_TP_31_0.7-1.0 | LF_TP_31 | 0.7-1 | 2/11/2022 | TP | Normal | 370 | 7 | 5.5 | <0.03 | <0.2 | - | <3.1 | <5 | - | - | - | 6200 | 12 | 8.32 | 0.18 | 1.7 | 0.08 | 4.9 | - | 1.9 | 1.5 | 7510 | 3 | 3.7 | <0.025 | 2.6 | 372 | 25.1 | 10.4 |
| LF_TP_32_0.2-0.3 | LF_TP_32 | 0.2-0.3 | 27/10/2022 | TP | Normal | 31,000 | 12 | 6.9 | <0.03 | 0.78 | - | 45.5 | <5 | - | - | - | 164,000 | 10 | 64.7 | 1.7 | 31 | 0.41 | 28.1 | - | 8.55 | 3470 | 9720 | 12.8 | 30.3 | <0.025 | 173 | 394 | 213 | 109 |
| LF_soil_DUP_4 | LF_TP_32 | 0.2-0.3 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 77,500 | 10 | - | 2.11 | 49 | 0.504 | 25.2 | - | - | 32.7 | 8170 | 12 | - | <0.025 | 156 | - | - | 149 |
| LF_TP_32_1.8-2.0 | LF_TP_32 | 1.8-2 | 27/10/2022 | TP | Normal | 52,000 | 14 | 6.5 | <0.03 | <0.2 | - | 74.6 | <5 | - | - | - | 109,000 | 23.2 | 104 | 2.89 | 45 | 0.25 | 16.1 | - | 6.19 | 53.8 | 10,500 | 12.3 | 20.1 | <0.025 | 167 | 459 | 88.7 | 93.2 |
| LF_TP_33_0.2-0.3 | LF_TP_33 | 0.2-0.3 | 28/10/2022 | TP | Normal | 490 | 8 | 5 | <0.03 | 1.2 | - | 4.7 | 36.2 | - | - | - | 5420 | 11 | 8.55 | 0.1 | <1.3 | 0.075 | 5.2 | - | 1.6 | 5.1 | 7820 | 6.55 | 2.5 | <0.025 | 6.03 | 242 | 30.9 | 18.9 |
| LF_TP_33_1.8-2.0 | LF_TP_33 | 1.8-2 | 28/10/2022 | TP | Normal | 290 | 12 | 6.2 | <0.03 | <0.2 | - | 11.6 | <5 | - | - | - | 5140 | 5.3 | 3.35 | 0.12 | 1.9 | 0.027 | 7.5 | - | 3.2 | 2.2 | 7030 | 2.1 | 5.07 | <0.025 | 4.4 | 381 | 23.6 | 13.5 |
| LF_soil_DUP_7 | LF_TP_33 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 6850 | 5.4 | - | 0.14 | 3 | 0.028 | 7.6 | - | - | 2.2 | 8370 | 2.2 | - | <0.025 | 4.4 | - | - | 12.6 |
| LF_TP_34_0.2-0.3 | LF_TP_34 | 0.2-0.3 | 3/11/2022 | TP | Normal | 190 | 8 | 4.1 | <0.03 | <0.2 | - | <3.1 | <5 | - | - | - | 4370 | 5.3 | 4.65 | 0.099 | 2.6 | 0.057 | 3.6 | - | 0.9 | 2.8 | 3880 | 8.16 | 2.4 | <0.025 | 3 | 162 | 41 | 7.39 |
| LF_TP_34_1.8-2.0 | LF_TP_34 | 1.8-2 | 3/11/2022 | TP | Normal | 240 | 7 | 4.6 | <0.03 | <0.2 | - | <3.1 | <5 | - | - | - | 6980 | 10 | 3.93 | 0.18 | 1.3 | 0.049 | 5.1 | - | 2.87 | 2.1 | 7040 | 1.6 | 7.17 | <0.025 | 3.8 | 286 | 18.2 | 13.3 |
| LF_TP_35_0.3-0.4 | LF_TP_35 | 0.3-0.4 | 27/10/2022 | TP | Normal | 3800 | 13 | 5.9 | <0.03 | 0.32 | - | <3 | <5 | - | - | - | 215,000 | 3.7 | 11.7 | 1.34 | 120 | 0.048 | 17.9 | - | 1.3 | 32.6 | 4440 | 2.8 | 9.26 | <0.025 | 21.1 | 370 | 285 | 15.2 |
| LF_TP_35_1.5-1.6 | LF_TP_35 | 1.5-1.6 | 27/10/2022 | TP | Normal | 1100 | 13 | 7.3 | <0.03 | <0.2 | - | 10.2 | 7.91 | - | - | - | 313,000 | 2 | 19.6 | 2.06 | 204 | 0.067 | 26.9 | - | 1.3 | 46 | 5720 | 5.03 | 17.5 | <0.025 | 34.7 | 463 | 598 | 26.5 |
| LF_soil_DUP_3 | LF_TP_35 | 1.5-1.6 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 138,000 | 1.9 | - | 2.3 | 223 | 0.07 | 23.8 | - | - | 51.9 | 5080 | 8.38 | - | <0.025 | 32.1 | - | - | 28.9 |
| LF_TP_35_2.0-2.2 | LF_TP_35 | 2-2.2 | 31/10/2022 | TP | Normal | 4600 | 24 | 7.9 | <0.03 | <0.2 | - | 4.8 | <5 | - | - | - | 249,000 | 6.6 | 18.1 | 1.96 | 224 | 0.068 | 29.5 | - | 1.2 | 53.5 | 5760 | 5.24 | 16.3 | <0.025 | 35 | 561 | 751 | 45.8 |
| LF_TP_36_0.2-0.3 | LF_TP_36 | 0.2-0.3 | 27/10/2022 | TP | Normal | 4800 | 13 | 7.5 | <0.03 | <0.4 | - | <3.2 | 8.65 | - | - | - | 28,800 | 1.7 | 35.1 | 2.18 | 235 | 0.17 | 32.5 | - | 1.6 | 58.6 | 5520 | 26.6 | 14.9 | <0.025 | 49.4 | 628 | 815 | 50.3 |
| LF_TP_36_1.8-2.0 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Normal | 9600 | 27 | 7.1 | <0.03 | 5.68 | - | 12.7 | 74.5 | - | - | - | 26,500 | 9 | 143 | 0.69 | 85 | 3.8 | 34.3 | - | 5.33 | 278 | 14,000 | 593 | 15.3 | 0.2 | 67.1 | 527 | 143 | 566 |
| LF_soil_DUP_2 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 42,500 | 9.8 | - | 0.64 | 93 | 3.82 | 61.7 | - | - | 323 | 16,800 | 638 | - | 0.67 | 71.5 | - | - | 631 |
| LF_TP_37_0.2-0.3 | LF_TP_37 | 0.2-0.3 | 28/10/2022 | TP | Normal | 320 | 12 | 6.4 | <0.03 | <0.2 | - | <3 | 10.2 | - | - | - | 5170 | 1.6 | 3.14 | 0.091 | <1.3 | 0.038 | 4.6 | - | 1.4 | 1.8 | 4380 | 1.5 | 3.27 | <0.025 | 2.5 | 381 | 30.8 | 7.78 |
| LF_TP_37_2.0-2.2 | LF_TP_37 | 2-2.2 | 28/10/2022 | TP | Normal | 250 | 23 | 7.3 | <0.03 | 0.73 | - | 152 | 63.9 | - | - | - | 6720 | 3.6 | 12.8 | 0.12 | 48 | 0.036 | 8.9 | - | 1.6 | 5.2 | 4420 | 2.3 | 4.17 | 0.026 | 4 | 423 | 40.6 | 8.86 |
| LF_TP_38_0.2-0.3 | LF_TP_38 | 0.2-0.3 | 28/10/2022 | TP | Normal | 390 | 42 | 4.3 | <0.04 | 1.9 | - | 34.2 | 73.6 | - | - | - | 29,800 | 5 | 16.8 | 0.65 | 3 | 0.068 | 22.7 | - | 3.85 | 20.2 | 34,000 | 4.1 | 11.5 | 0.15 | 12.4 | 231 | 139 | 32.2 |
| LF_TP_38_0.8-1.0 | LF_TP_38 | 0.8-1 | 28/10/2022 | TP | Normal | 230 | 34 | 4.9 | <0.03 | 0.51 | - | 25.2 | 85.7 | - | - | - | 37,500 | 9.5 | 27.6 | 0.68 | <1.3 | 0.072 | 27.3 | - | 8.12 | 21 | 62,700 | 5.43 | 14.8 | 0.1 | 20.3 | 646 | 206 | 59 |
| LF_TP_39_0.2-0.3 | LF_TP_39 | 0.2-0.3 | 3/11/2022 | TP | Normal | 230 | 4 | 4.3 | <0.03 | <0.2 | - | 3.2 | <5 | - | - | - | 6650 | 13.5 | 12.1 | 0.17 | 4.6 | 0.061 | 6.7 | - | 2.5 | 3.2 | 11,800 | 8.09 | 5.88 | <0.025 | 5.4 | 387 | 849 | 16.4 |
| LF_TP_40_1.8-2.0 | LF_TP_40 | 1.8-2 | 28/10/2022 | TP | Normal | 1300 | 6 | 6.4 | <0.03 | 0.27 | - | <3 | <5 | - | - | - | 6110 | 8.9 | 4.1 | 0.1 | 2.2 | 0.038 | 5.6 | - | 2.5 | 3.3 | 8080 | 1.7 | 3.68 | <0.025 | 3.7 | 380 | 63.9 | 10.9 |
| LF_soil_DUP_5 | LF_TP_40 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 7640 | 9.3 | - | 0.12 | 4.5 | 0.039 | 6 | - | - | 3.2 | 9500 | 1.9 | - | <0.025 | 3.4 | - | - | 9.58 |
| LF_TP_40_1.0-1.2 | LF_TP_40 | 1-1.2 | 28/10/2022 | TP | Normal | 1700 | 7 | 6.5 | <0.03 | <0.2 | - | <3 | <5 | - | - | - | 5810 | 4.4 | 3.88 | 0.099 | 3.5 | 0.027 | 5.2 | - | 2 | 2.1 | 6370 | 1.6 | 4.2 | <0.025 | 3.7 | 359 | 69.3 | 9.79 |
| LF_TP_41_1.0-1.2 | LF_TP_41 | 1-1.2 | 28/10/2022 | TP | Normal | 3200 | 21 | 7.2 | <0.03 | <0.2 | - | 5 | <5 | - | - | - | 233,000 | 0.83 | 10.9 | 1.2 | 331 | 0.013 | 26.5 | - | 0.28 | 10.9 | 710 | 2 | 1.7 | <0.025 | 20.1 | 399 | 465 | 7.61 |
| LF_TP_41_2.2-2.3 | LF_TP_41 | 2.2-2.3 | 28/10/2022 | TP | Normal | 1500 | 3 | 6.6 | <0.03 | <0.2 | - | <2.9 | <5 | - | - | - | 7770 | 7.2 | 6.95 | 0.12 | 4.5 | 0.051 | 7.1 | - | 2.5 | 1.8 | 9360 | 4.2 | 3.45 | <0.025 | 3.7 | 576 | 164 | 11.2 |
| LF_TP_42_0.1-0.3 | LF_TP_42 | 0.1-0.3 | 3/11/2022 | TP | Normal | 9300 | 22 | 5.2 | <0.03 | <0.4 | - | 3.7 | 27.4 | - | - | - | 257,000 | 1.4 | 15.2 | 3.41 | 419 | 0.06 | 29.1 | - | 0.63 | 26.1 | 1750 | 3.4 | 7.77 | <0.025 | 21.2 | 670 | 857 | 23.7 |
| LF_TP_42_0.7-1.0 | LF_TP_42 | 0.7-1 | 3/11/2022 | TP | Normal | 230 | 5 | 4.2 | <0.03 | 0.33 | - | 3.1 | 8.78 | - | - | - | <2.5 | <0.13 | <0.025 | <0.013 | <1.3 | <0.005 | <0.13 | - | <0.025 | <0.075 | <13 | <0.25 | <0.025 | <0.025 | <0.05 | <0.075 | <0.13 | <0.05 |
| LF_TP_43_0.2-0.3 | LF_TP_43 | 0.2-0.3 | 3/11/2022 | TP | Normal | 200 | 11 | 3.8 | <0.03 | 0.85 | - | 3.2 | 5.56 | - | - | - | 3620 | 3.8 | 4.81 | 0.056 | 3.5 | 0.029 | 1.8 | - | 0.38 | 1.3 | 2880 | 2.3 | 0.61 | <0.025 | 1.9 | 57.9 | 20.6 | 2.8 |
| LF_TP_43_0.8-1.0 | LF_TP_43 | 0.8-1 | 3/11/2022 | TP | Normal | 150 | 3 | 4.4 | <0.03 | 0.25 | - | <3.1 | <5 | - | - | - | 4270 | 6.1 | 6.62 | 0.088 | <1.3 | 0.026 | 5.9 | - | 1.6 | 1.4 | 7910 | 2.3 | 2.69 | <0.025 | 2.9 | 191 | 14.3 | 7.56 |
| LF_TP_44_0.2-0.3 | LF_TP_44 | 0.2-0.3 | 28/10/2022 | TP | Normal | 210 | 7 | 4.9 | <0.03 | 0.44 | - | <3.1 | 8.32 | - | - | - | 4410 | 13 | 4.25 | 0.11 | 1.8 | 0.027 | 5 | - | 2.5 | 1.6 | 8260 | 3.1 | 3.6 | <0.025 | 3 | 398 | 22.1 | 10.7 |
| LF_TP_44_1.0-1.2 | LF_TP_44 | 1-1.2 | 28/10/2022 | TP | Normal | 280 | 2 | 5 | <0.03 | <0.2 | - | 4.9 | 26.8 | - | - | - | 3590 | 3.5 | 4.19 | 0.077 | <1.3 | 0.015 | 4.1 | - | 1.4 | 1.5 | 4810 | 1.3 | 2.67 | <0.025 | 2.6 | 160 | 9.2 | 6.18 |
| LF_TP_45_0.2-0.3 | LF_TP_45 | 0.2-0.3 | 3/11/2022 | TP | Normal | 150 | 12 | 3.5 | <0.03 | 0.84 | - | 3.9 | 5.68 | - | - | - | 2120 | 2.1 | 3.86 | 0.024 | 2.8 | 0.025 | 2.3 | - | 0.29 | 1.1 | 2540 | 3.4 | 0.28 | 0.029 | 0.71 | 89.6 | 11 | 2.3 |
| LF_TP_45_1.7-2.0 | LF_TP_45 | 1.7-2 | 3/11/2022 | TP | Normal | 160 | 11 | 4.4 | <0.03 | 0.21 | - | <3.1 | <5 | - | - | - | 5240 | 7.1 | 4.02 | 0.13 | 1.6 | 0.047 | 7.4 | - | 2.1 | 2 | 7970 | 1.8 | 4.92 | <0.025 | 3.3 | 439 | 25.8 | 9.91 |
| LF_TP_46_0.2-0.3 | LF_TP_46 | 0.2-0.3 | 28/10/2022 | TP | Normal | 270 | <1 | 4.7 | <0.03 | 0.27 | - | <3.1 | 24 | - | - | - | 4190 | 7.9 | 5.77 | 0.08 | <1.3 | 0.019 | 5.9 | - | 1.8 | 1.9 | 7560 | 3.4 | 1.9 | <0.025 | 2.9 | 261 | 17.8 | 6.85 |
| LF_TP_46_1.8-2.0 | LF_TP_46 | 1.8-2 | 28/10/2022 | TP | Normal | 220 | 4 | 4.9 | <0.03 | <0.2 | - | <3 | 27.5 | - | - | - | 6080 | 12 | 2.85 | 0.15 | 1.3 | 0.029 | 5.2 | - | 2.82 | 2.3 | 7850 | 1.8 | 5.36 | <0.025 | 4 | 317 | 19 | 11 |
| LF_soil_DUP_6 | LF_TP_46 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 10,900 | 12.7 | - | 0.17 | 1.7 | 0.032 | 5.6 | - | - | 2.2 | 11,700 | 2 | - | <0.025 | 4.1 | - | - | 10.6 |
| LF_TP_47_0.2-0.3 | LF_TP_47 | 0.2-0.3 | 28/10/2022 | TP | Normal | 890 | 9 | 4.8 | <0.03 | 0.99 | - | 4.4 | 51.9 | - | - | - | 19,500 | 2.9 | 17 | 0.18 | 7.4 | 0.12 | 4 | - | 1.2 | 4 | 4390 | 11.4 | 1.9 | 0.053 | 9.74 | 164 | 38.9 | 50.6 |
| LF_TP_47_1.8-2.0 | LF_TP_47 | 1.8-2 | 28/10/2022 | TP | Normal | 270 | 6 | 4.6 | <0.03 | <0.2 | - | <3.1 | 25.5 | - | - | - | 9690 | 11 | 4.55 | 0.18 | 1.5 | 0.057 | 5.5 | - | 5.22 | 2.8 | 9880 | 2.3 | 5.52 | <0.025 | 3.6 | 281 | 17.3 | 12.3 |
| LF_TP_48_0.2-0.3 | LF_TP_48 | 0.2-0.3 | 28/10/2022 | TP | Normal | 5600 | 11 | 7.3 | <0.03 | 0.38 | - | <3 | <5 | - | - | - | 198,000 | 1.9 | 11.3 | 1.73 | 185 | 0.088 | 20.8 | - | 1.1 | 38.3 | 4420 | 12.4 | 10.9 | <0.025 | 24.5 | 480 | 445 | 23.2 |
| LF_TP_48_1.0-1.2 | LF_TP_48 | 1-1.2 | 28/10/2022 | TP | Normal | 1600 | 6 | 6.2 | <0.03 | 0.53 | - | 407.5 | 31.1 | - | - | - | 14,000 | 38.6 | 5.46 | 0.2 | 41 | 0.035 | 7.3 | - | 1.9 | 3.8 | 27,600 | 6.46 | 4.21 | <0.025 | 4 | 457 | 62.9 | 13.5 |
| LF_TP_49_1.4-1.5 | LF_TP_49 | 1.4-1.5 | 31/10/2022 | TP | Normal | 8700 | 11 | 7.5 | <0.03 | <0.2 | - | <3 | <5 | - | - | - | 102,000 | 4 | 9.98 | 0.7 | 89 | 0.081 | 14.6 | - | 1.8 | 23.2 | 6090 | 10.9 | 7.67 | <0.025 | 15.1 | 517 | 260 | 20.8 |
| LF_TP_49_2.3-2.7 | LF_TP_49 | 2.3-2.7 | 31/10/2022 | TP | Normal | 540 | 12 | 7.3 | <0.03 | <0.2 | - | <2.9 | <5 | - | - | - | 6100 | 11 | 3.29 | 0.14 | 9.3 | 0.018 | 5.8 | - | 4.2 | 2.8 | 8200 | 3.5 | 5.66 | <0.025 | 5.33 | 362 | 119 | 11.4 |
| LF_TP_50_1.4-1.6 | LF_TP_50 | 1.4-1.6 | 31/10/2022 | TP | Normal | 3900 | 25 | 7.9 | <0.03 | <0.4 | - | 6.6 | <5 | - | - | - | 146,000 | 0.92 | 11.7 | 2.35 | 355 | 0.067 | 32.9 | - | 0.67 | 52.1 | 2520 | 3 | 7.69 | <0.025 | 24.8 | 507 | 714 | 19.5 |
| LF_TP_50_3.0-3.5 | LF_TP_50 | 3-3.5 | 31/10/2022 | TP | Normal | 560 | 31 | 7.8 | <0.03 | <0.2 | - | <2.9 | 408 | - | - | - | 22,300 | 4.2 | 35.1 | 0.2 | 76 | 0.023 | 25.9 | - | 4.15 | 7 | 25,100 | 7.34 | 14.2 | 0.08 | 14.5 | 1030 | 103 | 19.1 |
| LF_TP_51_0.9-1.0 | LF_TP_51 | 0.9-1 | 31/10/2022 | TP | Normal | 320 | 14 | 6.5 | <0.03 | <0.2 | - | 87.9 | <5 | - | - | - | 2490 | 2.5 | 2.2 | 0.093 | 4.1 | 0.0076 | 3.6 | - | 1.4 | 1.7 | 4220 | 1 | 3.79 | <0.025 | 2.6 | 230 | 29.8 | 6.93 |
| LF_TP_51_2.7-3.0 | LF_TP_51 | 2.7-3 | 31/10/2022 | TP | Normal | 260 | 17 | 6.2 | <0.03 | <0.2 | - | <2.9 | 9.18 | - | - | - | 5850 | 3.2 | 3.41 | 0.13 | 4.6 | 0.015 | 6.8 | - | 2.84 | 3 | 6850 | 1.9 | 6.59 | <0.025 | 4.9 | 407 | 62.5 | 14.3 |
| LF_TP_52_1.8-2.0 | LF_TP_52 | 1.8-2 | 31/10/2022 | TP | Normal | 1600 | 11 | 6.7 | <0.03 | 5.54 | - | <3.2 | <5 | - | - | - | 17,800 | 4.9 | 5.75 | 0.21 | 16 | 0.04 | 5.8 | - | 1.7 | 7.6 | 6330 | 7.48 | 4.04 | <0.025 | 4.7 | 446 | 45.1 | 13.4 |
| LF_TP_52_2.7-3.0 | LF_TP_52 | 2.7-3 | 31/10/2022 | TP | Normal | 580 | 20 | 6.5 | <0.03 | 1.9 | - | 4.4 | 10.4 | - | - | - | 4670 | 4.3 | 3.97 | 0.11 | 12 | 0.04 | 4.8 | - | 1.5 | 4.2 | 5470 | 28 | 3.6 | <0.025 | 3.1 | 374 | 30.3 | 13.4 |
| LF_TP_53_1.4-1.5 | LF_TP_53 | 1.4-1.5 | 31/10/2022 | TP | Normal | 710 | 7 | 6 | <0.03 | 1.5 | - | <3 | 32.5 | - | - | - | 6350 | 5.4 | 6.27 | 0.15 | 5.1 | 0.1 | 6.7 | - | 1.9 | 7.71 | 6600 | 22.6 | 4.7 | <0.025 | 5.52 | 412 | 32.6 | 20.4 |
| LF_TP_53_2.0-2.2 | LF_TP_53 | 2-2.2 | 31/10/2022 | TP | Normal | 320 | 13 | 6.2 | <0.03 | <0.2 | - | <3 | <5 | - | - | - | 4030 | 4.6 | 2.5 | 0.1 | 3.5 | 0.032 | 4.5 | - | 1.9 | 1.4 | 5520 | 1.5 | 4.4 | <0.025 | 2.9 | 307 | 18.1 | 8.92 |
| LF_TP_54_1.8-2.0 | LF_TP_54 | 1.8-2 | 31/10/2022 | TP | Normal | 2500 | 6 | 7.5 | <0.03 | <0.2 | - | 11.1 | 5.22 | - | - | - | 19,400 | 5.4 | 24.4 | 0.39 | 9.2 | 0.26 | 17.7 | - | 6.65 | 12.9 | 13,400 | 24.4 | 9.53 | <0.025 | 43.4 | 499 | 64.2 | 71.5 |
| LF_TP_54_2.7-3.0 | LF_TP_54 | 2.7-3 | 31/10/2022 | TP | Normal | 570 | 19 | 5.9 | <0.03 | 0.68 | - | 4.1 | 37.5 | - | - | - | 4820 | 6.5 | 6.13 | 0.12 | 5.8 | 0.045 | 6.3 | - | 1.1 | 2.3 | 4910 | 4.6 | 2.86 | 0.029 | 3.3 | 322 | 28.2 | 8.66 |
| LF_TP_55_0.6-0.7 | LF_TP_55 | 0.6-0.7 | 31/10/2022 | TP | Normal | 1800 | 9 | 6.4 | <0.03 | 1.7 | - | 61.5 | 18.6 | - | - | - | 7900 | 5.1 | 5.83 | 0.14 | 31 | 0.04 | 5.4 | - | 0.83 | 3.5 | 4640 | 10.1 | 2.3 | <0.025 | 3 | 379 | 48.8 | 8.61 |
| LF_TP_55_1.0-1.4 | LF_TP_55 | 1-1.4 | 31/10/2022 | TP | Normal | 760 | 16 | 6.6 | <0.03 | <0.2 | - | 8.6 | 12.1 | - | - | - | 5020 | 12.8 | 5.06 | 0.13 | 10 | 0.038 | 5.6 | - | 2.4 | 2.2 | 8400 | 3.6 | 5.47 | <0.025 | 3.6 | 440 | 26.4 | 11.6 |
| LF_TP_56_2.3-2.5 | LF_TP_56 | 2.3-2.5 | 31/10/2022 | TP | Normal | 320 | 19 | 6.4 | <0.03 | 0.88 | - | 4 | 13.9 | - | - | - | 3120 | 2.7 | 6.79 | 0.069 | 14 | 0.025 | 2.7 | - | 0.45 | 1.2 | 3060 | 2.8 | 0.73 | <0.025 | 0.95 | 213 | 32.2 | 4.9 |
| LF_TP_56_3.2-3.5 | LF_TP_56 | 3.2-3.5 | 31/10/2022 | TP | Normal | 510 | 18 | 6.7 | <0.03 | <0.2 | - | 9.3 | 7.31 | - | - | - | 5610 | 13 | 5.1 | 0.16 | 12 | 0.074 | 8 | - | 2.58 | 2.6 | 10,500 | 3.4 | 6 | <0.025 | 3.7 | 569 | 34.1 | 12.2 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial
MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)
NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health
NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs
USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020
CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values

| | | | | | | BTEXN | | | | | TPH | | | | | | | | | | | PAHs | | | | | | | | | | | | | | | | | | | PAHs - extended | | | | SVOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Benzene | Toluene | Ethylbenzene | Xylene (o) | Xylene (m & p) | C7-C9 | C10-C14 | C15-C36 | C7-C36 (Total) | C10 - C11 | C12 - C14 | C15 - C20 | C21 - C25 | C26 - C29 | C30 - C44 | C7 - C44 (Total) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | PAHs (Sum of total) - Lab calc | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | Benzo(e)pyrene | Perylene | Benzo(b)fluoranthene | 1-Methylnaphthalene |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.05 | 0.1 | 0.05 | 0.05 | 0.1 | | | | | | | | | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | | 0.01 | 0.03 | 0.01 | | | 0.1 | 0.01 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 300 | | | | | | | |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4000 | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 160 | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7.2/70 | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 190/230' | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 40 | 40 | | | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 35 | 35 | | | | | |
| CCME Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A19R 0-1.5m | A19R | 0-1.5 | 13/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | 0.042 | <0.012 | 0.119 | 0.92 | 1.43 | 1.53 | 0.55 | 1.06 | 0.96 | 0.21 | 1.59 | 0.018 | 1.04 | <0.06 | 0.44 | 1.6 | 12.8 | 2.1 | - | <0.012 | 0.85 | 0.39 | - | <0.012 |
| A40D 0-2.5m | A40D | 0-2.5 | 27/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.012 | <0.012 | <0.012 | 0.011 | 0.015 | 0.015 | <0.012 | 0.011 | 0.012 | <0.012 | 0.013 | <0.012 | <0.012 | <0.06 | <0.012 | 0.013 | <0.3 | <0.027 | - | <0.012 | 0.011 | <0.012 | - | <0.012 |
| A40D 17.5-20m | A40D | 17.5-20 | 27/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.07 | <0.013 | <0.013 | <0.3 | <0.03 | - | <0.013 | <0.013 | <0.013 | - | <0.013 |
| A54D 1-2m | A54 | 1-2 | 12/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.026 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A54D 4.5-5m | A54 | 4.5-5 | 12/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.06 | <0.012 | <0.012 | <0.3 | <0.028 | - | <0.012 | <0.012 | <0.012 | - | <0.012 |
| A55D 7-8m | A55 | 7-8 | 15/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.06 | <0.012 | <0.012 | <0.3 | <0.029 | - | <0.012 | <0.012 | <0.012 | - | <0.012 |
| A55D 2.6-3m | A55D | 2.6-3 | 15/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.05 | <0.01 | <0.01 | <0.3 | <0.025 | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A5AR 1-2m | A5AR | 1-2 | 8/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 116 | 121 | - | - | - | - | - | - | - | 0.05 | <0.011 | 0.143 | 1.83 | 2.2 | 3.3 | 1.06 | 1.61 | 2.1 | 0.37 | 2.3 | 0.031 | 1.65 | <0.06 | 0.62 | 2.1 | 22 | 3.4 | - | <0.011 | 1.63 | 0.58 | - | <0.011 |
| A5AR 8-8.6m | A5AR | 8-8.6 | 8/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.012 | <0.012 | <0.012 | 0.02 | 0.027 | 0.03 | 0.012 | 0.022 | 0.027 | <0.012 | 0.026 | <0.012 | 0.02 | <0.06 | <0.012 | 0.019 | <0.3 | 0.04 | - | <0.012 | 0.017 | 0.013 | - | <0.012 |
| A60 0-3m | A60 | 0-3 | 10/10/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | 0.013 | 0.015 | - | <0.01 | 0.01 | 0.014 | <0.01 | 0.015 | <0.01 | 0.01 | <0.05 | <0.01 | 0.015 | <0.3 | - | - | <0.01 | 0.013 | <0.01 | - | <0.01 |
| A60 4.5-6m | A60 | 4.5-6 | 10/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.012 | <0.012 | <0.012 | 0.019 | 0.03 | 0.033 | 0.014 | 0.02 | 0.021 | <0.012 | 0.028 | <0.012 | 0.019 | <0.06 | <0.012 | 0.024 | <0.3 | 0.039 | - | <0.018 | 0.018 | 0.012 | - | <0.012 |
| A61 0-3m | A61 | 0-3 | 10/10/2022 | MW | Normal | <0.06 | <0.06 | <0.06 | <0.06 | <0.12 | <20 | 21 | 300 | 320 | - | - | - | - | - | - | - | <0.014 | <0.014 | <0.014 | 0.024 | 0.035 | 0.039 | <0.014 | 0.024 | 0.026 | <0.014 | 0.034 | <0.014 | 0.024 | <0.07 | 0.016 | 0.032 | 0.4 | 0.046 | - | <0.03 | 0.023 | 0.068 | - | <0.014 |
| A61 3-4.5m | A61 | 3-4.5 | 10/10/2022 | MW | Normal | <0.06 | <0.06 | <0.06 | <0.06 | <0.11 | <20 | <20 | 173 | 184 | - | - | - | - | - | - | - | <0.013 | <0.013 | <0.013 | 0.013 | 0.02 | 0.02 | <0.013 | <0.013 | <0.013 | <0.013 | 0.018 | <0.013 | <0.013 | <0.07 | <0.013 | 0.016 | <0.4 | <0.032 | - | <0.02 | <0.013 | 0.101 | - | <0.013 |
| A63 2.0-3.0m | A63 | 2-3 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.06 | <0.012 | <0.012 | <0.3 | <0.029 | - | <0.012 | <0.012 | <0.012 | - | <0.012 |
| A64D 5.5-4.8m | A64D | 4.8-5.5 | 3/10/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.05 | <0.01 | <0.01 | <0.3 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A65 3.0-4.5m | A65 | 3-4.5 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | 0.011 | <0.011 | <0.011 | <0.011 | <0.011 | 0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.027 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A66 0-1.5m | A66 | 0-1.5 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | 0.051 | 0.085 | - | 0.035 | 0.075 | 0.056 | 0.013 | 0.091 | <0.01 | 0.07 | <0.05 | 0.028 | 0.088 | 0.8 | - | - | <0.01 | 0.051 | 0.024 | - | <0.01 |
| A66 4.5-6.0m | A66 | 4.5-6 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.026 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A67 0-1.5m | A67 | 0-1.5 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.011 | <0.011 | <0.011 | 0.041 | 0.057 | 0.062 | 0.024 | 0.039 | 0.04 | <0.011 | 0.074 | <0.011 | 0.037 | <0.06 | 0.022 | 0.067 | 0.5 | 0.081 | - | <0.011 | 0.032 | 0.016 | - | <0.011 |
| A67 5.5-6.0m | A67 | 5.5-6 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.025 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A70S 1-2m | A70 | 1-2 | 13/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | 0.012 | 0.017 | 0.019 | <0.011 | 0.01 | 0.011 | <0.011 | 0.013 | <0.011 | <0.011 | <0.06 | <0.011 | 0.013 | <0.3 | 0.026 | - | <0.011 | 0.011 | <0.011 | - | <0.011 |
| A70S 4-5m | A70 | 4-5 | 13/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.026 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A70D 6-7m | A70D | 6-7 | 12/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.06 | <0.012 | <0.012 | <0.3 | <0.029 | - | <0.012 | <0.012 | <0.012 | - | <0.012 |
| A70D 2-2.4m | A70D | 2-2.4 | 12/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.025 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A71S 1-2m | A71 | 1-2 | 16/12/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.01 | 0.011 | - | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 | <0.01 | <0.05 | <0.01 | 0.01 | <0.3 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A71S 5.6-6m | A71 | 5.6-6 | 16/12/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.05 | <0.01 | <0.01 | <0.3 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A71D 3-4m | A71D | 3-4 | 14/12/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.05 | <0.01 | <0.01 | <0.3 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A71D 11-12m | A71D | 11-12 | 14/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.07 | <0.013 | <0.013 | <0.3 | <0.03 | - | <0.013 | <0.013 | <0.013 | - | <0.013 |
| A7R 1-2m | A7R | 1-2 | 8/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 67 | <80 | - | - | - | - | - | - | - | <0.011 | <0.011 | 0.012 | 0.143 | 0.25 | 0.3 | 0.106 | 0.23 | 0.149 | 0.037 | 0.22 | <0.011 | 0.23 | <0.06 | 0.044 | 0.197 | 2.2 | 0.37 | - | <0.011 | 0.16 | 0.073 | - | <0.011 |
| A7R 6.2-7m | A7R | 6.2-7 | 8/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.025 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| CIR 1-2m | C1R | 1-2 | 5/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 530 | 540 | - | - | - | - | - | - | - | 0.68 | <0.011 | 2.3 | 6.9 | 9.5 | 9.4 | 3.4 | 6.9 | 6.2 | 1.13 | 16.3 | 0.58 | 7.2 | 0.15 | 6.8 | 15 | 100 | 13.5 | - | 0.079 | 4.8 | 2.7 | - | 0.058 |
| CIR 5-6m | C1R | 5-6 | 5/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 55 | <80 | - | - | - | - | - | - | - | 0.016 | <0.013 | 0.025 | 0.111 | 0.179 | 0.174 | 0.067 | 0.135 | 0.129 | 0.021 | 0.25 | <0.013 | 0.13 | <0.07 | 0.077 | 0.23 | 1.8 | 0.25 | - | <0.013 | 0.093 | 0.089 | - | <0.013 |
| C3R 2-3m | C3R | 2-3 | 6/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 6700 | 6700 | - | - | - | - | - | - | - | 13.3 | 0.117 | 42 | 260 | 340 | 340 | 134 | 220 | 270 | 41 | 470 | 7.2 | 240 | 2.4 | 145 | 450 | 3300 | 490 | - | 1.93 | 181 | 98 | - | 0.94 |
| C3R 8-9m | C3R | 8-9 | 6/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 480 | 490 | - | - | - | - | - | - | - | 2.2 | 0.094 | 5.8 | 14.2 | 14.8 | 18.1 | 6.6 | 11.5 | 13.3 | 2.4 | 32 | 0.6 | 11.8 | 0.17 | 25 | 26 | 198 | 23 | - | 0.21 | 9.1 | 4.3 | - | 0.176 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial
MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)
NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health
NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs
USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020
CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
# Table C1
# NZAS Landfill Soil Human Health Screening Values

| | | | | | | PAHs | | | | | | | | | | | | | | | | | | | PAHs - extended | | | | SVOCs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | PAHs (Sum of total) - Lab calc | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | Benzo(e)pyrene | Perylene | Benzo(b)fluoranthene | 1-Methylnaphthalene | Dibenzofuran |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | | 0.01 | 0.03 | 0.01 | | | 0.1 | 0.01 | 0.3 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | | | 300 | | | | | | | | |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | | | | | | | | | | | | | 4000 | | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | 160 | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | 7.2/70 | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | 190/230' | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | | | 40 | 40 | | | | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | | | | | | 35 | 35 | | | | | | |
| CCME Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | |
| TP1 0.2 | LF_TP_1 | 0.2 | 7/06/2022 | TP | Normal | 0.56 | <0.1 | 2 | 15 | 20 | - | 9.1 | 13 | 15 | 2.4 | 24 | 0.3 | 14 | <0.1 | 6.4 | 23 | - | 30 | 30 | <0.1 | - | - | 27 | - | <0.3 |
| TP1 2.0 | LF_TP_1 | 2 | 7/06/2022 | TP | Normal | <0.1 - 0.14 | <0.1 | 0.2 - 0.6 | 1.2 - 3.6 | 1.7 - 4.9 | - | 0.69 - 2 | 1.3 - 2.7 | 1.3 - 3.2 | 0.16 - 0.45 | 2.6 - 5.6 | <0.1 - 0.14 | 1.1 - 3 | <0.1 - 0.21 | 0.83 - 2.2 | 2.6 - 5.2 | - | 2.4 - 6.8 | 2.4 - 6.8 | <0.1 | - | - | 2.2 - 5.7 | - | <0.3 |
| TP1 3.0 | LF_TP_1 | 3 | 7/06/2022 | TP | Normal | 0.36 | <0.1 | 1 | 4.1 | 5.4 | - | 1.7 | 3.5 | 3.9 | 0.37 | 8.4 | 0.22 | 3.4 | 0.2 | 4.2 | 7.9 | - | 7.5 | 7.5 | <0.1 | - | - | 6.6 | - | <0.3 |
| TP2 0.3 | LF_TP_2 | 0.3 | 7/06/2022 | TP | Normal | <0.1 | <0.1 | 0.16 | 1.5 | 2.6 | - | 0.85 | 2.5 | 1.3 | 0.35 | 1.8 | <0.1 | 2.7 | <0.1 | 0.51 | 1.8 | - | 3.8 | 3.8 | <0.1 | - | - | 3 | - | <0.3 |
| TP2 0.8 | LF_TP_2 | 0.8 | 7/06/2022 | TP | Normal | 0.1 - 0.12 | <0.1 | 0.37 - 0.38 | 4.2 - 5.8 | 6.4 - 10 | - | 3 - 4.1 | 7.2 - 12 | 5.4 - 5.8 | 0.76 - 1.6 | 5.2 - 6.5 | <0.1 | 5.7 - 9.9 | <0.1 | 1.5 - 1.7 | 5 - 6.5 | - | 9.5 - 15 | 9.5 - 15 | <0.1 | - | - | 9.5 - 13 | - | <0.3 |
| TP2 2.0 | LF_TP_2 | 2 | 7/06/2022 | TP | Normal | 0.66 | <0.1 | 3.3 | 34 | 50 | - | 12 | 34 | 32 | 3.7 | 53 | 0.45 | 36 | <0.1 | 10 | 51 | - | 69 | 69 | <0.1 | - | - | 59 | - | <0.3 |
| TP3 0.25 | LF_TP_3 | 0.25 | 7/06/2022 | TP | Normal | 0.52 | <0.1 | 1.3 | 11 | 16 | - | 7.1 | 11 | 11 | 2.1 | 13 | 0.36 | 12 | <0.1 | 5.1 | 13 | - | 24 | 24 | <0.1 | - | - | 27 | - | <0.3 |
| TP3 0.65 | LF_TP_3 | 0.65 | 7/06/2022 | TP | Normal | <0.1 | <0.1 | <0.1 | 0.94 | 1.1 | - | 0.46 | 0.8 | 1.5 | 0.2 | 1.8 | <0.1 | 0.96 | <0.1 | 0.23 | 1.3 | - | 1.8 | 1.8 | <0.1 | - | - | 2.2 | - | <0.3 |
| TP3 1.4 | LF_TP_3 | 1.4 | 7/06/2022 | TP | Normal | 0.74 | <0.1 | 3.8 | 12 | 30 | - | 7.1 | 11 | 13 | 1.8 | 51 | 0.59 | 12 | <0.1 | 12 | 45 | - | 39 | 39 | <0.1 | - | - | 38 | - | 0.36 |
| TP3 3.8 | LF_TP_3 | 3.8 | 7/06/2022 | TP | Normal | 0.89 | <0.1 | 3.8 | 21 | 31 | - | 10 | 20 | 21 | 2.6 | 39 | 0.49 | 16 | <0.1 | 9.9 | 38 | - | 43 | 43 | <0.1 | - | - | 38 | - | <0.3 |
| TP4 0.2 | LF_TP_4 | 0.2 | 7/06/2022 | TP | Normal | <0.1 | <0.1 | 0.16 | 1.9 | 3.1 | - | 1.4 | 1.7 | 1.8 | 0.32 | 2.3 | <0.1 | 1.9 | <0.1 | 0.63 | 2.2 | - | 4.3 | 4.3 | <0.1 | - | - | 3.9 | - | <0.3 |
| TP4 0.5 | LF_TP_4 | 0.5 | 7/06/2022 | TP | Normal | 0.5 | 0.2 | 1.3 | 13 | 30 | - | 11 | 18 | 14 | 3.5 | 15 | 0.29 | 18 | <0.1 | 4.1 | 17 | - | 41 | 41 | <0.1 | - | - | 31 | - | <0.3 |
| TP4 3.5 | LF_TP_4 | 3.5 | 7/06/2022 | TP | Normal | 1.5 | <0.1 | 4.6 | 12 | 14 | - | 7.4 | 8.1 | 14 | 1.5 | 44 | 1.2 | 8.8 | 0.31 | 16 | 38 | - | 22 | 22 | 0.15 | - | - | 33 | - | 1.1 |
| LF_TP_5_0.2-0.3 | LF_TP_5 | 0.2-0.3 | 25/10/2022 | TP | Normal | 0.49 | 0.047 | 1.4 | 35 | 35 | 140 | 33 | 51 | 54 | 9.3 | 27 | 0.34 | 48 | 0.039 | 3.2 | 15 | 452.8 | 71 | 71 | 0.029 | - | - | - | 0.026 | - |
| LF_TP_5_0.9-1.0 | LF_TP_5 | 0.9-1 | 25/10/2022 | TP | Normal | 0.096 | 0.031 | 0.92 | 30 | 33 | 120 | 15 | 44 | 47 | 8.7 | 23 | 0.067 | 38 | 0.015 | 2.2 | 22 | 384 | 62 | 62 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_6_0.2-0.3 | LF_TP_6 | 0.2-0.3 | 25/10/2022 | TP | Normal | 2.1 | 0.054 | 7.2 | 32 | 41 | 42 | 13 | 17 | 26 | 4.1 | 62 | 1.3 | 28 | 0.58 | 22 | 61 | 359.3 | 58 | 58 | 0.17 | - | - | - | 0.13 | - |
| LF_TP_6_1.8-2.0 | LF_TP_6 | 1.8-2 | 25/10/2022 | TP | Normal | 8.1 | 0.17 | 23 | 96 | 110 | 120 | 41 | 57 | 79 | 13 | 200 | 5 | 61 | 3.2 | 84 | 190 | 1090 | 160 | 160 | 0.84 | - | - | - | 0.72 | - |
| LF_TP_7_0.2-0.3 | LF_TP_7 | 0.2-0.3 | 28/10/2022 | TP | Normal | 0.018 | <0.01 | 0.064 | 0.48 | 0.66 | 0.99 | 0.42 | 0.45 | 0.64 | 0.086 | 0.63 | 0.011 | 0.52 | <0.01 | 0.17 | 0.72 | - | 1 | 1 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_7_1.4-1.5 | LF_TP_7 | 1.4-1.5 | 28/10/2022 | TP | Normal | 2 | 0.039 | 4.7 | >19 | 63 | 66 | 37 | 37 | 62 | 7.4 | >19 | 1 | 42 | 0.37 | 18 | 69 | - | 87 | 87 | 0.12 | - | - | - | 0.09 | - |
| LF_soil_DUP_8 | LF_TP_7 | 1.4-1.5 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_8_0.2-0.3 | LF_TP_8 | 0.2-0.3 | 26/10/2022 | TP | Normal | 0.38 | 0.094 | 1.9 | 15 | 36 | 35 | 12 | 15 | 40 | 3.4 | 22 | 0.19 | 11 | 0.056 | 5.7 | 24 | 221.7 | 48 | 48 | 0.022 | - | - | - | 0.015 | - |
| LF_TP_8_1.8-2.0 | LF_TP_8 | 1.8-2 | 26/10/2022 | TP | Normal | 1.8 | 0.043 | 17 | 66 | 160 | 120 | 47 | 97 | 110 | 8.4 | 150 | 0.94 | 84 | 0.25 | 38 | 150 | 1050 | 210 | 210 | 0.5 | - | - | - | 0.42 | - |
| LF_TP_8_1.0-1.2 | LF_TP_8 | 1-1.2 | 26/10/2022 | TP | Normal | 0.98 | 0.045 | 4.1 | 20 | 48 | 31 | 13 | 14 | 27 | 3.1 | 40 | 0.63 | 12 | 0.23 | 11 | 0.14 | 225.2 | 59 | 59 | 0.47 | - | - | - | 0.55 | - |
| LF_TP_9_0.2-0.3 | LF_TP_9 | 0.2-0.3 | 26/10/2022 | TP | Normal | 0.019 | <0.01 | 0.049 | 0.37 | 0.58 | 0.62 | 0.26 | 0.39 | 0.58 | 0.089 | 0.56 | 0.016 | 0.32 | <0.01 | 0.25 | 0.6 | - | 0.83 | 0.83 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_9_1.8-2.0 | LF_TP_9 | 1.8-2 | 26/10/2022 | TP | Normal | 0.095 | <0.01 | 0.17 | 1.6 | 2.7 | 3.2 | 1.3 | 1.7 | 2.3 | 0.42 | 2 | 0.043 | 1.5 | 0.011 | 0.65 | 2.2 | - | 3.9 | 3.9 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_9_1.0-1.2 | LF_TP_9 | 1-1.2 | 26/10/2022 | TP | Normal | 0.041 | <0.01 | 0.079 | 0.73 | 1.2 | 1.3 | 0.56 | 0.69 | 1.1 | 0.17 | 1 | 0.023 | 0.59 | <0.01 | 0.36 | 1.1 | - | 1.7 | 1.7 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_10_0.3-0.4 | LF_TP_10 | 0.3-0.4 | 26/10/2022 | TP | Normal | 0.98 | 0.069 | 3.2 | 58 | 110 | 160 | 52 | 66 | 180 | 9.2 | 81 | 0.46 | 54 | 0.11 | 14 | 76 | 865 | 150 | 150 | 0.064 | - | - | - | 0.041 | - |
| LF_TP_10_1.8-2.0 | LF_TP_10 | 1.8-2 | 26/10/2022 | TP | Normal | 0.73 | 0.07 | 2.1 | 24 | 37 | 59 | 20 | 24 | 78 | 5.1 | 32 | 0.4 | 12 | 0.1 | 7.2 | 31 | 332.7 | 54 | 54 | 0.056 | - | - | - | 0.043 | - |
| LF_TP_10_1.0-1.2 | LF_TP_10 | 1-1.2 | 26/10/2022 | TP | Normal | 0.79 | 0.056 | 2 | 18 | 32 | 42 | 14 | 14 | 48 | 3.9 | 25 | 0.4 | 11 | 0.11 | 7.1 | 26 | 244.4 | 45 | 45 | 0.067 | - | - | - | 0.051 | - |
| LF_TP_11_0.3-0.4 | LF_TP_11 | 0.3-0.4 | 26/10/2022 | TP | Normal | 0.048 | 0.16 | 0.17 | 2 | 3.4 | 4.5 | 1.9 | 2.6 | 3.4 | 0.55 | 1.7 | <0.01 | 2.2 | 0.012 | 0.42 | 5 | - | 5 | 5 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_11_0.9-1.0 | LF_TP_11 | 0.9-1 | 26/10/2022 | TP | Normal | 5.6 | 0.15 | 11 | 51 | 77 | 84 | 31 | 51 | 56 | 6.6 | 83 | 3.9 | 47 | 2.6 | 37 | 88 | 634.9 | 110 | 110 | 0.8 | - | - | - | 0.6 | - |
| LF_TP_11_1.8-2.0 | LF_TP_11 | 1.8-2 | 26/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | 0.017 | <0.02 | <0.01 | <0.02 | 0.011 | <0.01 | <0.02 | <0.01 | 0.011 | <0.01 | <0.01 | <0.02 | - | 0.02 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_12_0.2-0.3 | LF_TP_12 | 0.2-0.3 | 1/11/2022 | TP | Normal | 0.39 | 0.019 | 1.2 | 8.2 | 24 | 28 | 12 | 18 | 34 | 1.4 | 23 | 0.2 | 17 | 0.054 | 3.9 | 21 | 192.4 | 33 | 33 | 0.043 | - | - | - | 0.032 | - |
| LF_TP_12_0.8-1.0 | LF_TP_12 | 0.8-1 | 1/11/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_13_0.2-0.3 | LF_TP_13 | 0.2-0.3 | 26/10/2022 | TP | Normal | 0.11 | 0.058 | 0.34 | 4.2 | 4.6 | 9.9 | 2.9 | 4 | 6.2 | 0.94 | 5.2 | 0.066 | 3.3 | 0.037 | 1.2 | 5.4 | 48.45 | 7.7 | 7.7 | 0.035 | - | - | - | 0.031 | - |
| LF_TP_13_0.8-1.0 | LF_TP_13 | 0.8-1 | 26/10/2022 | TP | Normal | 0.014 | <0.01 | 0.023 | 0.14 | 0.13 | 0.49 | 0.14 | 0.16 | 0.34 | 0.047 | 0.24 | <0.01 | 0.14 | 0.06 | 0.2 | 0.19 | - | 0.28 | 0.28 | 0.021 | - | - | - | 0.013 | - |
| LF_TP_13_1.8-2.0 | LF_TP_13 | 1.8-2 | 26/10/2022 | TP | Normal | 0.021 | <0.01 | 0.075 | 0.23 | 0.18 | 0.52 | 0.17 | 0.17 | 0.38 | 0.048 | 0.51 | <0.01 | 0.16 | 0.022 | 0.33 | 0.41 | - | 0.35 | 0.35 | 0.014 | - | - | - | <0.01 | - |
| LF_TP_14_0.2-0.3 | LF_TP_14 | 0.2-0.3 | 27/10/2022 | TP | Normal | 1.3 | 0.062 | 3.3 | 71 | 91 | 210 | 79 | 73 | 150 | 21 | 60 | 0.83 | 73 | 0.31 | 13 | 63 | 909.8 | 160 | 160 | 0.15 | - | - | - | 0.1 | - |
| LF_TP_14_0.8-1.0 | LF_TP_14 | 0.8-1 | 27/10/2022 | TP | Normal | 11 | 0.069 | 9.4 | 170 | 220 | 270 | 110 | 130 | 230 | 39 | 180 | 9.1 | 150 | 2.3 | 120 | 170 | 1821 | 330 | 330 | 1.3 | - | - | - | 0.85 | - |
| LF_TP_15_0.2-0.3 | LF_TP_15 | 0.2-0.3 | 26/10/2022 | TP | Normal | 0.38 | <0.01 | 1 | 7.8 | 11 | 14 | 5.3 | 7.6 | 9.4 | 1.6 | 16 | 0.15 | 6.4 | 0.028 | 3.7 | 16 | - | 17 | 17 | 0.017 | - | - | - | <0.01 | - |
| LF_TP_15_0.8-1.0 | LF_TP_15 | 0.8-1 | 26/10/2022 | TP | Normal | 0.49 | 0.016 | 1.4 | 13 | 16 | 20 | 7.8 | 12 | 16 | 2.7 | 15 | 0.25 | 9.8 | 0.093 | 5.3 | 17 | 136.8 | 24 | 24 | 0.036 | - | - | - | 0.023 | - |
| LF_TP_15_1.8-2.0 | LF_TP_15 | 1.8-2 | 26/10/2022 | TP | Normal | 18 | 0.13 | 36 | 240 | 280 | 330 | 110 | 170 | 190 | 12 | 230 | 14 | 210 | 1.7 | 140 | 220 | 2202 | 380 | 380 | 1.1 | - | - | - | 1.1 | - |
| LF_TP_16_1.0-2.0 | LF_TP_16 | 1-2 | 2/11/2022 | TP | Normal | <0.04 | <0.04 | 0.047 | 0.53 | 0.55 | 0.76 | 0.24 | <0.04 | 0.58 | <0.04 | 0.77 | <0.04 | 0.34 | <0.04 | 0.21 | 0.76 | - | 0.75 | 0.79 | <0.04 | - | - | - | <0.04 | - |
| LF_TP_16_0.2-0.3 | LF_TP_16 | 0.2-0.3 | 2/11/2022 | TP | Normal | 0.036 | <0.026 | 0.092 | 1 | 0.92 | 1.5 | 0.47 | 0.46 | 1.1 | <0.026 | 1.4 | <0.026 | 0.65 | 0.034 | 0.38 | 1.4 | - | 1.3 | 1.4 | <0.026 | - | - | - | <0.026 | - |
| LF_TP_17_0.2-0.3 | LF_TP_17 | 0.2-0.3 | 26/10/2022 | TP | Normal | 0.5 | 0.014 | 0.82 | 7.9 | 8.9 | 15 | 5.4 | 7.3 | 11 | 1.9 | 10 | 0.24 | 6.2 | 0.073 | 3.1 | 10 | 88.35 | 14 | 14 | 0.05 | - | - | - | 0.039 | - |
| LF_TP_17_1.8-2.0 | LF_TP_17 | 1.8-2 | 26/10/2022 | TP | Normal | 0.52 | 0.011 | 1.1 | 12 | 12 | 33 | 7.4 | 8.4 | 16 | 2.2 | 16 | 0.23 | 7.3 | 0.055 | 3.9 | 15 | 135.1 | 21 | 21 | 0.04 | - | - | - | 0.024 | - |
| LF_TP_17_1.0-1.2 | LF_TP_17 | 1-1.2 | 26/10/2022 | TP | Normal | 0.15 | <0.01 | 0.32 | 5 | 5 | 11 | 3.5 | 3.8 | 9 | 1.1 | 5.5 | 0.072 | 3.3 | 0.047 | 1.3 | 5.5 | - | 8.5 | 8.5 | 0.028 | - | - | - | 0.016 | - |
| LF_TP_18_0.2-0.3 | LF_TP_18 | 0.2-0.3 | 27/10/2022 | TP | Normal | 0.014 | <0.01 | 0.026 | 0.14 | 0.18 | 0.23 | 0.097 | 0.094 | 0.19 | 0.02 | 0.21 | <0.01 | 0.12 | <0.01 | 0.077 | 0.21 | - | 0.26 | 0.26 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_18_1.8-2.0 | LF_TP_18 | 1.8-2 | 27/10/2022 | TP | Normal | 0.47 | 0.014 | 1.2 | 11 | 28 | 21 | 11 | 17 | 23 | 1.7 | 15 | 0.23 | 18 | 0.055 | 4.3 | 16 | 168 | 36 | 36 | 0.029 | - | - | - | 0.019 | - |
| LF_TP_19_0.2-0.3 | LF_TP_19 | 0.2-0.3 | 26/10/2022 | TP | Normal | <0.024 | <0.024 | <0.024 | 0.25 | 0.24 | 0.39 | 0.12 | <0.024 | 0.27 | <0.024 | 0.25 | <0.024 | 0.18 | <0.024 | 0.084 | <0.024 | - | 0.34 | 0.36 | <0.024 | - | - | - | <0.024 | - |
| LF_TP_19_1.3-1.5 | LF_TP_19 | 1.3-1.5 | 26/10/2022 | TP | Normal | <0.019 | <0.019 | <0.019 | <0.02 | <0.019 | <0.02 | <0.019 | <0.02 | <0.019 | <0.019 | <0.02 | <0.019 | <0.019 | <0.019 | <0.019 | <0.02 | - | <0.01 | 0.05 | <0.019 | - | - | - | <0.019 | - |
| LF_TP_20_0.2-0.3 | LF_TP_20 | 0.2-0.3 | 27/10/2022 | TP | Normal | 0.058 | <0.01 | 0.14 | 1.6 | 1.7 | 3 | 1.2 | 1.1 | 2 | 0.33 | 1.4 | 0.03 | 1.3 | <0.01 | 0.45 | 1.4 | - | 2.7 | 2.7 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_20_1.8-2.0 | LF_TP_20 | 1.8-2 | 27/10/2022 | TP | Normal | 0.16 | <0.01 | 0.39 | 4.2 | 3.4 | 7.1 | 2.7 | 2.2 | 4.2 | 0.75 | 3.3 | 0.094 | 2.7 | 0.03 | 1.5 | 3.1 | - | 5.9 | 5.9 | 0.015 | - | - | - | <0.01 | - |
| LF_TP_21_0.2-0.3 | LF_TP_21 | 0.2-0.3 | 2/11/2022 | TP | Normal | 0.057 | <0.038 | 0.14 | 1.2 | 1.4 | 1.9 | 0.64 | <0.038 | 1.4 | <0.038 | 2.2 | <0.038 | 0.96 | <0.038 | 0.56 | 2.2 | - | 1.9 | 1.9 | <0.038 | - | - | - | <0.038 | - |
| LF_TP_21_1.0-1.2 | LF_TP_21 | 1-1.2 | 2/11/2022 | TP | Normal | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | - | <0.01 | 0.05 | <0.021 | - | - | - | <0.021 | - |
| LF_TP_22_0.2-0.3 | LF_TP_22 | 0.2-0.3 | 2/11/2022 | TP | Normal | 0.038 | <0.01 | 0.074 | 0.64 | 0.78 | 0.95 | 0.34 | 0.39 | 0.67 | 0.099 | 1.1 | 0.019 | 0.56 | <0.01 | 0.26 | 1.1 | - | 1.2 | 1.2 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_22_0.8-1.0 | LF_TP_22 | 0.8-1 | 2/11/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_23_0.1-0.3 | LF_TP_23 | 0.1-0.3 | 2/11/2022 | TP | Normal | 0.15 | <0.022 | 0.34 | 3.4 | 4.1 | 6 | 1.9 | 2.2 | 4.3 | 0.53 | 5.2 | 0.079 | 3.1 | <0.022 | 1.4 | 5 | - | 6.2 | 6.2 | <0.022 | - | - | - | <0.022 | - |
| LF_TP_23_0.7-1.1 | LF_TP_23 | 0.7-1.1 | 2/11/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | 0.02 | 0.026 | <0.01 | <0.02 | 0.012 | <0.01 | <0.02 | <0.01 | 0.014 | <0.01 | <0.01 | 0.024 | - | 0.02 | 0.04 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_24_0.3-0.4 | LF_TP_24 | 0.3-0.4 | 2/11/2022 | TP | Normal | 0.2 | <0.01 | 0.35 | 3.6 | 4.3 | 6.2 | 2.1 | 2.7 | 4.2 | 0.7 | 5.5 | 0.11 | 3.5 | 0.019 | 1.4 | 5.2 | - | 6.7 | 6.7 | 0.019 | - | - | - | <0.01 | - |
| LF_TP_24_1.4-1.6 | LF_TP_24 | 1.4-1.6 | 2/11/2022 | TP | Normal | 0.063 | <0.01 | 0.11 | 1.1 | 0.74 | 1.3 | 0.4 | 0.28 | 1.4 | 0.11 | 1.8 | 0.028 | 0.43 | 0.031 | 0.57 | 1.6 | - | 1.2 | 1.2 | 0.022 | - | - | - | 0.013 | - |
| LF_TP_25_1.0-1.2 | LF_TP_25 | 1-1.2 | 1/11/2022 | TP | Normal | 0.34 | 0.013 | 0.99 | 7.7 | 20 | 14 | 8.9 | 4.2 | 23 | 1.4 | 16 | 0.22 | 13 | 0.021 | 4 | 15 | 128.8 | 27 | 27 | 0.02 | - | - | - | 0.013 | - |
| LF_soil_DUP_9 | LF_TP_25 | 1-1.2 | 1/11/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_26_0.2-0.3 | LF_TP_26 | 0.2-0.3 | 27/10/2022 | TP | Normal | 0.14 | <0.01 | 0.2 | 2 | 1.8 | 3.4 | 1.4 | 1.1 | 2.4 | 0.36 | 2 | 0.088 | 1.4 | <0.01 | 0.72 | 1.8 | - | 3 | 3 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_26_1.8-2.0 | LF_TP_26 | 1.8-2 | 27/10/2022 | TP | Normal | 0.03 | <0.01 | 0.078 | 0.91 | 1.1 | 1.7 | 0.77 | 0.64 | 1.3 | 0.18 | 1 | 0.017 | 0.8 | <0.01 | 0.27 | 1 | - | 1.7 | 1.7 | <0.01 | - | - | - | <0.01 | - |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial
MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)
NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health
NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs
USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020
CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values

| | | | | | | PAHs | | | | | | | | | | | | | | | | | | | PAHs - extended | | | | SVOCs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | PAHs (Sum of total) - Lab calc | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | Benzo(e)pyrene | Perylene | Benzo(b)fluoranthene | 1-Methylnaphthalene | Dibenzofuran |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | | 0.01 | 0.03 | 0.01 | | | 0.1 | 0.01 | 0.3 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | | | 300 | | | | | | | | |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | | | | | | | | | | | | | 4000 | | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | 160 | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | 7.2/70 | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | 190/230' | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | | | 40 | 40 | | | | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | | | | | | 35 | 35 | | | | | | |
| CCME Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | |
| LF_TP_27_0.2-0.3 | LF_TP_27 | 0.2-0.3 | 27/10/2022 | TP | Normal | 0.15 | <0.01 | 0.28 | 3.4 | 3.1 | 6.5 | 2.4 | 2 | 4.6 | 0.68 | 2.7 | 0.056 | 2.3 | 0.02 | 0.85 | 2.5 | - | 5.3 | 5.3 | 0.014 | - | - | - | <0.01 | - |
| LF_TP_27_1.8-2.0 | LF_TP_27 | 1.8-2 | 27/10/2022 | TP | Normal | 0.058 | <0.01 | 0.15 | 2.5 | 2.4 | 4.7 | 1.7 | 1.4 | 3.5 | 0.47 | 2.2 | 0.027 | 1.7 | <0.01 | 0.52 | 2.1 | - | 4 | 4 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_28_0.2-0.3 | LF_TP_28 | 0.2-0.3 | 27/10/2022 | TP | Normal | 2.2 | 0.015 | 8.2 | 60 | 100 | 100 | 44 | 61 | 110 | 3.2 | 80 | 1.8 | 67 | 0.21 | 37 | 75 | 749.6 | 130 | 130 | 0.11 | - | - | - | 0.074 | - |
| LF_TP_28_1.3-1.5 | LF_TP_28 | 1.3-1.5 | 27/10/2022 | TP | Normal | 1.8 | 0.017 | 7.1 | 32 | 58 | 63 | 30 | 35 | 66 | 2.9 | 53 | 1.7 | 39 | 0.11 | 17 | 48 | 454.6 | 78 | 78 | 0.074 | - | - | - | 0.059 | - |
| LF_TP_29_0.2-0.3 | LF_TP_29 | 0.2-0.3 | 27/10/2022 | TP | Normal | 0.53 | <0.01 | 1 | 10 | 23 | 20 | 10 | 14 | 23 | 1.7 | 13 | 0.27 | 15 | 0.078 | 4.1 | 13 | - | 31 | 31 | 0.036 | - | - | - | 0.022 | - |
| LF_soil_DUP_1 | LF_TP_29 | 0.2-0.3 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_29_1.0-1.1 | LF_TP_29 | 1-1.1 | 27/10/2022 | TP | Normal | 3.5 | 0.037 | 7.8 | 140 | 140 | 220 | 96 | 71 | 170 | 24 | 100 | 1.6 | 96 | 0.19 | 17 | 100 | 1187 | 220 | 220 | 0.22 | - | - | - | 0.17 | - |
| LF_TP_30_0.2-0.3 | LF_TP_30 | 0.2-0.3 | 27/10/2022 | TP | Normal | 0.11 | 0.013 | 0.57 | 9.6 | 18 | 27 | 10 | 11 | 40 | 1.4 | 15 | 0.068 | 4.1 | 0.017 | 2 | 14 | 152.9 | 25 | 25 | 0.01 | - | - | - | <0.01 | - |
| LF_TP_30_1.0-1.1 | LF_TP_30 | 1-1.1 | 27/10/2022 | TP | Normal | 0.23 | 0.038 | 1.5 | 45 | 45 | 110 | 38 | 29 | 140 | 3.4 | 58 | 0.13 | 31 | 0.024 | 7.3 | 50 | 558.6 | 73 | 73 | 0.017 | - | - | - | 0.013 | - |
| LF_TP_31_0.1-0.2 | LF_TP_31 | 0.1-0.2 | 2/11/2022 | TP | Normal | 0.067 | <0.01 | 0.17 | 1.6 | 1.9 | 3.1 | 0.92 | 1.1 | 2 | 0.32 | 2.2 | 0.064 | 1.5 | 0.023 | 0.8 | 2.2 | - | 3 | 3 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_31_0.7-1.0 | LF_TP_31 | 0.7-1 | 2/11/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | 0.014 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_32_0.2-0.3 | LF_TP_32 | 0.2-0.3 | 27/10/2022 | TP | Normal | 0.051 | <0.01 | 0.13 | 1.1 | 1.2 | 2 | 0.81 | 0.7 | 1.6 | 0.2 | 1.3 | 0.032 | 0.85 | 0.012 | 0.46 | 1.3 | - | 1.9 | 1.9 | 0.017 | - | - | - | <0.01 | - |
| LF_soil_DUP_4 | LF_TP_32 | 0.2-0.3 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_32_1.8-2.0 | LF_TP_32 | 1.8-2 | 27/10/2022 | TP | Normal | 0.02 | <0.01 | 0.05 | 0.57 | 0.65 | 1.3 | 0.51 | 0.4 | 1.1 | 0.12 | 0.49 | 0.012 | 0.47 | <0.01 | 0.14 | 0.54 | - | 1.1 | 1.1 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_33_0.2-0.3 | LF_TP_33 | 0.2-0.3 | 28/10/2022 | TP | Normal | 0.048 | <0.01 | 0.17 | 1.6 | 1.8 | 2.4 | 1.1 | 1.1 | 1.8 | 0.25 | 1.8 | 0.026 | 1.3 | <0.01 | 0.55 | 1.8 | - | 2.7 | 2.7 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_33_1.8-2.0 | LF_TP_33 | 1.8-2 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_soil_DUP_7 | LF_TP_33 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_34_0.2-0.3 | LF_TP_34 | 0.2-0.3 | 3/11/2022 | TP | Normal | 0.017 | <0.01 | 0.063 | 0.49 | 0.65 | 0.77 | 0.25 | 0.36 | 0.49 | 0.076 | 0.87 | <0.01 | 0.47 | <0.01 | 0.2 | 0.89 | - | 0.94 | 0.94 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_34_1.8-2.0 | LF_TP_34 | 1.8-2 | 3/11/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_35_0.3-0.4 | LF_TP_35 | 0.3-0.4 | 27/10/2022 | TP | Normal | 0.012 | <0.01 | 0.033 | 0.45 | 0.68 | 0.95 | 0.46 | 0.46 | 0.7 | 0.096 | 0.48 | <0.01 | 0.55 | <0.01 | 0.098 | 0.5 | - | 1 | 1 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_35_1.5-1.6 | LF_TP_35 | 1.5-1.6 | 27/10/2022 | TP | Normal | 1.6 | 0.015 | 2.9 | 5.4 | 3.5 | 7.6 | 2.8 | 2.3 | 7.9 | 0.65 | 10 | 1.8 | 2.8 | 0.75 | 11 | 8.7 | 69.72 | 6.2 | 6.2 | 0.29 | - | - | - | 0.19 | - |
| LF_soil_DUP_3 | LF_TP_35 | 1.5-1.6 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_35_2.0-2.2 | LF_TP_35 | 2-2.2 | 31/10/2022 | TP | Normal | 1.1 | 6.6 | 2.8 | 2.9 | 2.1 | 3.5 | 3.4 | 1.2 | 3.1 | 0.36 | 3.8 | 4.5 | 1.4 | 14 | 9.9 | 4.2 | 64.86 | 3.6 | 3.6 | 18 | - | - | - | 12 | - |
| LF_TP_36_0.2-0.3 | LF_TP_36 | 0.2-0.3 | 27/10/2022 | TP | Normal | 0.063 | <0.01 | 0.31 | 3.6 | 3.1 | 6.2 | 2.5 | 2.1 | 4.1 | 0.61 | 3.2 | 0.024 | 2.6 | <0.01 | 1.2 | 3.2 | - | 5.3 | 5.3 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_36_1.8-2.0 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Normal | 7 | 12 | 12 | 39 | 53 | 73 | 33 | 36 | 59 | 6.8 | 63 | 16 | 42 | 130 | 45 | 70 | 696.8 | 80 | 80 | 120 | - | - | - | 78 | - |
| LF_soil_DUP_2 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_37_0.2-0.3 | LF_TP_37 | 0.2-0.3 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_37_2.0-2.2 | LF_TP_37 | 2-2.2 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_38_0.2-0.3 | LF_TP_38 | 0.2-0.3 | 28/10/2022 | TP | Normal | 0.019 | <0.01 | 0.045 | 0.27 | 0.42 | 0.43 | 0.23 | 0.24 | 0.41 | 0.045 | 0.42 | <0.01 | 0.29 | <0.01 | 0.11 | 0.44 | - | 0.59 | 0.59 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_38_0.8-1.0 | LF_TP_38 | 0.8-1 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_39_0.2-0.3 | LF_TP_39 | 0.2-0.3 | 3/11/2022 | TP | Normal | <0.01 | <0.01 | 0.034 | 0.28 | 0.42 | 0.53 | 0.18 | 0.31 | 0.31 | 0.05 | 0.49 | <0.01 | 0.41 | <0.01 | 0.12 | 0.51 | - | 0.62 | 0.62 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_40_1.8-2.0 | LF_TP_40 | 1.8-2 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_soil_DUP_5 | LF_TP_40 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_40_1.0-1.2 | LF_TP_40 | 1-1.2 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | 0.036 | 0.39 | 0.59 | 0.63 | 0.34 | 0.35 | 0.56 | 0.059 | 0.63 | <0.01 | 0.39 | <0.01 | 0.093 | 0.66 | - | 0.83 | 0.83 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_41_1.0-1.2 | LF_TP_41 | 1-1.2 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_41_2.2-2.3 | LF_TP_41 | 2.2-2.3 | 28/10/2022 | TP | Normal | <0.01 | 0.015 | 0.014 | 0.079 | <0.01 | <0.02 | <0.01 | 0.08 | 0.11 | <0.01 | <0.02 | <0.01 | 0.094 | <0.01 | <0.01 | <0.02 | - | 0.02 | 0.04 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_42_0.1-0.3 | LF_TP_42 | 0.1-0.3 | 3/11/2022 | TP | Normal | 0.055 | <0.01 | 0.11 | 1.3 | 1.6 | 2.3 | 0.71 | 0.84 | 1.5 | 0.23 | 1.7 | 0.03 | 1.1 | <0.01 | 0.48 | 1.6 | - | 2.4 | 2.4 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_42_0.7-1.0 | LF_TP_42 | 0.7-1 | 3/11/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_43_0.2-0.3 | LF_TP_43 | 0.2-0.3 | 3/11/2022 | TP | Normal | <0.01 | <0.01 | 0.012 | 0.097 | 0.13 | 0.15 | 0.05 | 0.073 | 0.11 | 0.014 | 0.19 | <0.01 | 0.096 | <0.01 | 0.043 | 0.19 | - | 0.18 | 0.18 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_43_0.8-1.0 | LF_TP_43 | 0.8-1 | 3/11/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_44_0.2-0.3 | LF_TP_44 | 0.2-0.3 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_44_1.0-1.2 | LF_TP_44 | 1-1.2 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_45_0.2-0.3 | LF_TP_45 | 0.2-0.3 | 3/11/2022 | TP | Normal | 0.02 | <0.01 | 0.077 | 0.61 | 0.78 | 0.92 | 0.32 | 0.46 | 0.64 | 0.084 | 1.1 | 0.011 | 0.59 | <0.01 | 0.26 | 1.1 | - | 1.1 | 1.1 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_45_1.7-2.0 | LF_TP_45 | 1.7-2 | 3/11/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_46_0.2-0.3 | LF_TP_46 | 0.2-0.3 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | 0.045 | 0.094 | 0.077 | 0.038 | 0.047 | 0.084 | <0.01 | 0.077 | <0.01 | 0.051 | <0.01 | 0.02 | 0.08 | - | 0.12 | 0.13 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_46_1.8-2.0 | LF_TP_46 | 1.8-2 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_soil_DUP_6 | LF_TP_46 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_47_0.2-0.3 | LF_TP_47 | 0.2-0.3 | 28/10/2022 | TP | Normal | 0.24 | <0.01 | 0.76 | 6.7 | 590 | 1200 | 4.2 | 440 | 650 | 1.4 | 640 | 0.11 | 510 | 0.021 | 2.9 | 620 | - | 780 | 780 | 0.013 | - | - | - | <0.01 | - |
| LF_TP_47_1.8-2.0 | LF_TP_47 | 1.8-2 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_48_0.2-0.3 | LF_TP_48 | 0.2-0.3 | 28/10/2022 | TP | Normal | <0.01 | 0.063 | 0.075 | 0.61 | 1.6 | 1.8 | 1.9 | 1.2 | 1.5 | 0.23 | 0.54 | 0.023 | 1.5 | <0.01 | 0.23 | 1.1 | - | 2.4 | 2.4 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_48_1.0-1.2 | LF_TP_48 | 1-1.2 | 28/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | 0.022 | 0.036 | 0.014 | <0.02 | 0.033 | <0.01 | <0.02 | <0.01 | 0.018 | <0.01 | <0.01 | 0.031 | - | 0.03 | 0.04 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_49_1.4-1.5 | LF_TP_49 | 1.4-1.5 | 31/10/2022 | TP | Normal | 0.37 | 0.15 | 0.86 | 4.9 | 3.6 | 5.9 | 5.3 | 2.2 | 7.6 | 0.66 | 4.1 | 0.97 | 2.7 | 1.2 | 4.4 | 3.9 | 48.81 | 6.2 | 6.2 | 2.9 | - | - | - | 1.9 | - |
| LF_TP_49_2.3-2.7 | LF_TP_49 | 2.3-2.7 | 31/10/2022 | TP | Normal | 0.13 | 0.44 | 0.37 | 0.26 | 0.23 | 0.26 | 0.14 | 0.1 | 0.36 | 0.025 | 0.52 | 0.73 | 0.13 | 0.76 | 1.3 | 0.66 | 6.415 | 0.35 | 0.35 | 1.3 | - | - | - | 0.96 | - |
| LF_TP_50_1.4-1.6 | LF_TP_50 | 1.4-1.6 | 31/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | 0.061 | 0.1 | 0.18 | 0.077 | 0.078 | 0.16 | 0.016 | 0.066 | <0.01 | 0.083 | <0.01 | 0.013 | 0.068 | - | 0.16 | 0.16 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_50_3.0-3.5 | LF_TP_50 | 3-3.5 | 31/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_51_0.9-1.0 | LF_TP_51 | 0.9-1 | 31/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_51_2.7-3.0 | LF_TP_51 | 2.7-3 | 31/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_52_1.8-2.0 | LF_TP_52 | 1.8-2 | 31/10/2022 | TP | Normal | 0.63 | 1.5 | 1.4 | 2.8 | 2.1 | 3.4 | 3.2 | 1.4 | 3.5 | 0.38 | 3.2 | 2.4 | 1.7 | 1.9 | 7.9 | 3.4 | 40.81 | 3.7 | 3.7 | 5.7 | - | - | - | 5 | - |
| LF_TP_52_2.7-3.0 | LF_TP_52 | 2.7-3 | 31/10/2022 | TP | Normal | 0.58 | 0.95 | 1.1 | 2.3 | 2.2 | 2.8 | 2.8 | 1.3 | 3 | <0.36 | 2.9 | 2.4 | 1.6 | 3.2 | 9 | 3.1 | - | 3.2 | 3.5 | 7.4 | - | - | - | 5.8 | - |
| LF_TP_53_1.4-1.5 | LF_TP_53 | 1.4-1.5 | 31/10/2022 | TP | Normal | 0.91 | 3 | 2 | 3.9 | 4.9 | 4.5 | 4 | 2.7 | 7.2 | 0.55 | 3.4 | 2.8 | 3.2 | 7.2 | 8.1 | 3.8 | 62.16 | 7.1 | 7.1 | 9.8 | - | - | - | 7.4 | - |
| LF_TP_53_2.0-2.2 | LF_TP_53 | 2-2.2 | 31/10/2022 | TP | Normal | 0.02 | 0.024 | 0.019 | 0.031 | 0.038 | 0.051 | 0.025 | 0.022 | 0.048 | <0.01 | 0.06 | 0.036 | 0.027 | 0.21 | 0.066 | 0.075 | - | 0.05 | 0.06 | 0.12 | - | - | - | 0.1 | - |
| LF_TP_54_1.8-2.0 | LF_TP_54 | 1.8-2 | 31/10/2022 | TP | Normal | 0.011 | <0.01 | 0.03 | 0.28 | 0.4 | 0.54 | 0.25 | 0.29 | 0.42 | 0.062 | 0.36 | <0.01 | 0.31 | <0.01 | 0.089 | 0.37 | - | 0.61 | 0.61 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_54_2.7-3.0 | LF_TP_54 | 2.7-3 | 31/10/2022 | TP | Normal | 0.078 | 0.021 | 0.33 | 1.8 | 2 | 2.7 | 1.3 | 1.3 | 2 | 0.26 | 2.1 | 0.067 | 1.5 | 0.068 | 1 | 2.1 | 18.62 | 3.1 | 3.1 | 0.044 | - | - | - | 0.035 | - |
| LF_TP_55_0.6-0.7 | LF_TP_55 | 0.6-0.7 | 31/10/2022 | TP | Normal | 0.081 | 0.021 | 0.23 | 1.4 | 1.5 | 2 | 2.1 | 0.95 | 1.7 | 0.19 | 1.7 | 0.14 | 1.2 | 0.035 | 0.91 | 1.7 | 15.86 | 2.4 | 2.4 | 0.14 | - | - | - | 0.1 | - |
| LF_TP_55_1.0-1.4 | LF_TP_55 | 1-1.4 | 31/10/2022 | TP | Normal | 0.025 | 0.018 | 0.017 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | 0.024 | <0.01 | 0.03 | 0.047 | <0.01 | <0.01 | 0.072 | 0.044 | - | <0.01 | 0.03 | <0.01 | - | - | - | 0.037 | - |
| LF_TP_56_2.3-2.5 | LF_TP_56 | 2.3-2.5 | 31/10/2022 | TP | Normal | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | 0.044 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_56_3.2-3.5 | LF_TP_56 | 3.2-3.5 | 31/10/2022 | TP | Normal | 0.07 | 0.052 | 0.032 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | 0.099 | <0.01 | 0.084 | 0.092 | <0.02 | - | <0.01 | 0.03 | 0.4 | - | - | - | 0.34 | - |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial
MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)
NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health
NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs
USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020
CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

## Appendix C
## Table C1
## NZAS Landfill Soil Human Health Screening Values

| | | | | | | SVOCs | | MAH | PCBs | | | | | | | | | | | | | | | Chlorinated Hydrocarbons | | | Phthalates | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 1-Methylnaphthalene | Dibenzofuran | 1,2,4-trimethylbenzene | PCB-121 | PCB-149 | PCB-18 | PCB-31 | PCB-44 | PCB-49 | PCB-66 2,3',4,4'-Tetrachlorobiphenyl | PCB-86 | PCB-101 | PCB-118 | PCB-138 | PCB-153 | PCB-28 | PCB-52 | cis-1,2-dichloroethene | Methylene chloride | Vinyl chloride | Bis(2-ethylhexyl) phthalate | Di-n-octyl phthalate |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.01 | 0.3 | 0.05 | 0.003 | 0.003 | 0.006 | 0.003 | 0.003 | 0.003 | 0.003 | 0.005 | 0.003 | 0.003 | 0.005 | 0.003 | 0.003 | 0.003 | 0.05 | 0.2 | 0.1 | 0.5 | 0.5 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | 10 | | | | | | | | | | | | | | | | | | | |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | 80 | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | |
| TP1 0.2 | LF_TP_1 | 0.2 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.05 | <0.2 | <0.1 | 0.79 | <0.5 |
| TP1 2.0 | LF_TP_1 | 2 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.05 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP1 3.0 | LF_TP_1 | 3 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.05 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP2 0.3 | LF_TP_2 | 0.3 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.05 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP2 0.8 | LF_TP_2 | 0.8 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.05 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP2 2.0 | LF_TP_2 | 2 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | 0.0066 | 0.0074 | <0.006 | <0.003 | 0.0031 | <0.003 | <0.003 | 0.006 | 0.017 | 0.0074 | 0.014 | 0.0093 | <0.003 | 0.006 | <0.05 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP3 0.25 | LF_TP_3 | 0.25 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.05 | <0.2 | <0.1 | 0.55 | <0.5 |
| TP3 0.65 | LF_TP_3 | 0.65 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | <0.003 | 0.0032 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.005 | 0.005 | <0.003 | 0.0059 | 0.0036 | <0.003 | <0.003 | <0.05 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP3 1.4 | LF_TP_3 | 1.4 | 7/06/2022 | TP | Normal | - | 0.36 | <0.05 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.05 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP3 3.8 | LF_TP_3 | 3.8 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | <0.003 | <0.003 | 0.013 | 0.011 | 0.0086 | 0.0072 | 0.0077 | <0.005 | 0.0033 | <0.003 | <0.005 | <0.003 | 0.012 | 0.0076 | <0.05 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP4 0.2 | LF_TP_4 | 0.2 | 7/06/2022 | TP | Normal | - | <0.3 | <0.05 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.05 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP4 0.5 | LF_TP_4 | 0.5 | 7/06/2022 | TP | Normal | - | <0.3 | 0.21 | <0.003 | <0.003 | <0.006 | 0.0052 | 0.0063 | 0.004 | 0.0065 | <0.005 | 0.0053 | 0.0036 | 0.0055 | 0.0032 | 0.0055 | 0.0056 | 0.074 | <0.2 | <0.1 | <0.5 | <0.5 |
| TP4 3.5 | LF_TP_4 | 3.5 | 7/06/2022 | TP | Normal | - | 1.1 | 0.076 | <0.003 | <0.003 | 0.011 | 0.0075 | 0.0043 | 0.0042 | 0.0049 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | 0.0054 | 0.0033 | 0.13 | <0.2 | <0.1 | <0.5 | <0.5 |
| LF_TP_35_2.0-2.2 | LF_TP_35 | 2-2.2 | 31/10/2022 | TP | Normal | 12 | - | - | <0.003 | <0.003 | <0.006 | - | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | - | <0.003 | - | - | - | - | - |
| LF_TP_36_1.8-2.0 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Normal | 78 | - | - | 0.0076 | 0.025 | 0.0077 | - | 0.01 | 0.0056 | 0.0069 | 0.0067 | 0.025 | <0.003 | 0.051 | 0.033 | - | 0.0077 | - | - | - | - | - |
| LF_TP_48_1.0-1.2 | LF_TP_48 | 1-1.2 | 28/10/2022 | TP | Normal | <0.01 | - | - | <0.003 | <0.003 | <0.006 | - | <0.003 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | - | <0.003 | - | - | - | - | - |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial
MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)
NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health
NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs
USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020
CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

## Appendix C
## Table C2
## NZAS Landfill Sediment Human Health Screening Values

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | | | | | Nutrients | | | Organic Indicators |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Calcium | Magnesium | Potassium | Sodium | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Total Organic Carbon |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | % |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 12.5 | 5 | 5 | 125 | 3 | 3 | 5 | 2.4 | 1 | 0.1 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | 780 | 2000 | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | >10000 | >10000 | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | | | |
| CCME Recreational | | | | | | 400 | | | | | | | | | | | | | | |
| CCME Industrial | | | | | | 2000 | | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | <6 | | | | | | | | | | | | |
| CCME pH High | | | | | | | | >8 | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | |
| LF_Sed_1 | LF_SED_1 | 0.1 | 4/11/2022 | SD | Normal | 8300 | 26 | 7.5 | <0.2 | 2.42 | - | - | - | - | 53.2 | 11.9 | <5 | <2.6 | <1 | 15.5 |
| LF_Sed_1 | LF_SED_1 | 0.3 | 4/11/2022 | SD | Normal | 17,000 | 25 | 6.4 | <0.2 | 18.9 | - | - | - | - | 39.4 | 14.8 | 10.7 | <2.6 | <1 | 23.6 |
| LF_Sed_2 | LF_SED_2 | 0.1 | 4/11/2022 | SD | Normal | 6700 | 44 | 7.2 | <0.2 | 32.3 | - | - | - | - | 169.3 | 69.9 | 16.8 | <2.6 | 5.56 | 17.5 |
| LF_Sed_2 | LF_SED_2 | 0.3 | 4/11/2022 | SD | Normal | 22,000 | 41 | 6.9 | <0.2 | 4.61 | - | - | - | - | 200.6 | 155.7 | 39.2 | <2.6 | <1 | 33.9 |
| LF_Sed_3 | LF_SED_3 | 0.1 | 4/11/2022 | SD | Normal | 6400 | 40 | 8.5 | <0.2 | 2.03 | - | - | - | - | 73.8 | 12.8 | <5 | <2.6 | <1 | 11.4 |
| LF_Sed_3 | LF_SED_3 | 0.3 | 4/11/2022 | SD | Normal | 22,000 | 59 | 7.7 | <0.2 | 6.01 | - | - | - | - | 108.9 | 14.9 | 30.9 | <2.6 | <1 | 29 |
| LF_Sed_4 | LF_SED_4 | 0.1 | 4/11/2022 | SD | Normal | 2800 | 27 | 7 | <0.2 | <0.3 | - | - | - | - | 44.5 | 6.3 | 11.4 | <2.6 | <1 | 1.5 |
| LF_Sed_4 | LF_SED_4 | 0.3 | 4/11/2022 | SD | Normal | 600 | 19 | 6.9 | <0.2 | <0.3 | - | - | - | - | 23.4 | 3.6 | 15.9 | <2.6 | <1 | 0.3 |
| LF_Sed_5 | LF_SED_5 | 0.1 | 4/11/2022 | SD | Normal | 3300 | 89 - 93 | 5.8 | <0.2 | <1.9 | - | - | - | - | 1396 | 621.1 | 36.4 | <2.7 | <1 | 41 |
| LF_Sed_5 | LF_SED_5 | 0.3 | 4/11/2022 | SD | Normal | 1400 | 92 | 6 | <0.2 | 16.6 | - | - | - | - | 1717.7 | 281.4 | 34.1 | <2.5 | 1.52 | 49.1 |
| LF_Sed_6 | LF_SED_6 | 0.1 | 4/11/2022 | SD | Normal | 8100 | 88 | 6.2 | <0.2 | 35.7 | - | - | - | - | 557.2 | 28.9 | 14.5 | <2.6 | <1 | 23.9 |
| LF_Sed_6 | LF_SED_6 | 0.3 | 4/11/2022 | SD | Normal | 530 | 44 | 6.1 | <0.2 | <0.3 | - | - | - | - | 87.6 | <3.2 | <5 | <2.6 | <1 | 4.7 |
| LF_Sed_7 | LF_SED_7 | 0.1 | 4/11/2022 | SD | Normal | 530 | 89 | 3.6 | <0.2 | 18.5 | - | - | - | - | 624.3 | 66.7 | 13.2 | <2.6 | <1 | 50.4 |
| LF_Sed_7 | LF_SED_7 | 0.3 | 4/11/2022 | SD | Normal | 620 | 90 | 3.6 | <0.2 | 30 | - | - | - | - | 937.6 | 100.4 | 19.6 | <2.5 | <1 | 51.1 |
| LF_Sed_8 | LF_SED_8 | 0.1 | 4/11/2022 | SD | Normal | 580 | 85 | 4 | <0.2 | 8.44 | - | - | - | - | 1140.8 | 70 | 49.7 | <2.6 | <1 | 33 |
| LF_Sed_8 | LF_SED_8 | 0.3 | 4/11/2022 | SD | Normal | 250 | 56 | 4.3 | <0.2 | 2.57 | - | - | - | - | 237 | 17.7 | 6.7 | <2.6 | <1 | 5.4 |
| LF_Sed_9 | LF_SED_9 | 0.1 | 4/11/2022 | SD | Normal | 17,000 | 27 | 5.9 | <0.2 | <0.3 | - | - | - | - | 11 | 37.8 | <5 | <2.6 | <1 | 37.9 |
| LF_Sed_9 | LF_SED_9 | 0.3 | 4/11/2022 | SD | Normal | 3000 | 30 | 5.4 | <0.2 | <0.3 | - | - | - | - | <3.1 | 8.4 | <5 | <2.6 | <1 | 4.8 |
| LF_Sed_10 | LF_SED_10 | 0.1 | 4/11/2022 | SD | Normal | 19,000 | 35 | 6.1 | <0.2 | <0.3 | - | - | - | - | 19.2 | 37.8 | <5 | <2.6 | <1 | 43.9 |
| LF_Sed_10 | LF_SED_10 | 0.3 | 4/11/2022 | SD | Normal | 24,000 | 38 | 6.4 | <0.2 | <0.3 | - | - | - | - | 28.9 | 44.6 | <5 | <2.7 | <1 | 43.5 |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | 610 | 69 | 5.3 | <0.2 | 18.7 | - | - | - | - | 87.7 | 58.5 | 10.8 | <2.6 | <1 | 7.4 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | 230 | 27 | 5.5 | <0.2 | <0.3 | - | - | - | - | 30.6 | 20.7 | <5 | <2.5 | <1 | 1.3 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | 1800 | 91 | 4.7 | <0.2 | 54.8 | - | - | - | - | 522.6 | 2741.1 | 45.5 | <26 | <1 | 45.4 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | 500 | 31 | 5.6 | <0.03 | <0.3 | - | - | - | - | 37.9 | 270.6 | 8.23 | <2.6 | <1 | 0.77 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SED13 | LF_SED_13 | 0-0.2 | 5/12/2022 | SD | Normal | 440 | 51 | 5.5 | <0.2 | 1.1 | 1100 | 290 | 200 | 560 | 70.3 | <3.2 | <5 | <2.6 | <1 | 7.8 |
| LF_SED14 | LF_SED_14 | 0-0.2 | 5/12/2022 | SD | Normal | 1100 | 91 | 6.7 | <0.2 | 5.76 | 7760 | 4860 | 1380 | 7400 | 1117.4 | 23.5 | 8.83 | <2.7 | 3.85 | 45.9 |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | 2700 | 94 | 6.2 | <0.2 | 9.66 | 12,800 | 2690 | 966 | 2900 | 878.3 | 227.7 | 23.5 | <2.7 | <1 | 28.2 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | 490 | 92 | 5.6 | <0.2 | 4.28 | 2490 | 1710 | 330 | 2200 | 1168.8 | 21.5 | 25.4 | <2.7 | <1 | 25.7 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 5600 | 18 | 6.2 | <0.2 | <0.2 | 2490 | 1640 | 280 | 500 | 44 | 8.5 | <5 | 5.61 | <1 | 0.44 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 1600 | 37 | 7.5 | <0.2 | 9.16 | 6260 | 6680 | 340 | 6800 | 160.3 | 20.7 | 29.8 | <2.6 | <1 | 18.8 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 1000 | 53 | 5.9 | <0.2 | 5.67 | 2520 | 1810 | 170 | <270 | 30.3 | 24 | <5 | <2.6 | <1 | 6.6 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 140 | 13 | 5.3 | <0.2 | 1.6 | 3040 | 1770 | 250 | 150 | 45.8 | 13 | <5 | <2.5 | <1 | 1.7 |
| LF_SED21 | LF_SED_21 | 0-0.1 | 30/11/2022 | SD | Normal | 7800 | 86 | 5 | <0.2 | 5.72 | 6790 | 1430 | 621 | 15,400 | 31.5 | 816.9 | 163 | <2.4 | <1 | 43.5 |
| LF_SED22 | LF_SED_22 | 0-0.2 | 5/12/2022 | SD | Normal | 500 | 71 | 4.4 | <0.2 | <0.7 | 3780 | 1490 | 250 | 1900 | 548.5 | 284.9 | 29 | <2.6 | <1 | 16.8 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs calculated as per MfE's Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (2011)

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
## Table C2
## NZAS Landfill Sediment Human Health Screening Values

| | | | | | | Metals | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Aluminium | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Iron | Lead | Lithium | Manganese | Mercury | Molybdenum | Nickel | Titanium | Tin | Vanadium | Zinc |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 2.5 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.5 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.125 | 0.025 | 0.125 | 0.05 | 0.075 | 0.25 | 0.125 | 0.05 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | 90 | | | | 300 | | 300 | | | | | 19000 | | | 1200 | | | | 30000 |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | 500 | | | | 3600 | | 4000 | | | | | 60000 | | | 6000 | | | | 400000 |
| MfE Petroleum - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | 80 | | | >10,000 | 400 | 2700 | | | | >10,000 | | 880 | | | 1800 | | | | | | |
| NES Commercial / Industrial | | | | | | | 70 | | | >10,000 | 1300 | 6300 | | | | >10,000 | | 3300 | | | 4200 | | | | | | |
| CCME Recreational | | | | | | | | 500 | | | | | | | | | | | | | | | | | | 130 | |
| CCME Industrial | | | | | | | | 2000 | | | | | | | | | | | | | | | | | | 130 | |
| CCME pH Low | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | 77,000 | | | | | | | | | | | 55,000 | | 160 | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | 1,100,000 | | | | | | | | | | | 820,000 | | 2300 | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | 7700 | | | | | | | | | | | 5500 | | 16 | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | 110,000 | | | | | | | | | | | 82,000 | | 230 | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | |
| LF_Sed_1 | LF_SED_1 | 0.1 | 4/11/2022 | SD | Normal | 146,000 | 6.1 | 33 | 0.95 | 13 | 0.24 | 20.9 | - | - | 6.29 | 31.1 | 11,500 | 23 | 6.1 | - | <0.025 | - | 119 | 165 | - | 59.8 | 362 |
| LF_Sed_1 | LF_SED_1 | 0.3 | 4/11/2022 | SD | Normal | 105,000 | 11 | 29 | 0.94 | 9.2 | 0.543 | 27.6 | - | - | 8.69 | 32.9 | 13,600 | 22 | 8.94 | - | 0.052 | - | 165 | 243 | - | 81.7 | 222 |
| LF_Sed_2 | LF_SED_2 | 0.1 | 4/11/2022 | SD | Normal | 168,000 | 8 | 43.5 | 1.1 | 33 | 0.46 | 27.7 | - | - | 7.06 | 57.4 | 12,400 | 26 | 9.18 | - | <0.025 | - | 158 | 305 | - | 132 | 387 |
| LF_Sed_2 | LF_SED_2 | 0.3 | 4/11/2022 | SD | Normal | 120,000 | 37.7 | 43.8 | 1.64 | 20 | 3.69 | 42.2 | - | - | 9.71 | 43.1 | 16,600 | 54.5 | 9.71 | - | 0.15 | - | 327 | 327 | - | 257 | 276 |
| LF_Sed_3 | LF_SED_3 | 0.1 | 4/11/2022 | SD | Normal | 165,000 | 3.5 | 32.7 | 0.76 | 20 | 0.16 | 18.3 | - | - | 3.73 | 27.7 | 7340 | 13.6 | 7.42 | - | <0.025 | - | 99.1 | 156 | - | 60.4 | 170 |
| LF_Sed_3 | LF_SED_3 | 0.3 | 4/11/2022 | SD | Normal | 121,000 | 26.7 | 50.4 | 1.75 | 49 | 5.02 | 50.3 | - | - | 14.9 | 47.8 | 22,500 | 47 | 14.7 | - | 0.28 | - | 287 | 516 | - | 341 | 338 |
| LF_Sed_4 | LF_SED_4 | 0.1 | 4/11/2022 | SD | Normal | 10,300 | 7.8 | 7.83 | 0.23 | 21 | 0.032 | 6.7 | - | - | 1.4 | 2.2 | 8020 | 3.2 | 8.15 | - | <0.025 | - | 4.3 | 411 | - | 161 | 13.3 |
| LF_Sed_4 | LF_SED_4 | 0.3 | 4/11/2022 | SD | Normal | 4960 | 11 | 4.08 | 0.17 | 7.3 | 0.041 | 6.5 | - | - | 1.9 | 1.7 | 12,100 | 2 | 5.36 | - | <0.025 | - | 3 | 386 | - | 142 | 9.73 |
| LF_Sed_5 | LF_SED_5 | 0.1 | 4/11/2022 | SD | Normal | 4470 | 3.4 | 37.5 | 0.3 | 168 | 0.11 | 3.7 | - | - | 0.92 | 3.5 | 18,900 | 8.86 | 2.2 | - | <0.23 | - | 5.54 | 80.4 | - | 39.6 | 13.5 |
| LF_Sed_5 | LF_SED_5 | 0.3 | 4/11/2022 | SD | Normal | 2770 | 1.3 | 18.4 | 0.14 | 138 | 0.061 | 2.5 | - | - | 0.86 | 3.5 | 5330 | 5.08 | 1.8 | - | 0.079 | - | 4.3 | 68.5 | - | 23.1 | 7.35 |
| LF_Sed_6 | LF_SED_6 | 0.1 | 4/11/2022 | SD | Normal | 18,600 | 6.2 | 39.8 | 1.1 | 36 | 0.4 | 16 | - | - | 1.9 | 19.6 | 33,000 | 31.8 | 7.67 | - | 0.088 | - | 20.6 | 409 | - | 101 | 70.6 |
| LF_Sed_6 | LF_SED_6 | 0.3 | 4/11/2022 | SD | Normal | 2940 | 1.1 | 4.73 | 0.078 | 6.2 | 0.021 | 4.9 | - | - | 0.25 | 0.72 | 2880 | 2.5 | 2 | - | <0.025 | - | 0.99 | 270 | - | 16.9 | 2.7 |
| LF_Sed_7 | LF_SED_7 | 0.1 | 4/11/2022 | SD | Normal | 1050 | 1.1 | 10.5 | 0.049 | 10 | 0.12 | 1.5 | - | - | 0.57 | 3.1 | 1370 | 10.6 | 0.83 | - | 0.13 | - | 5.19 | 50.8 | - | 9.1 | 8.99 |
| LF_Sed_7 | LF_SED_7 | 0.3 | 4/11/2022 | SD | Normal | 1360 | 0.89 | 9.89 | 0.055 | 10 | 0.083 | 1.5 | - | - | 0.43 | 2.3 | 1200 | 5.17 | 1.3 | - | 0.094 | - | 3.3 | 49.9 | - | 6.1 | 6.81 |
| LF_Sed_8 | LF_SED_8 | 0.1 | 4/11/2022 | SD | Normal | 2970 | 1.7 | 19.7 | 0.1 | 16 | 0.32 | 3.1 | - | - | 0.6 | 6.3 | 2180 | 9.83 | 0.28 | - | 0.12 | - | 6.75 | 83.7 | - | 8 | 21.5 |
| LF_Sed_8 | LF_SED_8 | 0.3 | 4/11/2022 | SD | Normal | 1480 | 0.52 | 4.22 | 0.048 | 6.8 | 0.013 | 2.4 | - | - | 0.13 | 0.78 | 710 | 3.3 | 0.25 | - | 0.034 | - | 0.78 | 99.4 | - | 5.4 | 2.1 |
| LF_Sed_9 | LF_SED_9 | 0.1 | 4/11/2022 | SD | Normal | 23,800 | 25.4 | 25.3 | 1.2 | 2.7 | 0.48 | 41 | - | - | 6.64 | 40.9 | 25,800 | 17.5 | 5.41 | - | <0.025 | - | 231 | 267 | - | 130 | 73.9 |
| LF_Sed_9 | LF_SED_9 | 0.3 | 4/11/2022 | SD | Normal | 7540 | 11 | 8.35 | 0.42 | 2.4 | 0.21 | 8.2 | - | - | 2.4 | 5.9 | 9490 | 3.5 | 5.47 | - | <0.025 | - | 26.7 | 415 | - | 30 | 16.7 |
| LF_Sed_10 | LF_SED_10 | 0.1 | 4/11/2022 | SD | Normal | 80,800 | 26.2 | 22.6 | 1.88 | 3.2 | 0.552 | 44.8 | - | - | 5.05 | 35.9 | 19,700 | 20.6 | 6.73 | - | <0.025 | - | 234 | 110 | - | 156 | 171 |
| LF_Sed_10 | LF_SED_10 | 0.3 | 4/11/2022 | SD | Normal | 85,100 | 36.1 | 26.8 | 1.84 | 4.4 | 0.651 | 73.3 | - | - | 7.22 | 53.4 | 26,900 | 27.8 | 8.47 | - | <0.025 | - | 303 | 189 | - | 175 | 259 |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | 9680 | 5 | 10 | 0.2 | 5.5 | 0.11 | 7.9 | - | - | 2.4 | 5.6 | 8200 | 4.4 | 5.39 | - | 0.044 | - | 7.43 | 281 | - | 26.1 | 27 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | 5680 | 4.4 | 5.67 | 0.13 | 3 | 0.055 | 5.9 | - | - | 2 | 2.6 | 7110 | 3.2 | 5.38 | - | <0.025 | - | 4.7 | 326 | - | 21.4 | 18.7 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | 12,400 | 17.5 | 16.7 | 0.26 | 23 | 0.25 | 12.7 | - | - | 2.1 | 41.2 | 23,800 | 19.3 | 0.8 | - | 0.19 | - | 27.7 | 193 | - | 59.3 | 17.8 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | 5590 | 8.6 | 11.9 | 0.15 | 2.9 | 0.18 | 6.2 | - | - | 2 | 1.9 | 7470 | 2.2 | 3.93 | - | <0.025 | - | 3 | 419 | - | 23.7 | 16.1 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | 6750 | 9.6 | - | 0.17 | 2.8 | 0.22 | 7 | - | - | 2.2 | 2.3 | - | 2.6 | - | - | 0.031 | - | 3.4 | - | - | 26 | 18 |
| LF_SED13 | LF_SED_13 | 0-0.2 | 5/12/2022 | SD | Normal | 1820 | 0.33 | 5.07 | 0.051 | 3.5 | 0.021 | 6.3 | - | - | 0.16 | 1.2 | 730 | 2.4 | 0.6 | 26.6 | <0.025 | - | 2.5 | 207 | - | 5.5 | 2.1 |
| LF_SED14 | LF_SED_14 | 0-0.2 | 5/12/2022 | SD | Normal | 1810 | 0.66 | 14 | 0.067 | 100 | 0.076 | 5.2 | - | - | 0.52 | 2.8 | 1880 | 17.6 | 1.1 | 97.2 | 0.065 | - | 2.9 | 69 | - | 8.3 | 5.77 |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | 16,600 | 4.6 | 26.1 | 0.56 | 60 | 0.682 | 11 | - | - | 3.36 | 17.6 | 11,100 | 28.7 | 4.5 | 123 | 0.17 | - | 17.5 | 47.3 | - | 50.8 | 67.4 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | 4110 | 1.3 | 6.82 | 0.1 | 16 | 0.18 | 3.3 | - | - | 0.91 | 12.2 | 2670 | 41.1 | 1.3 | 11 | 0.12 | - | 5.51 | 125 | - | 53.8 | 26.8 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 7120 | 12 | 5.53 | 0.16 | 12 | 0.032 | 6 | <0.5 | 6 | 1.8 | 2.4 | 11,700 | 2.4 | 6.67 | 121 | <0.025 | 0.16 | 3.8 | 333 | <0.25 | 217 | 13.5 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 119,000 | 5 | 35.3 | 1.1 | 22 | 0.24 | 18.8 | <0.6 | 18.8 | 4.7 | 46.6 | 8490 | 16.8 | 6.74 | 123 | <0.025 | 2 | 106 | 159 | 2.1 | 69.8 | 273 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 72,500 | 8.1 | 57.4 | 0.67 | <2.7 | 1.5 | 18.1 | <0.9 | 18.1 | 2.4 | 24.2 | 4820 | 35.3 | 3.61 | 46.5 | <0.053 | 3.2 | 45.3 | 182 | 1.3 | 43.3 | 1130 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 11,900 | 7.9 | 19.3 | 0.21 | 2.9 | 0.27 | 12.7 | <0.5 | 12.7 | 2.69 | 29.7 | 10,200 | 13.7 | 6.1 | 81.3 | <0.025 | 1.8 | 14 | 321 | 0.97 | 32.6 | 171 |
| LF_SED21 | LF_SED_21 | 0-0.1 | 30/11/2022 | SD | Normal | 19,000 | 12.8 | 29.6 | 1.41 | 17 | 0.712 | 12.7 | <2.9 | 12.7 | 3.14 | 17.7 | 8570 | 17.3 | 4.17 | 338 | 0.14 | 3.2 | 147 | 104 | 1 | 61.1 | 66.7 |
| LF_SED22 | LF_SED_22 | 0-0.2 | 5/12/2022 | SD | Normal | 5260 | 3.1 | 7.6 | 0.12 | 5.8 | 0.21 | 9.3 | - | - | 0.72 | 5 | 2060 | 5.39 | 1 | 45.7 | 0.065 | - | 5.65 | 348 | - | 25.4 | 8.36 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial

MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)

NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health

NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs calculated as per MfE's Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health (2011)

USEPA - Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020

CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
# Table C2
# NZAS Landfill Sediment Human Health Screening Values

| | | | | | | TPH | | | | PAHs - standard 16 | | | | | | | | | | | | | | | | | | PAHs - extended | SVOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | C7-C9 | C10-C14 | C15-C36 | C7-C36 (Total) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | 1-Methylnaphthalene |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 10 | 15 | 25 | 50 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 | 0.01 |
| NEPM 2013 Table 1A(1) HIL C Rec | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NEPM 2013 Table 1A(1) HIL D Comm/Ind | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Petroleum  - Recreational (Agric) - Pyrene - SAND <1m | | | | | | | | | | | | | | | | | | | | | | | | | 160 | | | | |
| MfE Petroleum -Recreational (Agric) - Naphthalene <1m = 7.2, 1-4m 70 | | | | | | | | | | | | | | | | | | | | | | | 7.2/70 | | | | | | |
| MfE Petroleum  - Industrial - Naphthalene <1m = 190, 1-4m 230 | | | | | | | | | | | | | | | | | | | | | | | 190/230' | | | | | | |
| MfE Gasworks - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MfE Gasworks - Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NES Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | 40 | 40 | | |
| NES Commercial / Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | 35 | 35 | | |
| CCME Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME Industrial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH Low | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CCME pH High | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Recreational THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| USEPA Commercial / Industrial THQ0.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | |
| LF_Sed_1 | LF_SED_1 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 3564 | 3564 | 0.31 | <0.01 | 0.58 | 6.4 | 8.6 | 14 | 4.4 | 4.5 | 7.8 | 1.2 | 8.2 | 0.15 | 5.1 | 0.063 | 2.3 | 7.8 | 13 | 13 | 0.13 | 0.1 |
| LF_Sed_1 | LF_SED_1 | 0.3 | 4/11/2022 | SD | Normal | <10 | 39 | 2774 | 2814 | 0.72 | <0.01 | 1.4 | 23 | 24 | 59 | 14 | 14 | 43 | 5.1 | 27 | 0.45 | 17 | 0.067 | 5.6 | 24 | 41 | 41 | 0.062 | 0.043 |
| LF_Sed_2 | LF_SED_2 | 0.1 | 4/11/2022 | SD | Normal | <10 | 17 | 3547 | 3564 | 0.44 | 0.014 | 1 | 12 | 16 | 26 | 8.2 | 10 | 16 | 2.6 | 17 | 0.25 | 11 | 0.063 | 3.7 | 16 | 25 | 25 | 0.075 | 0.043 |
| LF_Sed_2 | LF_SED_2 | 0.3 | 4/11/2022 | SD | Normal | <10 | 49 | 5669 | 5718 | 1.1 | 0.015 | 2 | 21 | 25 | 61 | 16 | 20 | 37 | 6.2 | 25 | 0.59 | 21 | 0.065 | 8.1 | 23 | 44 | 44 | 0.055 | 0.038 |
| LF_Sed_3 | LF_SED_3 | 0.1 | 4/11/2022 | SD | Normal | <10 | 71 | 3076 | 3147 | 0.44 | <0.01 | 0.89 | 9.1 | 12 | 18 | 5.7 | 7 | 11 | 1.8 | 14 | 0.25 | 7.2 | 0.041 | 3.9 | 13 | 18 | 18 | 0.057 | 0.036 |
| LF_Sed_3 | LF_SED_3 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 3039 | 3039 | 5.7 | 0.047 | 19 | 84 | 130 | 170 | 55 | 70 | 100 | 15 | 140 | 3.9 | 76 | 0.43 | 56 | 140 | 190 | 190 | 0.2 | 0.14 |
| LF_Sed_4 | LF_SED_4 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 172 | 172 | 0.072 | <0.01 | 0.22 | 2.1 | 4.2 | 4.8 | 1.6 | 2.1 | 2.2 | 0.44 | 3.2 | 0.035 | 2.4 | <0.01 | 0.75 | 3.2 | 5.8 | 5.8 | <0.01 | <0.01 |
| LF_Sed_4 | LF_SED_4 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 43 | <50 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.022 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 | <0.01 |
| LF_Sed_5 | LF_SED_5 | 0.1 | 4/11/2022 | SD | Normal | <38 | 94 | 19,268 | 19,362 | 2.1 | <0.044 | 0.22 | 1.4 | 2.8 | 3.4 | 1.2 | 1.4 | 1.9 | <0.044 | 2.1 | 0.37 | 1.7 | <0.044 | 0.54 | 2.3 | 3.7 | 3.7 | <0.044 | <0.044 |
| LF_Sed_5 | LF_SED_5 | 0.3 | 4/11/2022 | SD | Normal | <32 | 90 | 3060 | 3151 | 0.43 | <0.037 | 0.048 | 0.11 | 0.22 | 0.3 | 0.068 | <0.037 | 0.17 | <0.037 | <0.037 | 0.049 | <0.037 | 0.045 | 0.046 | 0.17 | 0.27 | 0.31 | 0.046 | <0.037 |
| LF_Sed_6 | LF_SED_6 | 0.1 | 4/11/2022 | SD | Normal | <17 | 60 | 10,193 | 10,253 | 0.95 | 0.037 | 1.3 | 19 | 38 | 44 | 15 | 17 | 20 | 4.5 | 18 | 0.41 | 22 | 0.09 | 4.3 | 18 | 52 | 52 | 0.083 | 0.04 |
| LF_Sed_6 | LF_SED_6 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 886 | 886 | 0.037 | <0.01 | 0.054 | 0.72 | 1.3 | 1.5 | 0.49 | 0.49 | 0.72 | 0.12 | 0.68 | 0.019 | 0.62 | <0.01 | 0.17 | 0.68 | 1.7 | 1.7 | <0.01 | <0.01 |
| LF_Sed_7 | LF_SED_7 | 0.1 | 4/11/2022 | SD | Normal | <20 | <31 | 2163 | 2163 | <0.028 | <0.028 | <0.028 | 0.22 | 0.3 | 0.47 | 0.14 | <0.028 | 0.27 | 0.056 | 0.3 | <0.028 | <0.028 | <0.028 | 0.11 | 0.29 | 0.45 | 0.45 | <0.028 | <0.028 |
| LF_Sed_7 | LF_SED_7 | 0.3 | 4/11/2022 | SD | Normal | <24 | <38 | 1731 | 1731 | <0.032 | <0.032 | 0.034 | 0.39 | 0.6 | 0.78 | 0.24 | <0.032 | 0.41 | <0.032 | 0.48 | <0.032 | <0.032 | <0.032 | 0.15 | 0.47 | 0.75 | 0.78 | <0.032 | <0.032 |
| LF_Sed_8 | LF_SED_8 | 0.1 | 4/11/2022 | SD | Normal | <15 | <24 | 2076 | 2076 | 0.28 | <0.023 | 0.48 | 5.1 | 9.5 | 11 | 3.7 | 3.8 | 5.5 | 0.96 | 7.2 | 0.11 | 5 | 0.047 | 1.8 | 7.4 | 13 | 13 | <0.023 | <0.023 |
| LF_Sed_8 | LF_SED_8 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 422 | 422 | <0.01 | <0.01 | <0.01 | <0.02 | 0.013 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | 0.01 | 0.03 | <0.01 | <0.01 |
| LF_Sed_9 | LF_SED_9 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 829 | 829 | 0.65 | 0.013 | 1.1 | 13 | 19 | 20 | 9.9 | 14 | 16 | 3.5 | 19 | 0.27 | 14 | 0.034 | 4.9 | 18 | 29 | 29 | 0.033 | 0.02 |
| LF_Sed_9 | LF_SED_9 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 130 | 130 | 0.051 | <0.01 | 0.086 | 0.72 | 1.3 | 1.6 | 0.54 | 0.67 | 0.84 | 0.15 | 1 | 0.027 | 0.77 | <0.01 | 0.35 | 0.99 | 1.9 | 1.9 | <0.01 | <0.01 |
| LF_Sed_10 | LF_SED_10 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 770 | 770 | 0.57 | 0.025 | 0.81 | 12 | 8.4 | 18 | 5.6 | 3.9 | 17 | 1.8 | 17 | 0.22 | 5.5 | 0.029 | 4.7 | 15 | 15 | 15 | 0.032 | 0.021 |
| LF_Sed_10 | LF_SED_10 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 604 | 604 | 0.46 | 0.014 | 0.65 | 9.2 | 12 | 21 | 6.8 | 6.6 | 12 | 2 | 14 | 0.18 | 7.6 | 0.021 | 3.5 | 13 | 18 | 18 | 0.023 | 0.015 |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 1261 | 1261 | 0.15 | <0.011 | 0.31 | 3.2 | 5.9 | 7.2 | 2.3 | 2.6 | 3.6 | 0.6 | 4.2 | 0.076 | 3.1 | 0.018 | 1.2 | 4.2 | 8.1 | 8.1 | <0.011 | <0.011 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 189 | 189 | <0.01 | <0.01 | 0.016 | 0.15 | 0.29 | 0.32 | 0.1 | 0.14 | 0.16 | 0.015 | 0.22 | <0.01 | 0.16 | <0.01 | 0.056 | 0.22 | 0.38 | 0.38 | <0.01 | <0.01 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | <26 | <41 | 8543 | 8543 | 0.34 | <0.037 | 0.66 | 7.9 | 13 | 20 | 6.2 | 6.1 | 10 | 1.6 | 11 | 0.2 | 7.3 | <0.037 | 2.7 | 9.5 | 19 | 19 | <0.037 | <0.037 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 137 | 137 | <0.01 | <0.01 | 0.033 | 0.25 | 0.46 | 0.51 | 0.17 | 0.19 | 0.25 | 0.017 | 0.43 | <0.01 | 0.23 | <0.01 | 0.1 | 0.44 | 0.6 | 0.6 | <0.01 | <0.01 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SED13 | LF_SED_13 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | 0.025 | 0.024 | <0.01 | <0.02 | 0.011 | <0.01 | <0.02 | <0.01 | 0.014 | <0.01 | <0.01 | <0.02 | 0.03 | 0.04 | <0.01 | <0.01 |
| LF_SED14 | LF_SED_14 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.01 | 0.1 | <0.04 | <0.04 |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | 0.79 | <0.048 | 1.6 | 15 | 20 | 19 | 7.9 | 8 | 11 | 2.1 | 17 | 0.33 | 12 | 0.14 | 5 | 17 | 27 | 27 | 0.07 | <0.048 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | 0.31 | <0.041 | 0.76 | 6.2 | 8 | 8.1 | 3 | 3.8 | 4.8 | 0.89 | 8.4 | 0.15 | 5 | 0.061 | 2.4 | 8 | 11 | 11 | <0.041 | <0.041 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | 0.011 | <0.01 | 0.028 | 0.29 | 0.48 | 0.58 | 0.19 | 0.39 | 0.37 | 0.057 | 0.44 | <0.01 | 0.39 | <0.01 | 0.11 | 0.44 | 0.69 | 0.69 | <0.01 | <0.01 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | 0.17 | <0.01 | 0.28 | 3.1 | 3.8 | 5.7 | 1.9 | 2.7 | 5.2 | 0.63 | 4.4 | 0.088 | 2.6 | 0.017 | 1.4 | 4.1 | 5.9 | 5.9 | 0.015 | 0.011 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | 0.53 | <0.01 | 0.8 | 9.4 | 13 | 17 | 5.4 | 8.7 | 11 | 2.1 | 10 | 0.24 | 9.4 | 0.064 | 3.2 | 10 | 19 | 19 | 0.031 | 0.018 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | 0.17 | <0.01 | 0.6 | 4.5 | 6.7 | 7.1 | 2.6 | 5 | 4.9 | 0.71 | 7.9 | 0.081 | 5 | 0.011 | 2.2 | 8 | 9.4 | 9.4 | <0.01 | <0.01 |
| LF_SED21 | LF_SED_21 | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | 0.17 | <0.023 | 0.29 | 2.1 | 2.1 | 3.8 | 1.3 | 1.5 | 3 | 0.28 | 4 | 0.074 | 1.4 | <0.023 | 1.2 | 4 | 3.3 | 3.3 | <0.023 | <0.023 |
| LF_SED22 | LF_SED_22 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | 0.1 | <0.011 | 0.22 | 1.9 | 2.5 | 2.5 | 0.92 | 1.1 | 1.6 | 0.31 | 2.6 | 0.054 | 1.5 | 0.016 | 0.76 | 2.5 | 3.6 | 3.6 | <0.011 | <0.011 |

**References**

NEPM - Australian Health-based Investigation Levels. HIL C - for recreational and HIL D for industrial
MfE Petroleum - Values taken from table 4.12 of the Ministry for the Environment, 1999 (revised 2011). Guidelines for assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
MfE Gasworks - Values taken from Tables 4C.9 - 4C.11 of the Guidelines for assessing and managing contaminated gasworks sites in New Zealand (1997)
NES - Values taken from Table B2 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health
NES - Values taken from Table B3 of the Ministry for the Environment, 2012. Users' Guide: NES for Assessing and Managing
Contaminants in Soil to Protect Human Health. TEF for dioxins and dioxin-like PCBs calculated as per MfE's Methodology for
USEPA -  Values taken from US EPA Regional Screening Level (RSL) Summary Table November 2020
CCME - Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health  Residential/Parkland, Commercial, Industrial (1999)

# Appendix C
## Table C3
## NZAS Landfill Sediment Ecological Screening Criteria

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | | | | | Nutrients | | | Organic Indicators |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Calcium | Magnesium | Potassium | Sodium | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Total Organic Carbon |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | % |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 12.5 | 5 | 5 | 125 | 3 | 3 | 5 | 2.4 | 1 | 0.1 |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV | | | | | | | | | | | | | | | | | | | | |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high | | | | | | | | | | | | | | | | | | | | |
| USEPA (2006) | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | |
| LF_Sed_1 | LF_SED_1 | 0.1 | 4/11/2022 | SD | Normal | 8300 | 26 | 7.5 | <0.2 | 2.42 | - | - | - | - | 53.2 | 11.9 | <5 | <2.6 | <1 | 15.5 |
| LF_Sed_1 | LF_SED_1 | 0.3 | 4/11/2022 | SD | Normal | 17,000 | 25 | 6.4 | <0.2 | 18.9 | - | - | - | - | 39.4 | 14.8 | 10.7 | <2.6 | <1 | 23.6 |
| LF_Sed_10 | LF_SED_10 | 0.1 | 4/11/2022 | SD | Normal | 19,000 | 35 | 6.1 | <0.2 | <0.3 | - | - | - | - | 19.2 | 37.8 | <5 | <2.6 | <1 | 43.9 |
| LF_Sed_10 | LF_SED_10 | 0.3 | 4/11/2022 | SD | Normal | 24,000 | 38 | 6.4 | <0.2 | <0.3 | - | - | - | - | 28.9 | 44.6 | <5 | <2.7 | <1 | 43.5 |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | 610 | 69 | 5.3 | <0.2 | 18.7 | - | - | - | - | 87.7 | 58.5 | 10.8 | <2.6 | <1 | 7.4 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | 230 | 27 | 5.5 | <0.2 | <0.3 | - | - | - | - | 30.6 | 20.7 | <5 | <2.5 | <1 | 1.3 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | 1800 | 91 | 4.7 | <0.2 | 54.8 | - | - | - | - | 522.6 | 2741.1 | 45.5 | <26 | <1 | 45.4 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | 500 | 31 | 5.6 | <0.03 | <0.3 | - | - | - | - | 37.9 | 270.6 | 8.23 | <2.6 | <1 | 0.77 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SED13 | LF_SED_13 | 0-0.2 | 5/12/2022 | SD | Normal | 440 | 51 | 5.5 | <0.2 | 1.1 | 1100 | 290 | 200 | 560 | 70.3 | <3.2 | <5 | <2.6 | <1 | 7.8 |
| LF_SED14 | LF_SED_14 | 0-0.2 | 5/12/2022 | SD | Normal | 1100 | 91 | 6.7 | <0.2 | 5.76 | 7760 | 4860 | 1380 | 7400 | 1117.4 | 23.5 | 8.83 | <2.7 | 3.85 | 45.9 |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | 2700 | 94 | 6.2 | <0.2 | 9.66 | 12,800 | 2690 | 966 | 2900 | 878.3 | 227.7 | 23.5 | <2.7 | <1 | 28.2 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | 490 | 92 | 5.6 | <0.2 | 4.28 | 2490 | 1710 | 330 | 2200 | 1168.8 | 21.5 | 25.4 | <2.7 | <1 | 25.7 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 5600 | 18 | 6.2 | <0.2 | <0.2 | 2490 | 1640 | 280 | 500 | 44 | 8.5 | <5 | 5.61 | <1 | 0.44 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 1600 | 37 | 7.5 | <0.2 | 9.16 | 6260 | 6680 | 340 | 6800 | 160.3 | 20.7 | 29.8 | <2.6 | <1 | 18.8 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 1000 | 53 | 5.9 | <0.2 | 5.67 | 2520 | 1810 | 170 | <270 | 30.3 | 24 | <5 | <2.6 | <1 | 6.6 |
| LF_Sed_2 | LF_SED_2 | 0.1 | 4/11/2022 | SD | Normal | 6700 | 44 | 7.2 | <0.2 | 32.3 | - | - | - | - | 169.3 | 69.9 | 16.8 | <2.6 | 5.56 | 17.5 |
| LF_Sed_2 | LF_SED_2 | 0.3 | 4/11/2022 | SD | Normal | 22,000 | 41 | 6.9 | <0.2 | 4.61 | - | - | - | - | 200.6 | 155.7 | 39.2 | <2.6 | <1 | 33.9 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 140 | 13 | 5.3 | <0.2 | 1.6 | 3040 | 1770 | 250 | 150 | 45.8 | 13 | <5 | <2.5 | <1 | 1.7 |
| LF_SED21 | LF_SED_21 | 0-0.1 | 30/11/2022 | SD | Normal | 7800 | 86 | 5 | <0.2 | 5.72 | 6790 | 1430 | 621 | 15,400 | 31.5 | 816.9 | 163 | <2.4 | <1 | 43.5 |
| LF_SED22 | LF_SED_22 | 0-0.2 | 5/12/2022 | SD | Normal | 500 | 71 | 4.4 | <0.2 | <0.7 | 3780 | 1490 | 250 | 1900 | 548.5 | 284.9 | 29 | <2.6 | <1 | 16.8 |
| LF_Sed_3 | LF_SED_3 | 0.1 | 4/11/2022 | SD | Normal | 6400 | 40 | 8.5 | <0.2 | 2.03 | - | - | - | - | 73.8 | 12.8 | <5 | <2.6 | <1 | 11.4 |
| LF_Sed_3 | LF_SED_3 | 0.3 | 4/11/2022 | SD | Normal | 22,000 | 59 | 7.7 | <0.2 | 6.01 | - | - | - | - | 108.9 | 14.9 | 30.9 | <2.6 | <1 | 29 |
| LF_Sed_4 | LF_SED_4 | 0.1 | 4/11/2022 | SD | Normal | 2800 | 27 | 7 | <0.2 | <0.3 | - | - | - | - | 44.5 | 6.3 | 11.4 | <2.6 | <1 | 1.5 |
| LF_Sed_4 | LF_SED_4 | 0.3 | 4/11/2022 | SD | Normal | 600 | 19 | 6.9 | <0.2 | <0.3 | - | - | - | - | 23.4 | 3.6 | 15.9 | <2.6 | <1 | 0.3 |
| LF_Sed_5 | LF_SED_5 | 0.1 | 4/11/2022 | SD | Normal | 3300 | 89 - 93 | 5.8 | <0.2 | <1.9 | - | - | - | - | 1396 | 621.1 | 36.4 | <2.7 | <1 | 41 |
| LF_Sed_5 | LF_SED_5 | 0.3 | 4/11/2022 | SD | Normal | 1400 | 92 | 6 | <0.2 | 16.6 | - | - | - | - | 1717.7 | 281.4 | 34.1 | <2.5 | 1.52 | 49.1 |
| LF_Sed_6 | LF_SED_6 | 0.1 | 4/11/2022 | SD | Normal | 8100 | 88 | 6.2 | <0.2 | 35.7 | - | - | - | - | 557.2 | 28.9 | 14.5 | <2.6 | <1 | 23.9 |
| LF_Sed_6 | LF_SED_6 | 0.3 | 4/11/2022 | SD | Normal | 530 | 44 | 6.1 | <0.2 | <0.3 | - | - | - | - | 87.6 | <3.2 | <5 | <2.6 | <1 | 4.7 |
| LF_Sed_7 | LF_SED_7 | 0.1 | 4/11/2022 | SD | Normal | 530 | 89 | 3.6 | <0.2 | 18.5 | - | - | - | - | 624.3 | 66.7 | 13.2 | <2.6 | <1 | 50.4 |
| LF_Sed_7 | LF_SED_7 | 0.3 | 4/11/2022 | SD | Normal | 620 | 90 | 3.6 | <0.2 | 30 | - | - | - | - | 937.6 | 100.4 | 19.6 | <2.5 | <1 | 51.1 |
| LF_Sed_8 | LF_SED_8 | 0.1 | 4/11/2022 | SD | Normal | 580 | 85 | 4 | <0.2 | 8.44 | - | - | - | - | 1140.8 | 70 | 49.7 | <2.6 | <1 | 33 |
| LF_Sed_8 | LF_SED_8 | 0.3 | 4/11/2022 | SD | Normal | 250 | 56 | 4.3 | <0.2 | 2.57 | - | - | - | - | 237 | 17.7 | 6.7 | <2.6 | <1 | 5.4 |
| LF_Sed_9 | LF_SED_9 | 0.1 | 4/11/2022 | SD | Normal | 17,000 | 27 | 5.9 | <0.2 | <0.3 | - | - | - | - | 11 | 37.8 | <5 | <2.6 | <1 | 37.9 |
| LF_Sed_9 | LF_SED_9 | 0.3 | 4/11/2022 | SD | Normal | 3000 | 30 | 5.4 | <0.2 | <0.3 | - | - | - | - | <3.1 | 8.4 | <5 | <2.6 | <1 | 4.8 |

**Notes**

[1] Polycyclic aromatic hydrocarbons, including the 18 parent PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene.

[2] Includes nitrate, nitrite, ammonia and phosphorus

[3] Bioaccumulation and secondary poisoning effects should be considered for this toxicant, based on data presented by ANZG (2018) and/or US EPA (2000).

NA - indicates appropriate published criteria not available

**References**

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality

US EPA (2000) Bioaccumulation Testing And Interpretation For The Purpose Of Sediment Quality Assessment

US EPA (2006) EPA Region III BTAG Marine screening benchmarks 7/2006

## Appendix C
## Table C3
## NZAS Landfill Sediment Ecological Screening Criteria

| | | | | | | Metals | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Aluminium | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Iron | Lead | Lithium | Manganese | Mercury | Molybdenum | Nickel | Titanium | Tin | Vanadium | Zinc |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 2.5 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.5 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.125 | 0.025 | 0.125 | 0.05 | 0.075 | 0.25 | 0.125 | 0.05 |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV | | | | | | | 20 | | | | 2 | 80 | | | | 65 | | 50 | | | 0.15 | | 21 | | | | 200 |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high | | | | | | | 70 | | | | 25 | 370 | | | | 270 | | 220 | | | 1 | | 52 | | | | 410 |
| USEPA (2006) | | | | | | | | | | | | | | | 50 | | 20,000 | | | | | | | | | | |
| Field_ID | Location_Code | Sample_Depth_Range | Sampled_Date_Time | Location_Type | Sample_Type | | | | | | | | | | | | | | | | | | | | | | |
| LF_Sed_1 | LF_SED_1 | 0.1 | 4/11/2022 | SD | Normal | 146,000 | 6.1 | 33 | 0.95 | 13 | 0.24 | 20.9 | - | - | 6.29 | 31.1 | 11,500 | 23 | 6.1 | - | <0.025 | - | 119 | 165 | - | 59.8 | 362 |
| LF_Sed_1 | LF_SED_1 | 0.3 | 4/11/2022 | SD | Normal | 105,000 | 11 | 29 | 0.94 | 9.2 | 0.543 | 27.6 | - | - | 8.69 | 32.9 | 13,600 | 22 | 8.94 | - | 0.052 | - | 165 | 243 | - | 81.7 | 222 |
| LF_Sed_10 | LF_SED_10 | 0.1 | 4/11/2022 | SD | Normal | 80,800 | 26.2 | 22.6 | 1.88 | 3.2 | 0.552 | 44.8 | - | - | 5.05 | 35.9 | 19,700 | 20.6 | 6.73 | - | <0.025 | - | 234 | 110 | - | 156 | 171 |
| LF_Sed_10 | LF_SED_10 | 0.3 | 4/11/2022 | SD | Normal | 85,100 | 36.1 | 26.8 | 1.84 | 4.4 | 0.651 | 73.3 | - | - | 7.22 | 53.4 | 26,900 | 27.8 | 8.47 | - | <0.025 | - | 303 | 189 | - | 175 | 259 |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | 9680 | 5 | 10 | 0.2 | 5.5 | 0.11 | 7.9 | - | - | 2.4 | 5.6 | 8200 | 4.4 | 5.39 | - | 0.044 | - | 7.43 | 281 | - | 26.1 | 27 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | 5680 | 4.4 | 5.67 | 0.13 | 3 | 0.055 | 5.9 | - | - | 2 | 2.6 | 7110 | 3.2 | 5.38 | - | <0.025 | - | 4.7 | 326 | - | 21.4 | 18.7 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | 12,400 | 17.5 | 16.7 | 0.26 | 23 | 0.25 | 12.7 | - | - | 2.1 | 41.2 | 23,800 | 19.3 | 0.8 | - | 0.19 | - | 27.7 | 193 | - | 59.3 | 17.8 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | 5590 | 8.6 | 11.9 | 0.15 | 2.9 | 0.18 | 6.2 | - | - | 2 | 1.9 | 7470 | 2.2 | 3.93 | - | <0.025 | - | 3 | 419 | - | 23.7 | 16.1 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | 6750 | 9.6 | - | 0.17 | 2.8 | 0.22 | 7 | - | - | 2.2 | 2.3 | - | 2.6 | - | - | 0.031 | - | 3.4 | - | - | 26 | 18 |
| LF_SED13 | LF_SED_13 | 0-0.2 | 5/12/2022 | SD | Normal | 1820 | 0.33 | 5.07 | 0.051 | 3.5 | 0.021 | 6.3 | - | - | 0.16 | 1.2 | 730 | 2.4 | 0.6 | 26.6 | <0.025 | - | 2.5 | 207 | - | 5.5 | 2.1 |
| LF_SED14 | LF_SED_14 | 0-0.2 | 5/12/2022 | SD | Normal | 1810 | 0.66 | 14 | 0.067 | 100 | 0.076 | 5.2 | - | - | 0.52 | 2.8 | 1880 | 17.6 | 1.1 | 97.2 | 0.065 | - | 2.9 | 69 | - | 8.3 | 5.77 |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | 16,600 | 4.6 | 26.1 | 0.56 | 60 | 0.682 | 11 | - | - | 3.36 | 17.6 | 11,100 | 28.7 | 4.5 | 123 | 0.17 | - | 17.5 | 47.3 | - | 50.8 | 67.4 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | 4110 | 1.3 | 6.82 | 0.1 | 16 | 0.18 | 3.3 | - | - | 0.91 | 12.2 | 2670 | 41.1 | 1.3 | 11 | 0.12 | - | 5.51 | 125 | - | 53.8 | 26.8 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | 7120 | 12 | 5.53 | 0.16 | 12 | 0.032 | 6 | <0.5 | 6 | 1.8 | 2.4 | 11,700 | 2.4 | 6.67 | 121 | <0.025 | 0.16 | 3.8 | 333 | <0.25 | 217 | 13.5 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | 119,000 | 5 | 35.3 | 1.1 | 22 | 0.24 | 18.8 | <0.6 | 18.8 | 4.7 | 46.6 | 8490 | 16.8 | 6.74 | 123 | <0.025 | 2 | 106 | 159 | 2.1 | 69.8 | 273 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | 72,500 | 8.1 | 57.4 | 0.67 | <2.7 | 1.5 | 18.1 | <0.9 | 18.1 | 2.4 | 24.2 | 4820 | 35.3 | 3.61 | 46.5 | <0.053 | 3.2 | 45.3 | 182 | 1.3 | 43.3 | 1130 |
| LF_Sed_2 | LF_SED_2 | 0.1 | 4/11/2022 | SD | Normal | 168,000 | 8 | 43.5 | 1.1 | 33 | 0.46 | 27.7 | - | - | 7.06 | 57.4 | 12,400 | 26 | 9.18 | - | <0.025 | - | 158 | 305 | - | 132 | 387 |
| LF_Sed_2 | LF_SED_2 | 0.3 | 4/11/2022 | SD | Normal | 120,000 | 37.7 | 43.8 | 1.64 | 20 | 3.69 | 42.2 | - | - | 9.71 | 43.1 | 16,600 | 54.5 | 9.71 | - | 0.15 | - | 327 | 327 | - | 257 | 276 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | 11,900 | 7.9 | 19.3 | 0.21 | 2.9 | 0.27 | 12.7 | <0.5 | 12.7 | 2.69 | 29.7 | 10,200 | 13.7 | 6.1 | 81.3 | <0.025 | 1.8 | 14 | 321 | 0.97 | 32.6 | 171 |
| LF_SED21 | LF_SED_21 | 0-0.1 | 30/11/2022 | SD | Normal | 19,000 | 12.8 | 29.6 | 1.41 | 17 | 0.712 | 12.7 | <2.9 | 12.7 | 3.14 | 17.7 | 8570 | 17.3 | 4.17 | 338 | 0.14 | 3.2 | 147 | 104 | 1 | 61.1 | 66.7 |
| LF_SED22 | LF_SED_22 | 0-0.2 | 5/12/2022 | SD | Normal | 5260 | 3.1 | 7.6 | 0.12 | 5.8 | 0.21 | 9.3 | - | - | 0.72 | 5 | 2060 | 5.39 | 1 | 45.7 | 0.065 | - | 5.65 | 348 | - | 25.4 | 8.36 |
| LF_Sed_3 | LF_SED_3 | 0.1 | 4/11/2022 | SD | Normal | 165,000 | 3.5 | 32.7 | 0.76 | 20 | 0.16 | 18.3 | - | - | 3.73 | 27.7 | 7340 | 13.6 | 7.42 | - | <0.025 | - | 99.1 | 156 | - | 60.4 | 170 |
| LF_Sed_3 | LF_SED_3 | 0.3 | 4/11/2022 | SD | Normal | 121,000 | 26.7 | 50.4 | 1.75 | 49 | 5.02 | 50.3 | - | - | 14.9 | 47.8 | 22,500 | 47 | 14.7 | - | 0.28 | - | 287 | 516 | - | 341 | 338 |
| LF_Sed_4 | LF_SED_4 | 0.1 | 4/11/2022 | SD | Normal | 10,300 | 7.8 | 7.83 | 0.23 | 21 | 0.032 | 6.7 | - | - | 1.4 | 2.2 | 8020 | 3.2 | 8.15 | - | <0.025 | - | 4.3 | 411 | - | 161 | 13.3 |
| LF_Sed_4 | LF_SED_4 | 0.3 | 4/11/2022 | SD | Normal | 4960 | 11 | 4.08 | 0.17 | 7.3 | 0.041 | 6.5 | - | - | 1.9 | 1.7 | 12,100 | 2 | 5.36 | - | <0.025 | - | 3 | 386 | - | 142 | 9.73 |
| LF_Sed_5 | LF_SED_5 | 0.1 | 4/11/2022 | SD | Normal | 4470 | 3.4 | 37.5 | 0.3 | 168 | 0.11 | 3.7 | - | - | 0.92 | 3.5 | 18,900 | 8.86 | 2.2 | - | <0.023 | - | 5.54 | 80.4 | - | 39.6 | 13.5 |
| LF_Sed_5 | LF_SED_5 | 0.3 | 4/11/2022 | SD | Normal | 2770 | 1.3 | 18.4 | 0.14 | 138 | 0.061 | 2.5 | - | - | 0.86 | 3.5 | 5330 | 5.08 | 1.8 | - | 0.079 | - | 4.3 | 68.5 | - | 23.1 | 7.35 |
| LF_Sed_6 | LF_SED_6 | 0.1 | 4/11/2022 | SD | Normal | 18,600 | 6.2 | 39.8 | 1.1 | 36 | 0.4 | 16 | - | - | 1.9 | 19.6 | 33,000 | 31.8 | 7.67 | - | 0.088 | - | 20.6 | 409 | - | 101 | 70.6 |
| LF_Sed_6 | LF_SED_6 | 0.3 | 4/11/2022 | SD | Normal | 2940 | 1.1 | 4.73 | 0.078 | 6.2 | 0.021 | 4.9 | - | - | 0.25 | 0.72 | 2880 | 2.5 | 2 | - | <0.025 | - | 0.99 | 270 | - | 16.9 | 2.7 |
| LF_Sed_7 | LF_SED_7 | 0.1 | 4/11/2022 | SD | Normal | 1050 | 1.1 | 10.5 | 0.049 | 10 | 0.12 | 1.5 | - | - | 0.57 | 3.1 | 1370 | 10.6 | 0.83 | - | 0.13 | - | 5.19 | 50.8 | - | 9.1 | 8.99 |
| LF_Sed_7 | LF_SED_7 | 0.3 | 4/11/2022 | SD | Normal | 1360 | 0.89 | 9.89 | 0.055 | 10 | 0.083 | 1.5 | - | - | 0.43 | 2.3 | 1200 | 5.17 | 1.3 | - | 0.094 | - | 3.3 | 49.9 | - | 6.1 | 6.81 |
| LF_Sed_8 | LF_SED_8 | 0.1 | 4/11/2022 | SD | Normal | 2970 | 1.7 | 19.7 | 0.1 | 16 | 0.32 | 3.1 | - | - | 0.6 | 6.3 | 2180 | 9.83 | 0.28 | - | 0.12 | - | 6.75 | 83.7 | - | 8 | 21.5 |
| LF_Sed_8 | LF_SED_8 | 0.3 | 4/11/2022 | SD | Normal | 1480 | 0.52 | 4.22 | 0.048 | 6.8 | 0.013 | 2.4 | - | - | 0.13 | 0.78 | 710 | 3.3 | 0.25 | - | 0.034 | - | 0.78 | 99.4 | - | 5.4 | 2.1 |
| LF_Sed_9 | LF_SED_9 | 0.1 | 4/11/2022 | SD | Normal | 23,800 | 25.4 | 25.3 | 1.2 | 2.7 | 0.48 | 41 | - | - | 6.64 | 40.9 | 25,800 | 17.5 | 5.41 | - | <0.025 | - | 231 | 267 | - | 130 | 73.9 |
| LF_Sed_9 | LF_SED_9 | 0.3 | 4/11/2022 | SD | Normal | 7540 | 11 | 8.35 | 0.42 | 2.4 | 0.21 | 8.2 | - | - | 2.4 | 5.9 | 9490 | 3.5 | 5.47 | - | <0.025 | - | 26.7 | 415 | - | 30 | 16.7 |

**Notes**

[1] Polycyclic aromatic hydrocarbons, including the 18 parent PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene.

[2] Includes nitrate, nitrite, ammonia and phosphorus

[3] Bioaccumulation and secondary poisoning effects should be considered for this toxicant, based on data presented by ANZG (2018) and/or US EPA (2000).

NA - indicates appropriate published criteria not available

**References**

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality

US EPA (2000) Bioaccumulation Testing And Interpretation For The Purpose Of Sediment Quality Assessment

US EPA (2006) EPA Region III BTAG Marine screening benchmarks 7/2006

## Appendix C
## Table C3
## NZAS Landfill Sediment Ecological Screening Criteria

| | | | | | | TPH | | | | PAHs - standard 16 | | | | | | | | | | | | | | | | | | PAHs - extended | SVOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | C7-C9 | C10-C14 | C15-C36 | C7-C36 (Total) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | 1-Methylnaphthalene |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 10 | 15 | 25 | 50 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 | 0.01 |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV | | | | | | | | | 280 | | | | | | | | | | | | | | | | | 10 | 10 | | |
| ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high | | | | | | | | | 550 | | | | | | | | | | | | | | | | | 50 | 50 | | |
| USEPA (2006) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | |
| LF_Sed_1 | LF_SED_1 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 3564 | 3564 | 0.31 | <0.01 | 0.58 | 6.4 | 8.6 | 14 | 4.4 | 4.5 | 7.8 | 1.2 | 8.2 | 0.15 | 5.1 | 0.063 | 2.3 | 7.8 | 13 | 13 | 0.13 | 0.1 |
| LF_Sed_1 | LF_SED_1 | 0.3 | 4/11/2022 | SD | Normal | <10 | 39 | 2774 | 2814 | 0.72 | <0.01 | 1.4 | 23 | 24 | 59 | 14 | 14 | 43 | 5.1 | 27 | 0.45 | 17 | 0.067 | 5.6 | 24 | 41 | 41 | 0.062 | 0.043 |
| LF_Sed_10 | LF_SED_10 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 770 | 770 | 0.57 | 0.025 | 0.81 | 12 | 8.4 | 18 | 5.6 | 3.9 | 17 | 1.8 | 17 | 0.22 | 5.5 | 0.029 | 4.7 | 15 | 15 | 15 | 0.032 | 0.021 |
| LF_Sed_10 | LF_SED_10 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 604 | 604 | 0.46 | 0.014 | 0.65 | 9.2 | 12 | 21 | 6.8 | 6.6 | 12 | 2 | 14 | 0.18 | 7.6 | 0.021 | 3.5 | 13 | 18 | 18 | 0.023 | 0.015 |
| LF_Sed_11 | LF_SED_11 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 1261 | 1261 | 0.15 | <0.011 | 0.31 | 3.2 | 5.9 | 7.2 | 2.3 | 2.6 | 3.6 | 0.6 | 4.2 | 0.076 | 3.1 | 0.018 | 1.2 | 4.2 | 8.1 | 8.1 | <0.011 | <0.011 |
| LF_Sed_11 | LF_SED_11 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 189 | 189 | <0.01 | <0.01 | 0.016 | 0.15 | 0.29 | 0.32 | 0.1 | 0.14 | 0.16 | 0.015 | 0.22 | <0.01 | 0.16 | <0.01 | 0.056 | 0.22 | 0.38 | 0.38 | <0.01 | <0.01 |
| LF_Sed_12 | LF_SED_12 | 0.1 | 4/11/2022 | SD | Normal | <26 | <41 | 8543 | 8543 | 0.34 | <0.037 | 0.66 | 7.9 | 13 | 20 | 6.2 | 6.1 | 10 | 1.6 | 11 | 0.2 | 7.3 | <0.037 | 2.7 | 9.5 | 19 | 19 | <0.037 | <0.037 |
| LF_Sed_12 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 137 | 137 | <0.01 | <0.01 | 0.033 | 0.25 | 0.46 | 0.51 | 0.17 | 0.19 | 0.25 | 0.017 | 0.43 | <0.01 | 0.23 | <0.01 | 0.1 | 0.44 | 0.6 | 0.6 | <0.01 | <0.01 |
| LF_sed_DUP_1 | LF_SED_12 | 0.3 | 4/11/2022 | SD | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_SED13 | LF_SED_13 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | 0.025 | 0.024 | <0.01 | <0.02 | 0.011 | <0.01 | <0.02 | <0.01 | 0.014 | <0.01 | <0.01 | <0.02 | 0.03 | 0.04 | <0.01 | <0.01 |
| LF_SED14 | LF_SED_14 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.04 | <0.01 | 0.1 | <0.04 | <0.04 |
| LF_SED15 | LF_SED_15 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | 0.79 | <0.048 | 1.6 | 15 | 20 | 19 | 7.9 | 8 | 11 | 2.1 | 17 | 0.33 | 12 | 0.14 | 5 | 17 | 27 | 27 | 0.07 | <0.048 |
| LF_SED16 | LF_SED_16 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | 0.31 | <0.041 | 0.76 | 6.2 | 8 | 8.1 | 3 | 3.8 | 4.8 | 0.89 | 8.4 | 0.15 | 5 | 0.061 | 2.4 | 8 | 11 | 11 | <0.041 | <0.041 |
| LF_SED17 | LF_SED_17 | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | 0.011 | <0.01 | 0.028 | 0.29 | 0.48 | 0.58 | 0.19 | 0.39 | 0.37 | 0.057 | 0.44 | <0.01 | 0.39 | <0.01 | 0.11 | 0.44 | 0.69 | 0.69 | <0.01 | <0.01 |
| LF_SED18 | LF_SED_18 | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | 0.17 | <0.01 | 0.28 | 3.1 | 3.8 | 5.7 | 1.9 | 2.7 | 5.2 | 0.63 | 4.4 | 0.088 | 2.6 | 0.017 | 1.4 | 4.1 | 5.9 | 5.9 | 0.015 | 0.011 |
| LF_SED19 | LF_SED_19 | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | 0.53 | <0.01 | 0.8 | 9.4 | 13 | 17 | 5.4 | 8.7 | 11 | 2.1 | 10 | 0.24 | 9.4 | 0.064 | 3.2 | 10 | 19 | 19 | 0.031 | 0.018 |
| LF_Sed_2 | LF_SED_2 | 0.1 | 4/11/2022 | SD | Normal | <10 | 17 | 3547 | 3564 | 0.44 | 0.014 | 1 | 12 | 16 | 26 | 8.2 | 10 | 16 | 2.6 | 17 | 0.25 | 11 | 0.063 | 3.7 | 16 | 25 | 25 | 0.075 | 0.043 |
| LF_Sed_2 | LF_SED_2 | 0.3 | 4/11/2022 | SD | Normal | <10 | 49 | 5669 | 5718 | 1.1 | 0.015 | 2 | 21 | 25 | 61 | 16 | 20 | 37 | 6.2 | 25 | 0.59 | 21 | 0.065 | 8.1 | 23 | 44 | 44 | 0.055 | 0.038 |
| LF_SED20 | LF_SED_20 | 0-0.1 | 29/11/2022 | SD | Normal | - | - | - | - | 0.17 | <0.01 | 0.6 | 4.5 | 6.7 | 7.1 | 2.6 | 5 | 4.9 | 0.71 | 7.9 | 0.081 | 5 | 0.011 | 2.2 | 8 | 9.4 | 9.4 | <0.01 | <0.01 |
| LF_SED21 | LF_SED_21 | 0-0.1 | 30/11/2022 | SD | Normal | - | - | - | - | 0.17 | <0.023 | 0.29 | 2.1 | 2.1 | 3.8 | 1.3 | 1.5 | 3 | 0.28 | 4 | 0.074 | 1.4 | <0.023 | 1.2 | 4 | 3.3 | 3.3 | <0.023 | <0.023 |
| LF_SED22 | LF_SED_22 | 0-0.2 | 5/12/2022 | SD | Normal | - | - | - | - | 0.1 | <0.011 | 0.22 | 1.9 | 2.5 | 2.5 | 0.92 | 1.1 | 1.6 | 0.31 | 2.6 | 0.054 | 1.5 | 0.016 | 0.76 | 2.5 | 3.6 | 3.6 | <0.011 | <0.011 |
| LF_Sed_3 | LF_SED_3 | 0.1 | 4/11/2022 | SD | Normal | <10 | 71 | 3076 | 3147 | 0.44 | <0.01 | 0.89 | 9.1 | 12 | 18 | 5.7 | 7 | 11 | 1.8 | 14 | 0.25 | 7.2 | 0.041 | 3.9 | 13 | 18 | 18 | 0.057 | 0.036 |
| LF_Sed_3 | LF_SED_3 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 3039 | 3039 | 5.7 | 0.047 | 19 | 84 | 130 | 170 | 55 | 70 | 100 | 15 | 140 | 3.9 | 76 | 0.43 | 56 | 140 | 190 | 190 | 0.2 | 0.14 |
| LF_Sed_4 | LF_SED_4 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 172 | 172 | 0.072 | <0.01 | 0.22 | 2.1 | 4.2 | 4.8 | 1.6 | 2.1 | 2.2 | 0.44 | 3.2 | 0.035 | 2.4 | <0.01 | 0.75 | 3.2 | 5.8 | 5.8 | <0.01 | <0.01 |
| LF_Sed_4 | LF_SED_4 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 43 | <50 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.022 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | 0.03 | <0.01 | <0.01 |
| LF_Sed_5 | LF_SED_5 | 0.1 | 4/11/2022 | SD | Normal | <38 | 94 | 19,268 | 19,362 | 2.1 | <0.044 | 0.22 | 1.4 | 2.8 | 3.4 | 1.2 | 1.4 | 1.9 | <0.044 | 2.1 | 0.37 | 1.7 | <0.044 | 0.54 | 2.3 | 3.7 | 3.7 | <0.044 | <0.044 |
| LF_Sed_5 | LF_SED_5 | 0.3 | 4/11/2022 | SD | Normal | <32 | 90 | 3060 | 3151 | 0.43 | <0.037 | 0.048 | 0.11 | 0.22 | 0.3 | 0.068 | <0.037 | 0.17 | <0.037 | <0.037 | 0.049 | <0.037 | 0.045 | 0.046 | 0.17 | 0.27 | 0.31 | 0.046 | <0.037 |
| LF_Sed_6 | LF_SED_6 | 0.1 | 4/11/2022 | SD | Normal | <17 | 60 | 10,193 | 10,253 | 0.95 | 0.037 | 1.3 | 19 | 38 | 44 | 15 | 17 | 20 | 4.5 | 18 | 0.41 | 22 | 0.09 | 4.3 | 18 | 52 | 52 | 0.083 | 0.04 |
| LF_Sed_6 | LF_SED_6 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 886 | 886 | 0.037 | <0.01 | 0.054 | 0.72 | 1.3 | 1.5 | 0.49 | 0.49 | 0.72 | 0.12 | 0.68 | 0.019 | 0.62 | <0.01 | 0.17 | 0.68 | 1.7 | 1.7 | <0.01 | <0.01 |
| LF_Sed_7 | LF_SED_7 | 0.1 | 4/11/2022 | SD | Normal | <20 | <31 | 2163 | 2163 | <0.028 | <0.028 | <0.028 | 0.22 | 0.3 | 0.47 | 0.14 | <0.028 | 0.27 | 0.056 | 0.3 | <0.028 | <0.028 | <0.028 | 0.11 | 0.29 | 0.45 | 0.45 | <0.028 | <0.028 |
| LF_Sed_7 | LF_SED_7 | 0.3 | 4/11/2022 | SD | Normal | <24 | <38 | 1731 | 1731 | <0.032 | <0.032 | 0.034 | 0.39 | 0.6 | 0.78 | 0.24 | <0.032 | 0.41 | <0.032 | 0.48 | <0.032 | <0.032 | <0.032 | 0.15 | 0.47 | 0.75 | 0.78 | <0.032 | <0.032 |
| LF_Sed_8 | LF_SED_8 | 0.1 | 4/11/2022 | SD | Normal | <15 | <24 | 2076 | 2076 | 0.28 | <0.023 | 0.48 | 5.1 | 9.5 | 11 | 3.7 | 3.8 | 5.5 | 0.96 | 7.2 | 0.11 | 5 | 0.047 | 1.8 | 7.4 | 13 | 13 | <0.023 | <0.023 |
| LF_Sed_8 | LF_SED_8 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 422 | 422 | <0.01 | <0.01 | <0.01 | <0.02 | 0.013 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | 0.01 | 0.03 | <0.01 | <0.01 |
| LF_Sed_9 | LF_SED_9 | 0.1 | 4/11/2022 | SD | Normal | <10 | <15 | 829 | 829 | 0.65 | 0.013 | 1.1 | 13 | 19 | 20 | 9.9 | 14 | 16 | 3.5 | 19 | 0.27 | 14 | 0.034 | 4.9 | 18 | 29 | 29 | 0.033 | 0.02 |
| LF_Sed_9 | LF_SED_9 | 0.3 | 4/11/2022 | SD | Normal | <10 | <15 | 130 | 130 | 0.051 | <0.01 | 0.086 | 0.72 | 1.3 | 1.6 | 0.54 | 0.67 | 0.84 | 0.15 | 1 | 0.027 | 0.77 | <0.01 | 0.35 | 0.99 | 1.9 | 1.9 | <0.01 | <0.01 |

**Notes**

[1] Polycyclic aromatic hydrocarbons, including the 18 parent PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, benz[a]anthracene, chrysene, benzo[a]pyrene, perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]pyrene, benzo[ghi]perylene, dibenz[a,h]anthracene and indeno[1,2,3-cd]pyrene.

[2] Includes nitrate, nitrite, ammonia and phosphorus

[3] Bioaccumulation and secondary poisoning effects should be considered for this toxicant, based on data presented by ANZG (2018) and/or US EPA (2000).

NA - indicates appropriate published criteria not available

**References**

ANZG (2018) Australia and New Zealand guidelines for fresh and marine water quality

US EPA (2000) Bioaccumulation Testing And Interpretation For The Purpose Of Sediment Quality Assessment

US EPA (2006) EPA Region III BTAG Marine screening benchmarks 7/2006

# Appendix C
## Table C4
## NZAS Landfill Soil Ecological Screening Values

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | | | | | Nutrients | | | | Organic Indicators |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Calcium | Magnesium | Potassium | Sodium | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Total Organic Carbon |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | % |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 12.5 | 5 | 5 | 125 | 3 | 2.9 | 5 | 2.4 | 1 | 2 | 0.1 |
| ECOSGV - Commercial | | | | | | | | | | | | | | | | | | | | | |
| ECOSGV - Recreational | | | | | | | | | | | | | | | | | | | | | |
| ECOSGV - Commercial - Indirect | | | | | | | | | | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | |
| ECOSSL - Commercial | | | | | | | | | | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | | |
| EIL - Commercial | | | | | | | | | | | | | | | | | | | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | |
| SQG - Comercial | | | | | | 2000 | | 6-8 | 8 | | | | | | | | | | | | |
| SQG - Recreational | | | | | | 400 | | 6-8 | 0.9 | | | | | | | | | | | | |
| SQG - Commercial Indirect | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | |
| EHS-S1 | EHS_S1 | 0-0.1 | 29/11/2022 | HA | Normal | 110 | 6 | 6 | - | <0.2 | 142,000 | 1280 | 120 | 1800 | <3 | <3 | 5.12 | <2.5 | <1 | - | 0.45 |
| EHS-Dup 1 | EHS_S1 | 0-0.1 | 29/11/2022 | HA | Field_D | 83 | 6 | - | - | <0.2 | - | - | - | - | <3 | <3 | <5 | <2.5 | <1 | - | - |
| EHS-S10 | EHS_S10 | 0-0.1 | 29/11/2022 | HA | Normal | 160 | 5 | 6.1 | - | <0.2 | 69,100 | 652 | 58 | 810 | 5.2 | <3.2 | <5 | <2.6 | <1 | - | <0.2 |
| EHS-Dup 2 | EHS_S10 | 0-0.1 | 29/11/2022 | HA | Field_D | 67 | 5 | - | - | <0.2 | - | - | - | - | <3 | <3 | <5 | <2.5 | <1 | - | - |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 600 | 5 | 5.5 | <0.2 | <0.2 | 3530 | 7590 | 350 | 150 | 16.5 | <3 | <5 | <2.5 | <1 | - | 2.1 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 260 | 8 | 4.6 | <0.2 | <0.2 | 2030 | 972 | 200 | <130 | 14.9 | <3.1 | 5.82 | <2.6 | <1 | - | 3.3 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 1000 | 12 | 5.1 | <0.2 | 0.89 | 3120 | 1860 | 270 | 200 | 20.7 | <3.2 | 14.8 | 6.38 | 1.36 | <2.1 | 8.2 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 470 | 6 | 6.4 | <0.2 | <0.2 | 11,700 | 3050 | 290 | 230 | 11.1 | <3.2 | <5 | <2.7 | <1 | <2 | 2.7 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | 990 | 9 | 6.3 | <0.2 | 0.22 | 14,100 | 2630 | 240 | 260 | 21.7 | <3.1 | <5 | <2.6 | <1 | <2 | - |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 1200 | 7 | 6.8 | <0.2 | <0.2 | 20,800 | 9850 | 240 | 390 | 32.1 | <3.2 | 5.33 | <2.7 | <1 | <2 | 5.1 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 1100 | 9 | 7.1 | <0.03 | <0.2 | 22,100 | 1450 | 240 | 420 | 5.8 | <3 | <5 | <2.5 | <1 | <2 | 8.7 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | 340 | 19 | 7 | <0.2 | 0.42 | 11,500 | 1770 | 300 | 220 | 19.3 | <2.9 | 6.52 | <2.4 | <1 | 4.87 | 2.2 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 200 | 56 | 3.5 | - | <0.4 | 560 | 250 | 140 | 420 | 238.1 | 26.6 | 5.4 | <2.6 | <1 | - | 4.2 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | 120 | 58 | - | - | <0.5 | - | - | - | - | 225.5 | 23.8 | 5.62 | <2.6 | <1 | - | - |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 200 | 86 | 3.3 | - | 1.8 | 1100 | 935 | 140 | 750 | 289.7 | 11.6 | 14.5 | <2.6 | <1 | - | 14 |
| EHS-S2 | EHS_S2 | 0-0.1 | 29/11/2022 | HA | Normal | 110 | 7 | 6.7 | - | <0.2 | 156,000 | 1440 | 140 | 1500 | 13.7 | <3.1 | <5 | <2.6 | <1 | - | <0.2 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 170 | 36 | 3.7 | - | 1.3 | 670 | 260 | 210 | 560 | 310.6 | 15.2 | 16.3 | <2.7 | <1 | - | 7.1 |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
CCME (1991) Interim Canadian environmental quality criteria for contaminated sites (SQG)
ASC NEPM (2013) - National Envionmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
# Table C4
# NZAS Landfill Soil Ecological Screening Values

| | | | | | | Metals | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Aluminium | Antimony | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Chromium (Trivalent) | Cobalt | Copper | Iron | Lead | Lithium | Manganese | Mercury | Molybdenum | Nickel | Titanium | Tin | Vanadium | Zinc |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 2.5 | 0.025 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.125 | 0.025 | 0.125 | 0.05 | 0.075 | 0.25 | 0.125 | 0.05 |
| ECOSGV - Commercial | | | | | | | | 147 | | | 15 | 40 | | 130 | 659 | | 618 | | 3057 | | | | | | | | | 488 |
| ECOSGV - Recreational | | | | | | | | 58 | | | 15 | 17 | | 130 | 402 | | 430 | | 1284 | | | | | | | | | 298 |
| ECOSGV - Commercial - Indirect | | | | | | | | | | | | 33 | | | | | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | 12 | | | | | | | | | | | | | | | | |
| ECOSSL - Commercial | | | | | | | | | | 40 | | | | | | 13/120/230 | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | 21 | | | | | | 0.5217391 | | | | | | | | | | | | |
| EIL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | 460 | | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | | | | 270 | | | | |
| SQG - Comercial | | | | | | | | | 2000 | | | | | | | | | | | | | 50 | | | | | 130 | |
| SQG - Recreational | | | | | | | | | 500 | | | | | | | | | | | | | 12 | | | | | 130 | |
| SQG - Commercial Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | |
| EHS-S1 | EHS_S1 | 0-0.1 | 29/11/2022 | HA | Normal | 2430 | - | 12 | 5.23 | 0.079 | 1.5 | 0.02 | 3.1 | - | - | 1.5 | 1.5 | 5480 | 1.2 | 3 | 83.9 | <0.025 | - | 2.5 | 204 | - | 15.7 | 6.22 |
| EHS-Dup 1 | EHS_S1 | 0-0.1 | 29/11/2022 | HA | Field_D | 1780 | - | 7.8 | 3.5 | 0.06 | <1.3 | 0.012 | 2.6 | - | - | 1.1 | 1 | 4050 | 0.83 | 2.3 | - | <0.025 | - | 1.8 | 140 | - | 11 | 4.7 |
| EHS-S10 | EHS_S10 | 0-0.1 | 29/11/2022 | HA | Normal | 965 | - | 6.1 | 2.4 | 0.029 | <1.3 | 0.011 | 1.4 | - | - | 0.68 | 0.61 | 2430 | 0.6 | 1.5 | 38.6 | <0.025 | - | 1.1 | 78.6 | - | 6.5 | 2.7 |
| EHS-Dup 2 | EHS_S10 | 0-0.1 | 29/11/2022 | HA | Field_D | 2440 | - | 12 | 4.5 | 0.084 | 1.6 | 0.025 | 3.3 | - | - | 1.6 | 1.5 | 5490 | 1.5 | 3.64 | - | <0.025 | - | 2.6 | 209 | - | 15.1 | 6.55 |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | 8910 | 0.075 | 4.4 | 16.1 | 0.22 | 1.9 | 0.091 | 8.8 | <0.4 | 8.81 | 5.83 | 6.5 | 9740 | 6.62 | 6.14 | 159 | <0.025 | 0.2 | 41.3 | 439 | 0.4 | 24.5 | 50.6 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | 3910 | 0.045 | 8.3 | 5.69 | 0.11 | <1.3 | 0.043 | 4.1 | <0.5 | 4.11 | 1.4 | 1.4 | 6350 | 2.8 | 2 | 91.6 | <0.025 | 0.21 | 3.3 | 270 | <0.25 | 22.6 | 9.39 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 16,100 | - | 4 | 12 | 0.28 | 10 | 0.13 | 6.6 | - | - | 1.8 | 8.22 | 5500 | 5 | 4.5 | 252 | <0.025 | - | 10.4 | 325 | - | 63.5 | 32.8 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | 7720 | - | 6.1 | 9.44 | 0.2 | 2 | 0.074 | 6.4 | - | - | 2.91 | 10.6 | 7350 | 8.15 | 5.88 | 125 | <0.025 | - | 17.8 | 334 | - | 27.1 | 20.5 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | 6330 | - | 6.1 | 8.5 | 0.17 | 4.1 | 0.082 | 6.1 | - | - | 2.84 | 9.68 | 7440 | 7.09 | 5.68 | 117 | <0.025 | - | 13.8 | 245 | - | 25.3 | 19.9 |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | 8730 | - | 7.6 | 7.66 | 0.23 | 1.3 | 0.092 | 8.5 | - | - | 6.26 | 5.8 | 8860 | 3.9 | 4.83 | 169 | <0.025 | - | 62.9 | 316 | - | 25.4 | 21.2 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | 6840 | - | 9.8 | 6.87 | 0.21 | 1.7 | 0.31 | 5.2 | - | - | 2 | 4.3 | 6860 | 2.2 | 3.96 | 186 | 0.042 | - | 10.8 | 290 | - | 22.9 | 15.1 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | 7860 | - | 6.5 | 14.7 | 0.18 | 3.4 | 0.058 | 6.7 | - | - | 2.54 | 5.2 | 8210 | 3.8 | 6.26 | 117 | <0.025 | - | 7.06 | 378 | - | 27 | 17.4 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | 917 | - | 0.51 | 2.5 | 0.021 | <1.3 | 0.005 | 1.5 | - | - | 0.12 | 0.59 | 490 | 1.2 | 0.3 | 5.8 | 0.027 | - | 0.87 | 104 | - | 2.7 | 2.2 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | 860 | - | 0.46 | 2.2 | 0.023 | <1.3 | <0.005 | 1.7 | - | - | 0.075 | 0.35 | 390 | 1 | 0.29 | - | <0.025 | - | 0.63 | 98.3 | - | 2.3 | 0.95 |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 1840 | - | 0.55 | 3.37 | 0.019 | 2.1 | 0.012 | 4 | - | - | 0.15 | 1.2 | 880 | 3.9 | 0.08 | 3 | 0.041 | - | 3.6 | 29.3 | - | 3.3 | 3.8 |
| EHS-S2 | EHS_S2 | 0-0.1 | 29/11/2022 | HA | Normal | 2390 | - | 12 | 5.34 | 0.088 | <1.3 | 0.017 | 2.9 | - | - | 1.4 | 1.4 | 5150 | 1.3 | 3.29 | 78 | <0.025 | - | 3 | 183 | - | 14.9 | 6.23 |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | 2270 | - | 0.9 | 3.87 | 0.035 | 1.4 | 0.018 | 1.6 | - | - | 0.22 | 0.73 | 1320 | 2 | 0.49 | 9.2 | <0.025 | - | 0.83 | 69.4 | - | 4.8 | 1.5 |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
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ASC NEPM (2013) - National Envionmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

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where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
## Table C4
## NZAS Landfill Soil Ecological Screening Values

| | | | | | | PAHs - standard 16 | | | | | | | | | | | | | | | | | | PAHs - extended | | SVOCs | Phthalates |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | Benzo(b)fluoranthene | Dibenzofuran | Bis(2-ethylhexyl) phthalate |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 | 0.1 | 0.3 | 0.5 |
| ECOSGV - Commercial | | | | | | | | | | 47 | | | | | | | | | | | | | | | | | |
| ECOSGV - Recreational | | | | | | | | | | 22 | | | | | | | | | | | | | | | | | |
| ECOSGV - Commercial - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSSL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EIL - Commercial | | | | | | | | | | | | | | | | | | | 370 | | | 47 | 47 | | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | 170 | | | 22 | 22 | | | | |
| SQG - Comercial | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Commercial Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | |
| EHS-S1 | EHS_S1 | 0-0.1 | 29/11/2022 | HA | Normal | <0.01 | <0.01 | <0.01 | 0.059 | 0.095 | 0.1 | 0.032 | 0.036 | 0.063 | <0.01 | 0.093 | <0.01 | 0.043 | <0.01 | 0.026 | 0.088 | 0.12 | 0.13 | <0.01 | - | - | - |
| EHS-Dup 1 | EHS_S1 | 0-0.1 | 29/11/2022 | HA | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS-S10 | EHS_S10 | 0-0.1 | 29/11/2022 | HA | Normal | <0.01 | <0.01 | <0.01 | 0.038 | 0.067 | 0.072 | 0.022 | 0.027 | 0.048 | <0.01 | 0.077 | <0.01 | 0.034 | <0.01 | 0.023 | 0.075 | 0.09 | 0.1 | <0.01 | - | - | - |
| EHS-Dup 2 | EHS_S10 | 0-0.1 | 29/11/2022 | HA | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_S11 | EHS_S11 | 0-0.3 | 30/11/2022 | HA | Normal | <0.01 | <0.01 | <0.1 - 0.025 | 0.13 - 0.45 | 0.17 - 0.73 | 0.23 | 0.083 - 0.28 | 0.12 - 0.49 | 0.21 - 0.4 | 0.016 - 0.1 | 0.32 - 0.67 | <0.01 | 0.089 - 0.57 | <0.01 | 0.094 - 0.21 | 0.32 - 0.64 | 0.24 - 1.1 | 0.24 - 1.1 | <0.01 | 0.85 | <0.3 | <0.5 |
| EHS_S12 | EHS_S12 | 0-0.3 | 30/11/2022 | HA | Normal | <0.1 - 0.021 | <0.01 | 0.058 - 0.1 | 0.32 - 0.94 | 0.41 - 1.4 | 0.54 | 0.22 - 0.47 | 0.28 - 0.88 | 0.48 - 1 | 0.043 - 0.19 | 0.75 - 1.2 | <0.01 | 0.24 - 1.1 | <0.01 | 0.22 - 0.33 | 0.76 - 1.2 | 0.6 - 2 | 0.6 - 2 | <0.01 | 1.7 | <0.3 | <0.5 |
| EHS_S13 | EHS_S13 | 0-0.3 | 2/12/2022 | HA | Normal | 0.053 - 0.19 | <0.01 | 0.17 - 2.6 | 1.8 - 20 | 2.5 - 20 | 3.2 | 1 - 20 | 1.5 - 19 | 1.7 - 20 | 0.34 - 8.5 | <0.1 - 2.2 | 0.029 - 0.16 | 1.8 - 20 | <0.01 | 0.54 - 16 | <0.2 - 2.1 | 3.7 - 37 | 3.7 - 37 | <0.01 | >20 | <0.3 | <0.5 |
| EHS_S14 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Normal | <0.1 - 0.068 | <0.01 | 0.13 - 0.15 | 1.2 - 1.6 | 2 - 2.3 | 2.4 | 0.78 - 0.86 | 1.2 - 1.5 | 1.1 - 1.3 | 0.31 - 0.36 | 1.5 - 1.8 | <0.1 - 0.029 | 1.5 - 1.9 | <0.01 | 0.42 - 0.5 | 1.4 - 1.7 | 2.9 - 3.3 | 2.9 - 3.3 | <0.01 | 2.4 | <0.3 | <0.5 |
| EHS_DUP8 | EHS_S14 | 0-0.3 | 2/12/2022 | HA | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS_S15 | EHS_S15 | 0-0.3 | 2/12/2022 | HA | Normal | <0.1 - 0.05 | <0.01 | <0.1 - 0.11 | 0.49 - 1 | 0.83 - 1.3 | 1.6 | <0.1 - 0.56 | 0.57 - 0.85 | 0.56 - 0.95 | 0.12 - 0.21 | 0.65 - 1.2 | <0.1 - 0.026 | 0.58 - 1.1 | <0.01 | 0.23 - 0.37 | 0.61 - 1.2 | 1.2 - 2 | 1.2 - 2 | <0.01 | 1.1 | <0.3 | <0.5 |
| EHS_S16 | EHS_S16 | 0-0.3 | 2/12/2022 | HA | Normal | <0.1 - 0.011 | <0.01 | <0.1 - 0.026 | 0.24 - 0.38 | 0.33 - 0.66 | 0.4 | 0.13 - 0.28 | 0.21 - 0.44 | 0.21 - 0.42 | <0.1 - 0.055 | 0.29 - 0.55 | <0.01 | 0.27 - 0.55 | <0.01 | 0.098 - 0.16 | 0.26 - 0.51 | 0.5 - 0.9 | 0.5 - 1 | <0.01 | 1.1 | <0.3 | <0.5 |
| EHS_S17 | EHS_S17 | 0-0.3 | 2/12/2022 | HA | Normal | <0.1 - 0.011 | <0.01 | <0.1 - 0.025 | 0.13 - 0.27 | 0.18 - 0.41 | 0.49 | <0.1 - 0.17 | 0.15 - 0.27 | 0.14 - 0.27 | <0.1 - 0.062 | 0.18 - 0.34 | <0.01 | 0.12 - 0.33 | <0.01 | <0.1 - 0.097 | <0.2 - 0.32 | 0.2 - 0.61 | 0.3 - 0.61 | <0.01 | 0.33 | <0.3 | <0.5 |
| EHS-S18 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Normal | <0.1 - 0.012 | <0.01 | 0.029 - 0.1 | 0.19 - 0.29 | 0.25 - 0.45 | 0.26 | 0.093 - 0.26 | <0.1 - 0.074 | 0.17 - 0.21 | 0.019 - 0.43 | 0.36 - 0.39 | <0.01 | 0.1 - 0.52 | <0.01 | 0.12 - 0.15 | 0.35 - 0.37 | 0.34 - 1 | 0.34 - 1 | <0.01 | 0.56 | <0.3 | 0.5 |
| EHS-Dup 3 | EHS_S18 | 0-0.1 | 29/11/2022 | HA | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| EHS-S19 | EHS_S19 | 0-0.1 | 29/11/2022 | HA | Normal | 0.26 - 0.27 | <0.026 | 0.47 - 0.48 | 3.5 - 3.9 | 5.1 - 5.4 | 5.7 | 2 - 2.2 | 1.6 - 2.6 | 3.5 - 4.3 | 0.47 - 1.8 | 3.8 - 6.1 | 0.13 - 0.28 | 2.2 - 4.5 | <0.24 - 0.03 | 1.5 - 1.9 | 3.5 - 5.8 | 7.4 - 8.8 | 7.4 - 8.8 | <0.026 | 7.4 | 0.34 | 1.5 |
| EHS-S2 | EHS_S2 | 0-0.1 | 29/11/2022 | HA | Normal | <0.01 | <0.01 | <0.01 | 0.08 | 0.13 | 0.14 | 0.041 | 0.047 | 0.088 | 0.011 | 0.12 | <0.01 | 0.056 | <0.01 | 0.038 | 0.12 | 0.17 | 0.17 | <0.01 | - | - | - |
| EHS-S20 | EHS_S20 | 0-0.1 | 29/11/2022 | HA | Normal | <0.1 - 0.042 | <0.01 | 0.1 - 0.12 | 0.67 - 0.72 | 1.1 - 1.2 | 1.1 | 0.37 - 0.43 | 0.35 - 0.62 | 0.57 - 0.76 | <0.1 - 0.077 | 0.91 - 1.3 | <0.1 - 0.018 | 0.44 - 1 | <0.01 | 0.28 - 0.37 | 0.87 - 1.3 | 1.5 | 1.5 - 1.6 | <0.01 | 1.3 | <0.3 | <0.5 |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
CCME (1991) Interim Canadian environmental quality criteria for contaminated sites (SQG)
ASC NEPM (2013) - National Envionmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
## Table C4
## NZAS Landfill Soil Ecological Screening Values

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | Nutrients | | | | Metals | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Aluminium | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Cobalt | Copper | Iron | Lead | Lithium | Mercury | Nickel | Titanium | Vanadium | Zinc |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 3 | 2.9 | 5 | 2.5 | 1 | 2 | 2.5 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.025 | 0.05 | 0.075 | 0.125 | 0.05 |
| ECOSGV - Commercial | | | | | | | | | | | | | | | | | | 147 | | | 15 | 40 | 659 | 130 | | 618 | | 3057 | | | | | | 488 |
| ECOSGV - Recreational | | | | | | | | | | | | | | | | | | 58 | | | 15 | 17 | 402 | 130 | | 430 | | 1284 | | | | | | 298 |
| ECOSGV - Commercial - Indirect | | | | | | | | | | | | | | | | | | | | | | 33 | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | 12 | | | | | | | | | | | | |
| ECOSSL - Commercial | | | | | | | | | | | | | | | | | | | | 40 | | | | | 13/120/230 | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | 21 | | | | | 0.5217391 | | | | | | | | | |
| EIL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 460 | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 270 | | | |
| SQG - Comercial | | | | | | 2000 | | 6-8 | 8 | | | | | | | | | | 2000 | | | | | | | | | | | 50 | | | 130 | |
| SQG - Recreational | | | | | | 400 | | 6-8 | 0.9 | | | | | | | | | | 500 | | | | | | | | | | | 12 | | | 130 | |
| SQG - Commercial Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A19R 0-1.5m | A19R | 0-1.5 | 13/10/2022 | MW | Normal | 700 | - | 6.1 | - | <0.1 | - | - | - | - | - | - | 10,900 | 3 | - | <0.2 | <20 | <0.1 | 7 | - | - | 9 | - | 4.2 | - | <0.1 | 8 | - | <100 | 48 |
| A40D 0-2.5m | A40D | 0-2.5 | 27/10/2022 | MW | Normal | 89 | - | 6 | - | <0.1 | - | - | - | - | - | - | 4100 | 8 | - | <0.2 | <20 | <0.1 | 4 | - | - | 33 | - | 1.9 | - | <0.1 | 7 | - | <100 | 14 |
| A40D 17.5-20m | A40D | 17.5-20 | 27/10/2022 | MW | Normal | - | - | 9 | - | - | - | - | - | - | - | - | 2100 | <2 | - | <0.2 | <20 | <0.1 | 7 | - | - | 23 | - | 1.1 | - | <0.1 | 7 | - | <100 | 7 |
| A54D 1-2m | A54 | 1-2 | 12/12/2022 | MW | Normal | - | - | 8.9 | - | - | - | - | - | - | - | - | 2200 | 4 | - | <0.2 | <20 | <0.1 | 3 | - | - | <2 | - | 0.8 | - | <0.1 | <2 | - | <100 | 18 |
| A54D 4.5-5m | A54 | 4.5-5 | 12/12/2022 | MW | Normal | - | - | 9.4 | - | - | - | - | - | - | - | - | 2400 | 6 | - | <0.2 | <20 | <0.1 | 7 | - | - | 13 | - | 0.9 | - | <0.1 | 8 | - | <100 | 12 |
| A55D 7-8m | A55 | 7-8 | 15/12/2022 | MW | Normal | - | - | 9.3 | - | - | - | - | - | - | - | - | 2200 | 4 | - | <0.2 | <20 | <0.1 | 16 | - | - | 49 | - | 0.7 | - | <0.1 | 11 | - | <100 | 12 |
| A55D 2.6-3m | A55D | 2.6-3 | 15/12/2022 | MW | Normal | - | - | 9.1 | - | - | - | - | - | - | - | - | 2700 | 6 | - | <0.2 | <20 | <0.1 | 4 | - | - | <2 | - | 1.6 | - | <0.1 | 3 | - | <100 | 200 |
| A5AR 1-2m | A5AR | 1-2 | 8/12/2022 | MW | Normal | 12,200 | - | 7.6 | - | <0.1 | - | - | - | - | - | - | 22,000 | 3 | - | 0.7 | <20 | 0.18 | 24 | - | - | 39 | - | 9.5 | - | <0.1 | 34 | - | <100 | 121 |
| A5AR 8-8.6m | A5AR | 8-8.6 | 8/12/2022 | MW | Normal | 300 | - | 8.1 | - | <0.1 | - | - | - | - | - | - | 3900 | 4 | - | <0.2 | <20 | <0.1 | 6 | - | - | 4 | - | 1.4 | - | <0.1 | 5 | - | <100 | 29 |
| A60 0-3m | A60 | 0-3 | 10/10/2022 | MW | Normal | - | - | 5.9 | - | - | - | - | - | - | - | - | 3700 | 6 | - | <0.2 | <20 | <0.1 | 13 | - | - | 2 | - | 1.4 | - | <0.1 | 11 | - | <100 | 12 |
| A60 4.5-6m | A60 | 4.5-6 | 10/10/2022 | MW | Normal | - | - | 6 | - | - | - | - | - | - | - | - | 3600 | 5 | - | <0.2 | <20 | <0.1 | 10 | - | - | 2 | - | 1.3 | - | <0.1 | 8 | - | <100 | 12 |
| A61 0-3m | A61 | 0-3 | 10/10/2022 | MW | Normal | 89 | - | 7.8 | - | <0.1 | - | - | - | - | - | - | 5400 | <2 | - | <0.2 | <20 | <0.1 | 33 | - | - | 5 | - | 1.4 | - | <0.1 | 210 | - | <100 | 13 |
| A61 3-4.5m | A61 | 3-4.5 | 10/10/2022 | MW | Normal | 86 | - | 7.5 | - | <0.1 | - | - | - | - | - | - | 4600 | 2 | - | <0.2 | <20 | <0.1 | 10 | - | - | 4 | - | 1 | - | <0.1 | 50 | - | <100 | 11 |
| A63 2.0-3.0m | A63 | 2-3 | 26/10/2022 | MW | Normal | 106 | - | 6.8 | - | <0.1 | - | - | - | - | - | - | 15,800 | 2 | - | 0.3 | <20 | <0.1 | 19 | - | - | 86 | - | 0.7 | - | <0.1 | 18 | - | 360 | 80 |
| A64D 5.5-4.8m | A64D | 4.8-5.5 | 3/10/2022 | MW | Normal | - | - | 8 | - | - | - | - | - | - | - | - | 3900 | <2 | - | <0.2 | <20 | <0.1 | 4 | - | - | 75 | - | 0.7 | - | <0.1 | 3 | - | <100 | 18 |
| A65 3.0-4.5m | A65 | 3-4.5 | 26/10/2022 | MW | Normal | - | - | 8.3 | - | - | - | - | - | - | - | - | 3200 | 5 | - | <0.2 | <20 | <0.1 | 6 | - | - | 4 | - | 1.3 | - | <0.1 | 11 | - | <100 | 10 |
| A66 0-1.5m | A66 | 0-1.5 | 26/10/2022 | MW | Normal | - | - | 7.3 | - | - | - | - | - | - | - | - | 3600 | 4 | - | <0.2 | <20 | <0.1 | 17 | - | - | 4 | - | 7.6 | - | <0.1 | 74 | - | <100 | 12 |
| A66 4.5-6.0m | A66 | 4.5-6 | 26/10/2022 | MW | Normal | - | - | 8.3 | - | - | - | - | - | - | - | - | 3400 | 9 | - | <0.2 | <20 | <0.1 | 5 | - | - | 2 | - | 1.3 | - | <0.1 | 4 | - | <100 | 10 |
| A67 0-1.5m | A67 | 0-1.5 | 26/10/2022 | MW | Normal | 185 | - | 6 | - | <0.1 | - | - | - | - | - | - | 5600 | 9 | - | <0.2 | <20 | <0.1 | 6 | - | - | <2 | - | 1.8 | - | <0.1 | 9 | - | <100 | 10 |
| A67 5.5-6.0m | A67 | 5.5-6 | 26/10/2022 | MW | Normal | 109 | - | 7.3 | - | <0.1 | - | - | - | - | - | - | 3200 | 6 | - | <0.2 | <20 | <0.1 | 4 | - | - | <2 | - | 1.2 | - | <0.1 | 3 | - | <100 | 10 |
| A70S 1-2m | A70 | 1-2 | 13/12/2022 | MW | Normal | - | - | 8.7 | - | - | - | - | - | - | - | - | 2400 | 6 | - | <0.2 | <20 | 0.16 | 4 | - | - | <2 | - | 1 | - | <0.1 | 4 | - | <100 | 11 |
| A70S 4-5m | A70 | 4-5 | 13/12/2022 | MW | Normal | - | - | 8.4 | - | - | - | - | - | - | - | - | 2100 | 5 | - | <0.2 | <20 | <0.1 | 4 | - | - | 2 | - | 1 | - | <0.1 | 3 | - | <100 | 8 |
| A70D 6-7m | A70D | 6-7 | 12/12/2022 | MW | Normal | - | - | 8.5 | - | - | - | - | - | - | - | - | 3100 | 2 | - | <0.2 | <20 | <0.1 | 6 | - | - | 2 | - | 1.1 | - | <0.1 | 4 | - | <100 | 13 |
| A70D 2-2.4m | A70D | 2-2.4 | 12/12/2022 | MW | Normal | - | - | 9.2 | - | - | - | - | - | - | - | - | 1620 | 4 | - | <0.2 | <20 | <0.1 | 3 | - | - | <2 | - | 0.7 | - | <0.1 | 4 | - | <100 | 7 |
| A71S 1-2m | A71 | 1-2 | 16/12/2022 | MW | Normal | - | - | 8.3 | - | - | - | - | - | - | - | - | 2600 | 3 | - | <0.2 | <20 | <0.1 | 6 | - | - | 2 | - | 1.1 | - | <0.1 | 10 | - | <100 | 13 |
| A71S 5.6-6m | A71 | 5.6-6 | 16/12/2022 | MW | Normal | - | - | 9 | - | - | - | - | - | - | - | - | 2600 | 4 | - | <0.2 | <20 | <0.1 | 5 | - | - | 2 | - | 0.9 | - | <0.1 | 5 | - | <100 | 15 |
| A71D 3-4m | A71D | 3-4 | 14/12/2022 | MW | Normal | - | - | 8.6 | - | - | - | - | - | - | - | - | 2800 | 4 | - | <0.2 | <20 | <0.1 | 5 | - | - | <2 | - | 0.9 | - | <0.1 | 6 | - | <100 | 14 |
| A71D 11-12m | A71D | 11-12 | 14/12/2022 | MW | Normal | - | - | 8.7 | - | - | - | - | - | - | - | - | 3100 | 6 | - | <0.2 | <20 | <0.1 | 5 | - | - | 2 | - | 1.1 | - | <0.1 | 4 | - | <100 | 11 |
| A7R 1-2m | A7R | 1-2 | 8/12/2022 | MW | Normal | 3700 | - | 6.2 | - | <0.1 | - | - | - | - | - | - | 26,000 | 6 | - | 0.2 | 25 | <0.1 | 6 | - | - | 5 | - | 3.4 | - | <0.1 | 5 | - | <100 | 12 |
| A7R 6.2-7m | A7R | 6.2-7 | 8/12/2022 | MW | Normal | 260 | - | 8.3 | - | <0.1 | - | - | - | - | - | - | 8100 | 3 | - | <0.2 | <20 | <0.1 | 3 | - | - | 60 | - | 0.7 | - | <0.1 | 5 | - | <100 | 34 |
| CIR 1-2m | C1R | 1-2 | 5/12/2022 | MW | Normal | 18,600 | - | 7.8 | - | <0.1 | - | - | - | - | - | - | 8800 | 4 | - | 0.2 | <20 | <0.1 | 5 | - | - | 3 | - | 2.5 | - | <0.1 | 11 | - | <100 | 22 |
| CIR 5-6m | C1R | 5-6 | 5/12/2022 | MW | Normal | 370 | - | 7.5 | - | <0.1 | - | - | - | - | - | - | 4200 | <2 | - | <0.2 | <20 | <0.1 | 6 | - | - | 3 | - | 1.5 | - | <0.1 | 4 | - | <100 | 13 |
| C3R 2-3m | C3R | 2-3 | 6/12/2022 | MW | Normal | 9300 | - | 7.7 | - | 1.33 | - | - | - | - | - | - | 51,000 | 5 | - | 1.3 | 51 | 0.31 | 156 | - | - | 97 | - | 15.3 | - | <0.1 | 62 | - | 164 | 115 |
| C3R 8-9m | C3R | 8-9 | 6/12/2022 | MW | Normal | 6000 | - | 8 | - | 0.15 | - | - | - | - | - | - | 14,400 | 3 | - | 0.4 | <20 | <0.1 | 8 | - | - | 6 | - | 3 | - | <0.1 | 14 | - | <100 | 111 |

**References**
Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
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**Notes**
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where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | Nutrients | | | | Metals | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Aluminium | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Cobalt | Copper | Iron | Lead | Lithium | Mercury | Nickel | Titanium | Vanadium | Zinc |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 3 | 2.9 | 5 | 2.5 | 1 | 2 | 2.5 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.025 | 0.05 | 0.075 | 0.125 | 0.05 |
| ECOSGV - Commercial | | | | | | | | | | | | | | | | | | 147 | | | 15 | 40 | 659 | 130 | | 618 | | 3057 | | | | | | 488 |
| ECOSGV - Recreational | | | | | | | | | | | | | | | | | | 58 | | | 15 | 17 | 402 | 130 | | 430 | | 1284 | | | | | | 298 |
| ECOSGV - Commercial - Indirect | | | | | | | | | | | | | | | | | | | | | | 33 | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | 12 | | | | | | | | | | | | |
| ECOSSL - Commercial | | | | | | | | | | | | | | | | | | | | 40 | | | | | 13/120/230 | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | 21 | | | | | 0.5217391 | | | | | | | | | |
| EIL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 460 | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 270 | | | |
| SQG - Comercial | | | | | | 2000 | | 6-8 | 8 | | | | | | | | | | 2000 | | | | | | | | | | | 50 | | | 130 | |
| SQG - Recreational | | | | | | 400 | | 6-8 | 0.9 | | | | | | | | | | 500 | | | | | | | | | | | 12 | | | 130 | |
| SQG - Commercial Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TP1 0.2 | LF_TP_1 | 0.2 | 7/06/2022 | TP | Normal | 5400 | 13 | - | <0.03 | <0.3 | 13.2 | 8 | <5 | <2.6 | <1 | <2 | 32,900 | 19.5 | 62.1 | 1 | 20 | 1.98 | 33.8 | <0.5 | 6.76 | 578 | 19,500 | 67.9 | 15.3 | 0.045 | 133 | 440 | 135 | 317 |
| TP1 2.0 | LF_TP_1 | 2 | 7/06/2022 | TP | Normal | 610 - 1100 | 16 - 17 | - | <0.03 | <0.2 | 5.6 - 6.1 | <3 | <5 | <2.5 | <1 | <2 | 5430 - 6830 | 8.4 - 10 | 10.5 - 10.9 | 0.18 - 0.19 | 3.1 - 4.6 | 0.09 - 0.12 | 8.2 - 8.4 | <0.5 | 1.8 - 2 | 6 - 7.67 | 6750 - 7170 | 2.4 - 3.6 | 8.37 - 8.76 | <0.025 | 6.54 - 7.88 | 399 - 462 | 51.7 - 55.8 | 24.3 - 28.2 |
| TP1 3.0 | LF_TP_1 | 3 | 7/06/2022 | TP | Normal | 1800 | 19 | - | <0.03 | <0.2 | 14.9 | 5.3 | <5 | <2.5 | <1 | <2 | 11,700 | 16.7 | 17.7 | 0.32 | 10 | 0.26 | 15.2 | <0.5 | 2.84 | 26.5 | 12,400 | 15.1 | 10.4 | <0.025 | 25.8 | 451 | 100 | 57.5 |
| TP2 0.3 | LF_TP_2 | 0.3 | 7/06/2022 | TP | Normal | 2400 | 10 | - | <0.03 | 0.7 | 10.8 | <3 | <5 | 2.51 | <1 | <2 | 25,500 | 5.9 | 13.7 | 0.39 | 26 | 0.19 | 11 | <0.4 | 2 | 22.1 | 7240 | 20.9 | 5.96 | <0.025 | 10.4 | 520 | 110 | 44.1 |
| TP2 0.8 | LF_TP_2 | 0.8 | 7/06/2022 | TP | Normal | 2700 - 4900 | 9 - 12 | - | <0.03 | 0.69 - 1.4 | 19 - 27.3 | 5.5 - 7.5 | <5 | <2.5 - 2.57 | <1 | <2 | 25,200 - 32,100 | 15 - 17.3 | 46.4 - 49.6 | 0.58 - 0.76 | 19 - 21 | 0.39 - 0.45 | 20.1 - 25.3 | <0.4 | 3.38 - 3.62 | 51.5 - 79.3 | 3,300 - 16,30 | 49.7 - 68.3 | 7.94 - 9.03 | <0.025 | 26.3 - 30.4 | 479 - 533 | 68.5 - 83.1 | 185 - 224 |
| TP2 2.0 | LF_TP_2 | 2 | 7/06/2022 | TP | Normal | 5000 | 10 | - | <0.03 | 1.5 | 25.5 | 59.1 | <5 | 5.71 | <1 | <2 | 57,800 | 10 | 29.3 | 0.66 | 51 | 0.31 | 17.7 | <0.4 | 3.27 | 51.3 | 13,400 | 28.5 | 6.88 | <0.025 | 26.9 | 512 | 214 | 139 |
| TP3 0.25 | LF_TP_3 | 0.25 | 7/06/2022 | TP | Normal | 2300 | 22 | - | <0.03 | 0.97 | 16.1 | 4.7 | 8.08 | 3.21 | <1 | <2 | 27,300 | 8 | 25.4 | 0.43 | 20 | 0.29 | 15.8 | <0.5 | 3.77 | 24.9 | 11,100 | 30.2 | 6.81 | <0.025 | 25.5 | 505 | 95.3 | 209 |
| TP3 0.65 | LF_TP_3 | 0.65 | 7/06/2022 | TP | Normal | 16,000 | 16 | - | <0.03 | <0.3 | 36 | 108.4 | <5 | 2.89 | <1 | <2 | 114,000 | 12 | 60.2 | 2.31 | 15 | 0.26 | 11 | <0.5 | 22.9 | 29.7 | 4140 | 44.3 | 5.03 | <0.025 | 1470 | 175 | 323 | 364 |
| TP3 1.4 | LF_TP_3 | 1.4 | 7/06/2022 | TP | Normal | 5900 | 8 | - | <0.03 | 41.2 | 14.5 | 32.7 | 6.98 | <2.6 | <1 | <2 | 22,500 | 6.1 | 14 | 0.5 | 43 | 0.14 | 15.9 | <0.5 | 2.54 | 10.8 | 12,200 | 5.33 | 5.89 | <0.025 | 13.4 | 493 | 146 | 226 |
| TP3 3.8 | LF_TP_3 | 3.8 | 7/06/2022 | TP | Normal | 11,000 | 13 | - | <0.03 | 6.01 | 114.4 | 102.2 | 6.46 | <2.6 | <1 | <2 | 64,200 | 16 | 33.8 | 1.58 | 210 | 0.44 | 58.6 | <0.5 | 3.88 | 47.6 | 18,000 | 23.1 | 10.2 | <0.025 | 63.7 | 558 | 342 | 136 |
| TP4 0.2 | LF_TP_4 | 0.2 | 7/06/2022 | TP | Normal | 2200 | 8 | - | <0.03 | 0.22 | 31 | 3.3 | <5 | <2.5 | <1 | <2 | 17,600 | 4.1 | 25.9 | 0.45 | 9.3 | 0.095 | 14.7 | <0.4 | 8.44 | 10.1 | 13,400 | 13.9 | 10.4 | <0.025 | 64.1 | 749 | 54.1 | 73.1 |
| TP4 0.5 | LF_TP_4 | 0.5 | 7/06/2022 | TP | Normal | 6800 | 9 | - | <0.03 | 2.16 | 36.3 | 15.4 | 13.4 | <2.6 | <1 | <2 | 29,400 | 7.1 | 27.2 | 0.67 | 49 | 0.32 | 17.3 | <0.5 | 3.48 | 33.1 | 10,700 | 97.4 | 9.19 | 0.057 | 25.9 | 671 | 159 | 70.1 |
| TP4 3.5 | LF_TP_4 | 3.5 | 7/06/2022 | TP | Normal | 12,000 | 17 | - | <0.03 | 17.4 | 66.5 | 91.9 | 6.92 | <2.6 | <1 | <2 | 81,500 | 15.2 | 51.2 | 2.55 | 228 | 0.884 | 59.9 | <0.5 | 9.01 | 602 | 31,700 | 101 | 22.5 | 0.026 | 230 | 401 | 536 | 1580 |
| LF_TP_5_0.2-0.3 | LF_TP_5 | 0.2-0.3 | 25/10/2022 | TP | Normal | - | 9 | 6.7 | - | - | - | <3.1 | <5 | - | - | - | 13,600 | 6.2 | 87.6 | 0.33 | 5.2 | 4.87 | 38.2 | - | 29.3 | 53.4 | 30,100 | 112 | 9.6 | 0.037 | 287 | 580 | 173 | 197 |
| LF_TP_5_0.9-1.0 | LF_TP_5 | 0.9-1 | 25/10/2022 | TP | Normal | - | 16 | 6.8 | - | - | - | 9.7 | <5 | - | - | - | 22,100 | 14.4 | 89.7 | 0.46 | 11 | 5.44 | 43.4 | - | 19.2 | 590 | 35,900 | 114 | 7.6 | 0.063 | 189 | 444 | 147 | 468 |
| LF_TP_6_0.2-0.3 | LF_TP_6 | 0.2-0.3 | 25/10/2022 | TP | Normal | - | 10 | 6.1 | - | - | - | 5.4 | <5 | - | - | - | 30,300 | 4.2 | 12.3 | 0.4 | 35 | 0.14 | 12.7 | - | 1.9 | 16.8 | 5790 | 22.4 | 4.94 | <0.025 | 14.2 | 481 | 191 | 33.4 |
| LF_TP_6_1.8-2.0 | LF_TP_6 | 1.8-2 | 25/10/2022 | TP | Normal | - | 31 | 5.9 | - | - | - | 101.4 | 7.07 | - | - | - | 6650 | 1.1 | 21.3 | 0.16 | 5.4 | 0.2 | 13.6 | - | 2 | 17.8 | 4400 | 10.8 | 3.5 | <0.025 | 37.4 | 254 | 83.3 | 19.1 |
| LF_TP_7_0.2-0.3 | LF_TP_7 | 0.2-0.3 | 28/10/2022 | TP | Normal | 1200 | 10 | 7.2 | <0.03 | 0.3 | - | 5.4 | 6.93 | - | - | - | 12,900 | 5.7 | 24.7 | 0.27 | 3.3 | 0.083 | 12 | - | 4.01 | 7.4 | 13,300 | 5.63 | 9.17 | <0.025 | 11.9 | 742 | 38.4 | 25.7 |
| LF_TP_7_1.4-1.5 | LF_TP_7 | 1.4-1.5 | 28/10/2022 | TP | Normal | 540 | 12 | 6.8 | <0.03 | 0.46 | - | 12.8 | 33.5 | - | - | - | 11,800 | 5.7 | 11.7 | 0.12 | <1.3 | 0.056 | 8.8 | - | 2.55 | 6.2 | 10,500 | 8.03 | 5.58 | 0.041 | 8.99 | 319 | 39.5 | 20 |
| LF_soil_DUP_8 | LF_TP_7 | 1.4-1.5 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 12,600 | 6.6 | - | 0.13 | 1.3 | 0.064 | 8.1 | - | - | 6.3 | 10,800 | 8.34 | - | <0.025 | 8.5 | - | - | 21 |
| LF_TP_8_0.2-0.3 | LF_TP_8 | 0.2-0.3 | 26/10/2022 | TP | Normal | 630 | 11 | 7 | <0.03 | 0.27 | - | <3.1 | <5 | - | - | - | 3270 | 4.5 | 19.5 | 0.49 | 36 | 0.582 | 13.7 | - | 3.01 | 23.3 | 10,700 | 37.5 | 11.3 | <0.025 | 35.2 | 551 | 140 | 68.8 |
| LF_TP_8_1.8-2.0 | LF_TP_8 | 1.8-2 | 26/10/2022 | TP | Normal | 4000 | 18 | 7.9 | <0.03 | 142 | - | 23 | 18 | - | - | - | 135,000 | 6.4 | 25.4 | 0.55 | 149 | 2.17 | 29.3 | - | 4.15 | 50.8 | 25,700 | 132 | 92.4 | <0.025 | 106 | 331 | 350 | 363 |
| LF_TP_8_1.0-1.2 | LF_TP_8 | 1-1.2 | 26/10/2022 | TP | Normal | 11,000 | 17 | 6.8 | <0.03 | 36.6 | - | 17.1 | 11.8 | - | - | - | 119,000 | 12 | 71.3 | 0.93 | 49 | 1.77 | 172 | - | 6.68 | 144 | 43,600 | 80.7 | 15.1 | <0.025 | 146 | 258 | 165 | 436 |
| LF_TP_9_0.2-0.3 | LF_TP_9 | 0.2-0.3 | 26/10/2022 | TP | Normal | 1300 | 6 | 6.7 | <0.03 | <0.2 | - | <3 | 8.2 | - | - | - | 8540 | 4.2 | 10.5 | 0.2 | 14 | 0.16 | 7.6 | - | 3.11 | 6.8 | 7040 | 3.6 | 6.13 | <0.025 | 18.4 | 299 | 35.7 | 35.8 |
| LF_TP_9_1.8-2.0 | LF_TP_9 | 1.8-2 | 26/10/2022 | TP | Normal | 760 | 6 | 6.6 | <0.03 | <0.2 | - | 6.3 | 6.67 | - | - | - | 11,500 | 5.5 | 13.2 | 0.27 | 10 | 0.15 | 8.8 | - | 3.56 | 43.5 | 9710 | 6.32 | 5.78 | <0.025 | 16.7 | 369 | 31 | 119 |
| LF_TP_9_1.0-1.2 | LF_TP_9 | 1-1.2 | 26/10/2022 | TP | Normal | 1600 | 7 | 6.5 | <0.03 | <0.2 | - | 4.9 | 8.82 | - | - | - | 8700 | 3.8 | 11 | 0.2 | 6.1 | 0.16 | 8.2 | - | 2.91 | 6.7 | 7810 | 4 | 5.07 | <0.025 | 13.5 | 339 | 23 | 142 |
| LF_TP_10_0.3-0.4 | LF_TP_10 | 0.3-0.4 | 26/10/2022 | TP | Normal | 1800 | 17 | 6.6 | <0.03 | 0.92 | - | 12.1 | 7.71 | - | - | - | 68,100 | 7.3 | 45.9 | 1.7 | 11 | 2.01 | 41.3 | - | 6.66 | 85.6 | 24,800 | 47.7 | 17.1 | 0.034 | 137 | 492 | 69 | 277 |
| LF_TP_10_1.8-2.0 | LF_TP_10 | 1.8-2 | 26/10/2022 | TP | Normal | 12,000 | 12 | 7.2 | <0.03 | 1.6 | - | 19.2 | <5 | - | - | - | 32,900 | 9.9 | 23 | 0.87 | 11 | 0.973 | 30.6 | - | 4.64 | 2990 | 16,300 | 168 | 8.28 | 0.066 | 59.8 | 365 | 50.4 | 393 |
| LF_TP_10_1.0-1.2 | LF_TP_10 | 1-1.2 | 26/10/2022 | TP | Normal | 15,000 | 16 | 7.2 | <0.03 | 2.8 | - | 43.9 | <5 | - | - | - | 92,900 | 5.4 | 48.8 | 1.42 | 10 | 0.9 | 45 | - | 5.24 | 109 | 23,500 | 29.9 | 15.1 | 0.036 | 70.3 | 367 | 50.1 | 493 |
| LF_TP_11_0.3-0.4 | LF_TP_11 | 0.3-0.4 | 26/10/2022 | TP | Normal | 9700 | 9 | 6.6 | <0.03 | 5.9 | - | <3 | 5.07 | - | - | - | 39,300 | 5.3 | 11.9 | 0.5 | 49 | 0.18 | 10 | - | 2 | 19.3 | 6420 | 29.9 | 7.52 | <0.025 | 11.2 | 457 | 156 | 34.2 |
| LF_TP_11_0.9-1.0 | LF_TP_11 | 0.9-1 | 26/10/2022 | TP | Normal | 5200 | 14 | 7.3 | <0.03 | 0.96 | - | 3.2 | 6.35 | - | - | - | 39,300 | 7.3 | 38.5 | 0.8 | 20 | 0.782 | 17.9 | - | 3.83 | 106 | 10,500 | 140 | 8.7 | 0.27 | 46.9 | 535 | 58 | 170 |
| LF_TP_11_1.8-2.0 | LF_TP_11 | 1.8-2 | 26/10/2022 | TP | Normal | 300 | 5 | 6.5 | <0.03 | 0.28 | - | <2.9 | <5 | - | - | - | 3900 | 5.1 | 2.59 | 0.13 | 2 | 0.03 | 5.8 | - | 1.9 | 1.7 | 6230 | 1.6 | 5.06 | <0.025 | 3.1 | 355 | 20.2 | 9.29 |
| LF_TP_12_0.2-0.3 | LF_TP_12 | 0.2-0.3 | 1/11/2022 | TP | Normal | 13,000 | 13 | 6.3 | <0.03 | 1.1 | - | 8.2 | 37.1 | - | - | - | 25,300 | 28.4 | 66 | 1.34 | 31 | 3.23 | 70.2 | - | 10.9 | 1070 | 40,200 | 107 | 10.8 | 0.06 | 67 | 376 | 50.7 | 893 |
| LF_TP_12_0.8-1.0 | LF_TP_12 | 0.8-1 | 1/11/2022 | TP | Normal | 330 | 18 | 5 | <0.03 | 0.35 | - | <3.2 | 17.2 | - | - | - | 5080 | 4.2 | 2.88 | 0.083 | <1.3 | 0.058 | 7.9 | - | 1.3 | 1.7 | 7150 | 2.9 | 2.4 | <0.025 | 2.5 | 463 | 30.1 | 8.4 |
| LF_TP_13_0.2-0.3 | LF_TP_13 | 0.2-0.3 | 26/10/2022 | TP | Normal | 39,000 | 11 | 6.5 | <0.03 | 0.73 | - | 6.8 | 7.1 | - | - | - | 67,300 | 77.2 | 95.6 | 2.38 | 61 | 12.8 | 83.1 | - | 6.76 | 2150 | 29,300 | 212 | 17.5 | 0.038 | 91.2 | 514 | 103 | 2310 |
| LF_TP_13_0.8-1.0 | LF_TP_13 | 0.8-1 | 26/10/2022 | TP | Normal | 39,000 | 21 | 7 | <0.03 | 3.84 | - | 34.8 | 9.57 | - | - | - | 193,000 | 180 | 124 | 6.32 | 90 | 8.38 | 157 | - | 6.91 | 2360 | 31,000 | 213 | 52.2 | 0.1 | 105 | 485 | 67.1 | 1540 |
| LF_TP_13_1.8-2.0 | LF_TP_13 | 1.8-2 | 26/10/2022 | TP | Normal | 40,000 | 23 | 7.5 | <0.03 | 4.64 | - | 70.3 | <5 | - | - | - | 109,000 | 143 | 113 | 4.56 | 144 | 28.1 | 182 | - | 7.91 | 2600 | 72,900 | 204 | 43.2 | 0.35 | 182 | 468 | 63.6 | 2500 |
| LF_TP_14_0.2-0.3 | LF_TP_14 | 0.2-0.3 | 27/10/2022 | TP | Normal | 59,000 | 15 | 6.2 | <0.03 | 0.59 | - | 10.9 | <5 | - | - | - | 79,900 | 6.9 | 75.2 | 2.02 | 8.1 | 2.12 | 20.9 | - | 5.43 | 38.3 | 16,500 | 183 | 14.9 | 0.06 | 111 | 583 | 102 | 283 |
| LF_TP_14_0.8-1.0 | LF_TP_14 | 0.8-1 | 27/10/2022 | TP | Normal | 8400 | 18 | 6.8 | <0.03 | 2.61 | - | 36.3 | <5 | - | - | - | 24,600 | 10 | 105 | 0.53 | 6.4 | 1.75 | 165 | - | 9.95 | 459 | 88,900 | 384 | 5.74 | 0.043 | 90.2 | 477 | 37.6 | 1480 |
| LF_TP_15_0.2-0.3 | LF_TP_15 | 0.2-0.3 | 26/10/2022 | TP | Normal | 940 | 7 | 5.7 | <0.03 | <0.2 | - | <3 | <5 | - | - | - | 12,100 | 4 | 16 | 0.26 | 1.7 | 0.23 | 7.6 | - | 3.14 | 6.1 | 8240 | 11.3 | 6.88 | <0.025 | 14.4 | 310 | 25.5 | 98.5 |
| LF_TP_15_0.8-1.0 | LF_TP_15 | 0.8-1 | 26/10/2022 | TP | Normal | 2000 | 6 | 6.4 | <0.03 | <0.2 | - | 4.9 | 6.45 | - | - | - | 19,100 | 3.4 | 18.5 | 0.26 | 3.8 | 0.18 | 7.2 | - | 2.79 | 13.4 | 6840 | 11.3 | 8.13 | <0.025 | 16.3 | 331 | 25.4 | 109 |
| LF_TP_15_1.8-2.0 | LF_TP_15 | 1.8-2 | 26/10/2022 | TP | Normal | 1400 | 9 | 7.2 | <0.03 | <0.2 | - | 15.9 | <5 | - | - | - | 7920 | 3 | 27.6 | 0.25 | 3.9 | 0.38 | 12.6 | - | 2.92 | 14.8 | 15,600 | 42.2 | 4.87 | <0.025 | 34.3 | 231 | 36.8 | 798 |
| LF_TP_16_1.0-2.0 | LF_TP_16 | 1-2 | 2/11/2022 | TP | Normal | 610 | 92 | 3.7 | <0.26 | 7.34 | - | 380.3 | 169 | - | - | - | 3480 | 0.67 | 5.25 | 0.055 | 10 | 0.054 | 1.8 | - | 0.29 | 1.5 | 760 | 4.8 | 0.5 | 0.058 | 2.9 | 54.3 | 5.1 | 11.1 |
| LF_TP_16_0.2-0.3 | LF_TP_16 | 0.2-0.3 | 2/11/2022 | TP | Normal | 360 | 88 | 3.4 | <0.18 | 7.92 | - | 110.3 | 29.2 | - | - | - | 1200 | 0.56 | 5.47 | 0.049 | 5.4 | 0.068 | 1 | - | 0.25 | 1.2 | 860 | 11.6 | 0.16 | 0.063 | 3.8 | 24.1 | 4.8 | 6.87 |
| LF_TP_17_0.2-0.3 | LF_TP_17 | 0.2-0.3 | 26/10/2022 | TP | Normal | 23,000 | 12 | 6.3 | <0.03 | 1.7 | - | 4.5 | 8.72 | - | - | - | 51,200 | 5.2 | 33.8 | 1.65 | 13 | 0.532 | 26.8 | - | 5.59 | 80.3 | 24,000 | 29.6 | 30.9 | 0.14 | 85.8 | 462 | 87.1 | 171 |
| LF_TP_17_1.8-2.0 | LF_TP_17 | 1.8-2 | 26/10/2022 | TP | Normal | 34,000 | 22 | 7.1 | 0.56 | 210 | - | 145 | <5 | - | - | - | 164,000 | 6.3 | 43.8 | 5.36 | 358 | 0.553 | 90 | - | 3.26 | 133 | 35,500 | 47.3 | 83.8 | 2 | 115 | 708 | 886 | 506 |
| LF_TP_17_1.0-1.2 | LF_TP_17 | 1-1.2 | 26/10/2022 | TP | Normal | 28,000 | 22 | 6.8 | <0.03 | 2.6 | - | 63.7 | <5 | - | - | - | 127,000 | 9 | 47.3 | 5.59 | 17 | 0.4 | 462 | - | 10.9 | 111 | 127,000 | 18.5 | 74 | 0.029 | 188 | 176 | 204 | 124 |
| LF_TP_18_0.2-0.3 | LF_TP_18 | 0.2-0.3 | 27/10/2022 | TP | Normal | 750 | 6 | 5.7 | <0.03 | 0.49 | - | <3.1 | 20.8 | - | - | - | 7170 | 4.9 | 8.6 | 0.1 | <1.3 | 0.044 | 7.1 | - | 2.55 | 5 | 8920 | 5.96 | 2.52 | 0.037 | 14 | 430 | 24.8 | 22 |
| LF_TP_18_1.8-2.0 | LF_TP_18 | 1.8-2 | 27/10/2022 | TP | Normal | 7200 | 12 | 6.3 | <0.03 | 0.53 | - | 20.9 | <5 | - | - | - | 24,200 | 6.5 | 30.2 | 0.67 | 3.4 | 9.66 | 46.1 | - | 8.35 | 42 | 29,200 | 32.1 | 8 | 0.031 | 62 | 510 | 42.9 | 208 |
| LF_TP_19_0.2-0.3 | LF_TP_19 | 0.2-0.3 | 26/10/2022 | TP | Normal | - | 86 | 3.5 | - | - | - | 137.6 | 14.1 | - | - | - | 1600 | 0.46 | 6.37 | 0.045 | 7.3 | 0.033 | 7.9 | - | 0.32 | 1.7 | 650 | 8.73 | 1.6 | 0.077 | 4.2 | 65.5 | 2.9 | 3.3 |
| LF_TP_19_1.3-1.5 | LF_TP_19 | 1.3-1.5 | 26/10/2022 | TP | Normal | - | 83 | 4 | - | - | - | 9.7 | 6.93 | - | - | - | 3800 | 0.9 | 6.26 | 0.11 | 5.4 | 0.16 | 11 | - | 0.4 | 5.1 | 590 | 6.26 | 0.56 | 0.26 | 4.4 | 132 | 13.2 | 1.4 |
| LF_TP_20_0.2-0.3 | LF_TP_20 | 0.2-0.3 | 27/10/2022 | TP | Normal | 7700 | 7 | 5.7 | <0.03 | 0.27 | - | <3.1 | <5 | - | - | - | 27,000 | 3.6 | 27.7 | 0.86 | 2.1 | 0.12 | 10 | - | 4.14 | 11 | 8670 | 25 | 6.96 | 0.028 | 50.8 | 471 | 49.3 | 72.5 |
| LF_TP_20_1.8-2.0 | LF_TP_20 | 1.8-2 | 27/10/2022 | TP | Normal | 5900 | 12 | 6.7 | <0.03 | 0.23 | - | 49.2 | <5 | - | - | - | 2820 | 7.1 | 41.5 | 0.48 | 9.8 | 0.871 | 21.5 | - | 4.89 | 131 | 16,400 | 91.9 | 9.37 | 0.028 | 26.7 | 65.8 | 59.8 | 131 |
| LF_TP_21_0.2-0.3 | LF_TP_21 | 0.2-0.3 | 2/11/2022 | TP | Normal | 140 | 92 | 3.4 | <0.25 | 10.4 | - | 35.8 | 33.3 | - | - | - | 1130 | 0.7 | 2.1 | 0.017 | 2 | 0.023 | 0.96 | - | 0.2 | 1.2 | 1200 | 4.4 | 0.062 | 0.036 | 3.4 | 23.2 | 3.3 | 4 |
| LF_TP_21_1.0-1.2 | LF_TP_21 | 1-1.2 | 2/11/2022 | TP | Normal | 130 | 83 | 3.8 | <0.12 | 8.43 | - | 75.3 | 12 | - | - | - | 1560 | 0.43 | 4.64 | 0.022 | 4.1 | 0.044 | 0.93 | - | 0.23 | 1 | 700 | 0.35 | 0.038 | 0.037 | 0.49 | 43.8 | 3.7 | 1.5 |
| LF_TP_22_0.2-0.3 | LF_TP_22 | 0.2-0.3 | 2/11/2022 | TP | Normal | 250 | 49 | 4 | <0.04 | 2.15 | - | 7 | <5 | - | - | - | 2510 | 2.6 | 2.85 | 0.06 | 2.4 | 0.03 | 3.5 | - | 0.25 | 0.5 | 4040 | 3.3 | 0.5 | 0.03 | 1.4 | 139 | 12 | 2.5 |
| LF_TP_22_0.8-1.0 | LF_TP_22 | 0.8-1 | 2/11/2022 | TP | Normal | 170 | 27 | 4.5 | <0.03 | <0.3 | - | 4.1 | <5 | - | - | - | 5970 | 2.9 | 5.04 | 0.14 | <1.3 | 0.077 | 6.2 | - | 1.4 | 1.7 | 4590 | 1.6 | 7.79 | <0.025 | 2.7 | 382 | 16.8 | 8.22 |
| LF_TP_23_0.1-0.3 | LF_TP_23 | 0.1-0.3 | 2/11/2022 | TP | Normal | 3000 | 85 | 5.7 | <0.14 | 3.24 | - | 19.1 | 57.4 | - | - | - | 12,300 | 23.3 | 18 | 0.53 | 6.3 | 0.38 | 8.6 | - | 2.5 | 9.68 | 20,900 | 6.45 | 2.3 | 0.086 | 102 | 203 | 42.3 | 22.1 |
| LF_TP_23_0.7-1.1 | LF_TP_23 | 0.7-1.1 | 2/11/2022 | TP | Normal | 270 | 37 | 5 | <0.04 | <0.3 | - | 37.6 | <5 | - | - | - | 4290 | 1.7 | 6.37 | 0.14 | 2.2 | 0.22 | 3.2 | - | 0.57 | 1.2 | 2580 | 1.5 | 2.4 | 0.025 | 1.9 | 272 | 12 | 4.9 |
| LF_TP_24_0.3-0.4 | LF_TP_24 | 0.3-0.4 | 2/11/2022 | TP | Normal | 86,000 | 27 | 5.9 | <0.03 | <0.3 | - | 16.1 | <5 | - | - | - | 53,400 | 41.7 | 49.7 | 4.46 | 3.2 | 0.16 | 35.6 | - | 10.9 | 78.5 | 43,500 | 12.5 | 19.2 | <0.025 | 319 | 115 | 103 | 88 |
| LF_TP_24_1.4-1.6 | LF_TP_24 | 1.4-1.6 | 2/11/2022 | TP | Normal | 180,000 | 10 | 5.8 | <0.03 | <0.2 | - | 504.6 | <5 | - | - | - | 20,200 | 26.6 | 38.2 | 4.83 | <1.3 | 0.024 | 29.9 | - | 7.22 | 63 | 34,700 | 9.58 | 13.2 | <0.025 | 340 | 17.6 | 95.4 | 22.5 |
| LF_TP_25_1.0-1.2 | LF_TP_25 | 1-1.2 | 1/11/2022 | TP | Normal | 100,000 | 17 | 6.4 | <0.03 | <0.2 | - | 138.2 | 25.8 | - | - | - | 50,700 | 40.3 | 25.8 | 3.22 | <1.3 | 1.32 | 36.9 | - | 11.2 | 99.4 | 57,500 | 29.6 | 8.76 | <0.025 | 503 | 47.8 | 148 | 106 |
| LF_soil_DUP_9 | LF_TP_25 | 1-1.2 | 1/11/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 42,400 | 41.4 | - | 5.15 | 3.5 | 1.24 | 40.9 | - | - | 97.9 | 59,700 | 33.2 | - | <0.025 | 494 | - | - | 99.2 |
| LF_TP_26_0.2-0.3 | LF_TP_26 | 0.2-0.3 | 27/10/2022 | TP | Normal | 5300 | 12 | 6.2 | <0.03 | 0.36 | - | 3.2 | <5 | - | - | - | 1910 | 3.7 | 35.9 | 0.44 | 5.1 | 0.23 | 8.8 | - | 6.6 | 23.4 | 9820 | 28.5 | 9.26 | <0.025 | 47.9 | 43.4 | 48.4 | 125 |
| LF_TP_26_1.8-2.0 | LF_TP_26 | 1.8-2 | 27/10/2022 | TP | Normal | 1700 | 12 | 6.8 | <0.03 | 0.5 | - | 13.1 | <5 | - | - | - | 6680 | 3.2 | 20.9 | 0.21 | 3.6 | 0.14 | 8.7 | - | 2.96 | 22.2 | 6440 | 10.6 | 4.42 | 0.044 | 12.9 | 318 | 23.7 | 53.5 |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
CCME (1991) Interim Canadian environmental quality criteria for contaminated sites (SQG)
ASC NEPM (2013) - National Environmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
## Table C4
## NZAS Landfill Soil Ecological Screening Values

| | | | | | | Minor ions | Inorganics | | | | Major Ions | | Nutrients | | | | Metals | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Fluoride | Moisture (%) | pH (Lab) | Cyanide (Free) | Cyanide (Total) | Chloride | Sulfate | Ammonia as N | Nitrate (as NO3-) | Nitrite (as NO2-) | Phosphate total (P) | Aluminium | Arsenic | Barium | Beryllium | Boron | Cadmium | Chromium (III+VI) | Chromium (hexavalent) | Cobalt | Copper | Iron | Lead | Lithium | Mercury | Nickel | Titanium | Vanadium | Zinc |
| | | | | | | mg/kg | % | pH Units | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0 | 1 | 1 | 0.03 | 0.2 | 3 | 2.9 | 5 | 2.5 | 1 | 2 | 2.5 | 0.125 | 0.025 | 0.013 | 1.25 | 0.005 | 0.125 | 0.4 | 0.025 | 0.075 | 12.5 | 0.25 | 0.025 | 0.025 | 0.05 | 0.075 | 0.125 | 0.05 |
| ECOSGV - Commercial | | | | | | | | | | | | | | | | | | 147 | | | 15 | 40 | 659 | 130 | | 618 | | 3057 | | | | | | 488 |
| ECOSGV - Recreational | | | | | | | | | | | | | | | | | | 58 | | | 15 | 17 | 402 | 130 | | 430 | | 1284 | | | | | | 298 |
| ECOSGV - Commercial - Indirect | | | | | | | | | | | | | | | | | | | | | | 33 | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | 12 | | | | | | | | | | | | |
| ECOSSL - Commercial | | | | | | | | | | | | | | | | | | | | 40 | | | | | 13/120/230 | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | 21 | | | | | 0.5217391 | | | | | | | | | |
| EIL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 460 | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 270 | | | |
| SQG - Comercial | | | | | | 2000 | | 6-8 | 8 | | | | | | | | | | 2000 | | | | | | | | | | | 50 | | | 130 | |
| SQG - Recreational | | | | | | 400 | | 6-8 | 0.9 | | | | | | | | | | 500 | | | | | | | | | | | 12 | | | 130 | |
| SQG - Commercial Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LF_TP_27_0.2-0.3 | LF_TP_27 | 0.2-0.3 | 27/10/2022 | TP | Normal | 3100 | 9 | 6.6 | <0.03 | 0.26 | - | <2.9 | <5 | - | - | - | 7000 | 4.2 | 30.6 | 0.28 | 1.7 | 0.47 | 11 | - | 4.58 | 21.8 | 5730 | 9.43 | 6.8 | <0.025 | 72 | 199 | 111 | 57 |
| LF_TP_27_1.8-2.0 | LF_TP_27 | 1.8-2 | 27/10/2022 | TP | Normal | 2600 | 30 | 6.9 | <0.03 | 0.53 | - | 130.2 | <5 | - | - | - | 151,000 | 0.43 | 12.6 | 0.23 | 16 | 0.45 | 14.7 | - | 4.68 | 472 | 20,900 | 43.9 | 2.9 | <0.025 | 53.9 | 25.3 | 15.2 | 315 |
| LF_TP_28_0.2-0.3 | LF_TP_28 | 0.2-0.3 | 27/10/2022 | TP | Normal | 43,000 | 15 | 6.3 | <0.03 | 0.23 | - | 118.7 | <5 | - | - | - | 54,900 | 75.9 | 22.8 | 2.5 | <1.3 | 0.4 | 40.4 | - | 15.8 | 100 | 47,800 | 14.7 | 3.58 | <0.025 | 280 | 133 | 101 | 131 |
| LF_TP_28_1.3-1.5 | LF_TP_28 | 1.3-1.5 | 27/10/2022 | TP | Normal | 43,000 | 16 | 6.2 | <0.03 | <0.2 | - | 101 | <5 | - | - | - | 5990 | 38.5 | 23.8 | 3.38 | <1.3 | 0.32 | 46.8 | - | 15.3 | 154 | 58,100 | 21.1 | 5.44 | <0.025 | 361 | 15.1 | 216 | 140 |
| LF_TP_29_0.2-0.3 | LF_TP_29 | 0.2-0.3 | 27/10/2022 | TP | Normal | 8900 | 11 | 5.9 | <0.03 | 0.31 | - | 4.6 | <5 | - | - | - | 4610 | 4.8 | 54.7 | 0.9 | 2.6 | 0.25 | 25.7 | - | 5.68 | 25.3 | 19,900 | 59.2 | 10.7 | <0.025 | 54.2 | 96.8 | 60.6 | 249 |
| LF_soil_DUP_1 | LF_TP_29 | 0.2-0.3 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 28,300 | 4 | - | 1.1 | 5 | 0.21 | 27.7 | - | - | 14.7 | 19,100 | 55.3 | - | <0.025 | 47.4 | - | - | 204 |
| LF_TP_29_1.0-1.1 | LF_TP_29 | 1-1.1 | 27/10/2022 | TP | Normal | 18,000 | 18 | 6.8 | <0.03 | 0.27 | - | 377.2 | <5 | - | - | - | 128,000 | 14.3 | 66.3 | 2.23 | 26 | 0.903 | 77.6 | - | 22.1 | 149 | 93,100 | 49.5 | 15.5 | 0.028 | 89.3 | 268 | 74.5 | 488 |
| LF_TP_30_0.2-0.3 | LF_TP_30 | 0.2-0.3 | 27/10/2022 | TP | Normal | 2500 | 6 | 6.8 | <0.03 | <0.2 | - | <3.1 | <5 | - | - | - | 19,700 | 4.8 | 24.1 | 0.33 | 3.1 | 0.695 | 14.3 | - | 9.85 | 10.9 | 12,600 | 12 | 6.78 | <0.025 | 72.2 | 394 | 46.6 | 71.7 |
| LF_TP_30_1.0-1.1 | LF_TP_30 | 1-1.1 | 27/10/2022 | TP | Normal | 10,000 | 9 | 6.9 | <0.03 | <0.2 | - | 8.4 | <5 | - | - | - | 56,000 | 12 | 31.7 | 0.53 | 4.1 | 2.43 | 18.9 | - | 9.46 | 22.4 | 14,800 | 46.7 | 8.52 | 0.047 | 91.9 | 456 | 81.1 | 167 |
| LF_TP_31_0.1-0.2 | LF_TP_31 | 0.1-0.2 | 2/11/2022 | TP | Normal | 700 | 26 | 5 | <0.03 | <0.2 | - | 6.5 | <5 | - | - | - | 22,600 | 4.6 | 24.9 | 0.27 | 3.9 | 0.25 | 16.2 | - | 4.32 | 11.3 | 16,800 | 7.05 | 23 | 0.034 | 11.6 | 834 | 54.7 | 40.2 |
| LF_TP_31_0.7-1.0 | LF_TP_31 | 0.7-1 | 2/11/2022 | TP | Normal | 370 | 7 | 5.5 | <0.03 | <0.2 | - | <3.1 | <5 | - | - | - | 6200 | 12 | 8.32 | 0.18 | 1.7 | 0.08 | 4.9 | - | 1.9 | 1.5 | 7510 | 3 | 3.7 | <0.025 | 2.6 | 372 | 25.1 | 10.4 |
| LF_TP_32_0.2-0.3 | LF_TP_32 | 0.2-0.3 | 27/10/2022 | TP | Normal | 31,000 | 12 | 6.9 | <0.03 | 0.78 | - | 45.5 | <5 | - | - | - | 164,000 | 10 | 64.7 | 1.7 | 31 | 0.41 | 28.1 | - | 8.55 | 3470 | 9720 | 12.8 | 30.3 | <0.025 | 173 | 394 | 213 | 109 |
| LF_soil_DUP_4 | LF_TP_32 | 0.2-0.3 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 77,500 | 10 | - | 2.11 | 49 | 0.504 | 25.2 | - | - | 32.7 | 8170 | 12 | - | <0.025 | 156 | - | - | 149 |
| LF_TP_32_1.8-2.0 | LF_TP_32 | 1.8-2 | 27/10/2022 | TP | Normal | 52,000 | 14 | 6.5 | <0.03 | <0.2 | - | 74.6 | <5 | - | - | - | 109,000 | 23.2 | 104 | 2.89 | 45 | 0.25 | 16.1 | - | 6.19 | 53.8 | 10,500 | 12.3 | 20.1 | <0.025 | 167 | 459 | 88.7 | 93.2 |
| LF_TP_33_0.2-0.3 | LF_TP_33 | 0.2-0.3 | 28/10/2022 | TP | Normal | 490 | 8 | 5 | <0.03 | 1.2 | - | 4.7 | 36.2 | - | - | - | 5420 | 11 | 8.55 | 0.1 | <1.3 | 0.075 | 5.2 | - | 1.6 | 5.1 | 7820 | 6.55 | 2.5 | <0.025 | 6.03 | 242 | 30.9 | 18.9 |
| LF_TP_33_1.8-2.0 | LF_TP_33 | 1.8-2 | 28/10/2022 | TP | Normal | 290 | 12 | 6.2 | <0.03 | <0.2 | - | 11.6 | <5 | - | - | - | 5140 | 5.3 | 3.35 | 0.12 | 1.9 | 0.027 | 7.5 | - | 3.2 | 2.2 | 7030 | 2.1 | 5.07 | <0.025 | 4.4 | 381 | 23.6 | 13.5 |
| LF_soil_DUP_7 | LF_TP_33 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 6850 | 5.4 | - | 0.14 | 3 | 0.028 | 7.6 | - | - | 2.2 | 8370 | 2.2 | - | <0.025 | 4.4 | - | - | 12.6 |
| LF_TP_34_0.2-0.3 | LF_TP_34 | 0.2-0.3 | 3/11/2022 | TP | Normal | 190 | 8 | 4.1 | <0.03 | <0.2 | - | <3.1 | <5 | - | - | - | 4370 | 5.3 | 4.65 | 0.099 | 2.6 | 0.057 | 3.6 | - | 0.9 | 2.8 | 3880 | 8.16 | 2.4 | <0.025 | 3 | 162 | 41 | 7.39 |
| LF_TP_34_1.8-2.0 | LF_TP_34 | 1.8-2 | 3/11/2022 | TP | Normal | 240 | 7 | 4.6 | <0.03 | <0.2 | - | <3.1 | <5 | - | - | - | 6980 | 10 | 3.93 | 0.18 | 1.3 | 0.049 | 5.1 | - | 2.87 | 2.1 | 7040 | 1.6 | 7.17 | <0.025 | 3.8 | 286 | 18.2 | 13.3 |
| LF_TP_35_0.3-0.4 | LF_TP_35 | 0.3-0.4 | 27/10/2022 | TP | Normal | 3800 | 13 | 5.9 | <0.03 | 0.32 | - | <3 | <5 | - | - | - | 215,000 | 3.7 | 11.7 | 1.34 | 120 | 0.048 | 17.9 | - | 1.3 | 32.6 | 4440 | 2.8 | 9.26 | <0.025 | 21.1 | 370 | 285 | 15.2 |
| LF_TP_35_1.5-1.6 | LF_TP_35 | 1.5-1.6 | 27/10/2022 | TP | Normal | 1100 | 13 | 7.3 | <0.03 | <0.2 | - | 10.2 | 7.91 | - | - | - | 313,000 | 2 | 19.6 | 2.06 | 204 | 0.067 | 26.9 | - | 1.3 | 46 | 5720 | 5.03 | 17.5 | <0.025 | 34.7 | 463 | 598 | 26.5 |
| LF_soil_DUP_3 | LF_TP_35 | 1.5-1.6 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 138,000 | 1.9 | - | 2.3 | 223 | 0.07 | 23.8 | - | - | 51.9 | 5080 | 8.38 | - | <0.025 | 32.1 | - | - | 28.9 |
| LF_TP_35_2.0-2.2 | LF_TP_35 | 2-2.2 | 31/10/2022 | TP | Normal | 4600 | 24 | 7.9 | <0.03 | <0.2 | - | 4.8 | <5 | - | - | - | 249,000 | 6.6 | 18.1 | 1.96 | 224 | 0.068 | 29.5 | - | 1.2 | 53.5 | 5760 | 5.24 | 16.3 | <0.025 | 35 | 561 | 751 | 45.8 |
| LF_TP_36_0.2-0.3 | LF_TP_36 | 0.2-0.3 | 27/10/2022 | TP | Normal | 4800 | 13 | 7.5 | <0.03 | <0.4 | - | <3.2 | 8.65 | - | - | - | 28,800 | 1.7 | 35.1 | 2.18 | 235 | 0.17 | 32.5 | - | 1.6 | 58.6 | 5520 | 26.6 | 14.9 | <0.025 | 49.4 | 628 | 815 | 50.3 |
| LF_TP_36_1.8-2.0 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Normal | 9600 | 27 | 7.1 | <0.03 | 5.68 | - | 12.7 | 74.5 | - | - | - | 26,500 | 9 | 143 | 0.69 | 85 | 3.8 | 34.3 | - | 5.33 | 278 | 14,000 | 593 | 15.3 | 0.2 | 67.1 | 527 | 143 | 566 |
| LF_soil_DUP_2 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 42,500 | 9.8 | - | 0.64 | 93 | 3.82 | 61.7 | - | - | 323 | 16,800 | 638 | - | 0.67 | 71.5 | - | - | 631 |
| LF_TP_37_0.2-0.3 | LF_TP_37 | 0.2-0.3 | 28/10/2022 | TP | Normal | 320 | 12 | 6.4 | <0.03 | <0.2 | - | <3 | 10.2 | - | - | - | 5170 | 1.6 | 3.14 | 0.091 | <1.3 | 0.038 | 4.6 | - | 1.4 | 1.8 | 4380 | 1.5 | 3.27 | <0.025 | 2.5 | 381 | 30.8 | 7.78 |
| LF_TP_37_2.0-2.2 | LF_TP_37 | 2-2.2 | 28/10/2022 | TP | Normal | 250 | 23 | 7.3 | <0.03 | 0.73 | - | 152 | 63.9 | - | - | - | 6720 | 3.6 | 12.8 | 0.12 | 48 | 0.036 | 8.9 | - | 1.6 | 5.2 | 4420 | 2.3 | 4.17 | 0.026 | 4 | 423 | 40.6 | 8.86 |
| LF_TP_38_0.2-0.3 | LF_TP_38 | 0.2-0.3 | 28/10/2022 | TP | Normal | 390 | 42 | 4.3 | <0.04 | 1.9 | - | 34.2 | 73.6 | - | - | - | 29,800 | 5 | 16.8 | 0.65 | 3 | 0.068 | 22.7 | - | 3.85 | 20.2 | 34,000 | 4.1 | 11.5 | 0.15 | 12.4 | 231 | 139 | 32.2 |
| LF_TP_38_0.8-1.0 | LF_TP_38 | 0.8-1 | 28/10/2022 | TP | Normal | 230 | 34 | 4.9 | <0.03 | 0.51 | - | 25.2 | 85.7 | - | - | - | 37,500 | 9.5 | 27.6 | 0.68 | <1.3 | 0.072 | 27.3 | - | 8.12 | 21 | 62,700 | 5.43 | 14.8 | 0.1 | 20.3 | 646 | 206 | 59 |
| LF_TP_39_0.2-0.3 | LF_TP_39 | 0.2-0.3 | 3/11/2022 | TP | Normal | 230 | 4 | 4.3 | <0.03 | <0.2 | - | 3.2 | <5 | - | - | - | 6650 | 13.5 | 12.1 | 0.17 | 4.6 | 0.061 | 6.7 | - | 2.5 | 3.2 | 11,800 | 8.09 | 5.88 | <0.025 | 5.4 | 387 | 849 | 16.4 |
| LF_TP_40_1.8-2.0 | LF_TP_40 | 1.8-2 | 28/10/2022 | TP | Normal | 1300 | 6 | 6.4 | <0.03 | 0.27 | - | <3 | <5 | - | - | - | 6110 | 8.9 | 4.1 | 0.1 | 2.2 | 0.038 | 5.6 | - | 2.5 | 3.3 | 8080 | 1.7 | 3.68 | <0.025 | 3.7 | 380 | 63.9 | 10.9 |
| LF_soil_DUP_5 | LF_TP_40 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 7640 | 9.3 | - | 0.12 | 4.5 | 0.039 | 6 | - | - | 3.2 | 9500 | 1.9 | - | <0.025 | 3.4 | - | - | 9.58 |
| LF_TP_40_1.0-1.2 | LF_TP_40 | 1-1.2 | 28/10/2022 | TP | Normal | 1700 | 7 | 6.5 | <0.03 | <0.2 | - | <3 | <5 | - | - | - | 5810 | 4.4 | 3.88 | 0.099 | 3.5 | 0.027 | 5.2 | - | 2 | 2.1 | 6370 | 1.6 | 4.2 | <0.025 | 3.7 | 359 | 69.3 | 9.79 |
| LF_TP_41_1.0-1.2 | LF_TP_41 | 1-1.2 | 28/10/2022 | TP | Normal | 3200 | 21 | 7.2 | <0.03 | <0.2 | - | 5 | <5 | - | - | - | 233,000 | 0.83 | 10.9 | 1.2 | 331 | 0.013 | 26.5 | - | 0.28 | 10.9 | 710 | 2 | 1.7 | <0.025 | 20.1 | 399 | 465 | 7.61 |
| LF_TP_41_2.2-2.3 | LF_TP_41 | 2.2-2.3 | 28/10/2022 | TP | Normal | 1500 | 3 | 6.6 | <0.03 | <0.2 | - | <2.9 | <5 | - | - | - | 7770 | 7.2 | 6.95 | 0.12 | 4.5 | 0.051 | 7.1 | - | 2.5 | 1.8 | 9360 | 4.2 | 3.45 | <0.025 | 3.7 | 576 | 164 | 11.2 |
| LF_TP_42_0.1-0.3 | LF_TP_42 | 0.1-0.3 | 3/11/2022 | TP | Normal | 9300 | 22 | 5.2 | <0.03 | <0.4 | - | 3.7 | 27.4 | - | - | - | 257,000 | 1.4 | 15.2 | 3.41 | 419 | 0.06 | 29.1 | - | 0.63 | 26.1 | 1750 | 3.4 | 7.77 | <0.025 | 21.2 | 670 | 857 | 23.7 |
| LF_TP_42_0.7-1.0 | LF_TP_42 | 0.7-1 | 3/11/2022 | TP | Normal | 230 | 5 | 4.2 | <0.03 | 0.33 | - | 3.1 | 8.78 | - | - | - | <2.5 | <0.13 | <0.025 | <0.013 | <1.3 | <0.005 | <0.13 | - | <0.025 | <0.075 | <13 | <0.25 | <0.025 | <0.025 | <0.05 | <0.075 | <0.13 | <0.05 |
| LF_TP_43_0.2-0.3 | LF_TP_43 | 0.2-0.3 | 3/11/2022 | TP | Normal | 200 | 11 | 3.8 | <0.03 | 0.85 | - | 3.2 | 5.56 | - | - | - | 3620 | 3.8 | 4.81 | 0.056 | 3.5 | 0.029 | 1.8 | - | 0.38 | 1.3 | 2880 | 2.3 | 0.61 | <0.025 | 1.9 | 57.9 | 20.6 | 2.8 |
| LF_TP_43_0.8-1.0 | LF_TP_43 | 0.8-1 | 3/11/2022 | TP | Normal | 150 | 3 | 4.4 | <0.03 | 0.25 | - | <3.1 | <5 | - | - | - | 4270 | 6.1 | 6.62 | 0.088 | <1.3 | 0.026 | 5.9 | - | 1.6 | 1.4 | 7910 | 2.3 | 2.69 | <0.025 | 2.9 | 191 | 14.3 | 7.56 |
| LF_TP_44_0.2-0.3 | LF_TP_44 | 0.2-0.3 | 28/10/2022 | TP | Normal | 210 | 7 | 4.9 | <0.03 | 0.44 | - | <3.1 | 8.32 | - | - | - | 4410 | 13 | 4.25 | 0.11 | 1.8 | 0.027 | 5 | - | 2.5 | 1.6 | 8260 | 3.1 | 3.6 | <0.025 | 3 | 398 | 22.1 | 10.7 |
| LF_TP_44_1.0-1.2 | LF_TP_44 | 1-1.2 | 28/10/2022 | TP | Normal | 280 | 2 | 5 | <0.03 | <0.2 | - | 4.9 | 26.8 | - | - | - | 3590 | 3.5 | 4.19 | 0.077 | <1.3 | 0.015 | 4.1 | - | 1.4 | 1.5 | 4810 | 1.3 | 2.67 | <0.025 | 2.6 | 160 | 9.2 | 6.18 |
| LF_TP_45_0.2-0.3 | LF_TP_45 | 0.2-0.3 | 3/11/2022 | TP | Normal | 150 | 12 | 3.5 | <0.03 | 0.84 | - | 3.9 | 5.68 | - | - | - | 2120 | 2.1 | 3.86 | 0.024 | 2.8 | 0.025 | 2.3 | - | 0.29 | 1.1 | 2540 | 3.4 | 0.28 | 0.029 | 0.71 | 89.6 | 11 | 2.3 |
| LF_TP_45_1.7-2.0 | LF_TP_45 | 1.7-2 | 3/11/2022 | TP | Normal | 160 | 11 | 4.4 | <0.03 | 0.21 | - | <3.1 | <5 | - | - | - | 5240 | 7.1 | 4.02 | 0.13 | 1.6 | 0.047 | 7.4 | - | 2.1 | 2 | 7970 | 1.8 | 4.92 | <0.025 | 3.3 | 439 | 25.8 | 9.91 |
| LF_TP_46_0.2-0.3 | LF_TP_46 | 0.2-0.3 | 28/10/2022 | TP | Normal | 270 | <1 | 4.7 | <0.03 | 0.27 | - | <3.1 | 24 | - | - | - | 4190 | 7.9 | 5.77 | 0.08 | <1.3 | 0.019 | 5.9 | - | 1.8 | 1.9 | 7560 | 3.4 | 1.9 | <0.025 | 2.9 | 261 | 17.8 | 6.85 |
| LF_TP_46_1.8-2.0 | LF_TP_46 | 1.8-2 | 28/10/2022 | TP | Normal | 220 | 4 | 4.9 | <0.03 | <0.2 | - | <3 | 27.5 | - | - | - | 6080 | 12 | 2.85 | 0.15 | 1.3 | 0.029 | 5.2 | - | 2.82 | 2.3 | 7850 | 1.8 | 5.36 | <0.025 | 4 | 317 | 19 | 11 |
| LF_soil_DUP_6 | LF_TP_46 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | 10,900 | 12.7 | - | 0.17 | 1.7 | 0.032 | 5.6 | - | - | 2.2 | 11,700 | 2 | - | <0.025 | 4.1 | - | - | 10.6 |
| LF_TP_47_0.2-0.3 | LF_TP_47 | 0.2-0.3 | 28/10/2022 | TP | Normal | 890 | 9 | 4.8 | <0.03 | 0.99 | - | 4.4 | 51.9 | - | - | - | 19,500 | 2.9 | 17 | 0.18 | 7.4 | 0.12 | 4 | - | 1.2 | 4 | 4390 | 11.4 | 1.9 | 0.053 | 9.74 | 164 | 38.9 | 50.6 |
| LF_TP_47_1.8-2.0 | LF_TP_47 | 1.8-2 | 28/10/2022 | TP | Normal | 270 | 6 | 4.6 | <0.03 | <0.2 | - | <3.1 | 25.5 | - | - | - | 9690 | 11 | 4.55 | 0.18 | 1.5 | 0.057 | 5.5 | - | 5.22 | 2.8 | 9880 | 2.3 | 5.52 | <0.025 | 3.6 | 281 | 17.3 | 12.3 |
| LF_TP_48_0.2-0.3 | LF_TP_48 | 0.2-0.3 | 28/10/2022 | TP | Normal | 5600 | 11 | 7.3 | <0.03 | 0.38 | - | <3 | <5 | - | - | - | 198,000 | 1.9 | 11.3 | 1.73 | 185 | 0.088 | 20.8 | - | 1.1 | 38.3 | 4420 | 12.4 | 10.9 | <0.025 | 24.5 | 480 | 445 | 23.2 |
| LF_TP_48_1.0-1.2 | LF_TP_48 | 1-1.2 | 28/10/2022 | TP | Normal | 1600 | 6 | 6.2 | <0.03 | 0.53 | - | 407.5 | 31.1 | - | - | - | 14,000 | 38.6 | 5.46 | 0.2 | 41 | 0.035 | 7.3 | - | 1.9 | 3.8 | 27,600 | 6.46 | 4.21 | <0.025 | 4 | 457 | 62.9 | 13.5 |
| LF_TP_49_1.4-1.5 | LF_TP_49 | 1.4-1.5 | 31/10/2022 | TP | Normal | 8700 | 11 | 7.5 | <0.03 | <0.2 | - | <3 | <5 | - | - | - | 102,000 | 4 | 9.98 | 0.7 | 89 | 0.081 | 14.6 | - | 1.8 | 23.2 | 6090 | 10.9 | 7.67 | <0.025 | 15.1 | 517 | 260 | 20.8 |
| LF_TP_49_2.3-2.7 | LF_TP_49 | 2.3-2.7 | 31/10/2022 | TP | Normal | 540 | 12 | 7.3 | <0.03 | <0.2 | - | <2.9 | <5 | - | - | - | 6100 | 11 | 3.29 | 0.14 | 9.3 | 0.018 | 5.8 | - | 4.2 | 2.8 | 8200 | 3.5 | 5.66 | <0.025 | 5.33 | 362 | 119 | 11.4 |
| LF_TP_50_1.4-1.6 | LF_TP_50 | 1.4-1.6 | 31/10/2022 | TP | Normal | 3900 | 25 | 7.9 | <0.03 | <0.4 | - | 6.6 | <5 | - | - | - | 146,000 | 0.92 | 11.7 | 2.35 | 355 | 0.067 | 32.9 | - | 0.67 | 52.1 | 2520 | 3 | 7.69 | <0.025 | 24.8 | 507 | 714 | 19.5 |
| LF_TP_50_3.0-3.5 | LF_TP_50 | 3-3.5 | 31/10/2022 | TP | Normal | 560 | 31 | 7.8 | <0.03 | <0.2 | - | <2.9 | 408 | - | - | - | 22,300 | 4.2 | 35.1 | 0.2 | 76 | 0.023 | 25.9 | - | 4.15 | 7 | 25,100 | 7.34 | 14.2 | 0.08 | 14.5 | 1030 | 103 | 19.1 |
| LF_TP_51_0.9-1.0 | LF_TP_51 | 0.9-1 | 31/10/2022 | TP | Normal | 320 | 14 | 6.5 | <0.03 | <0.2 | - | 87.9 | <5 | - | - | - | 2490 | 2.5 | 2.2 | 0.093 | 4.1 | 0.0076 | 3.6 | - | 1.4 | 1.7 | 4220 | 1 | 3.79 | <0.025 | 2.6 | 230 | 29.8 | 6.93 |
| LF_TP_51_2.7-3.0 | LF_TP_51 | 2.7-3 | 31/10/2022 | TP | Normal | 260 | 17 | 6.2 | <0.03 | <0.2 | - | <2.9 | 9.18 | - | - | - | 5850 | 3.2 | 3.41 | 0.13 | 4.6 | 0.015 | 6.8 | - | 2.84 | 3 | 6850 | 1.9 | 6.59 | <0.025 | 4.9 | 407 | 62.5 | 14.3 |
| LF_TP_52_1.8-2.0 | LF_TP_52 | 1.8-2 | 31/10/2022 | TP | Normal | 1600 | 11 | 6.7 | <0.03 | 5.54 | - | <3.2 | <5 | - | - | - | 17,800 | 4.9 | 5.75 | 0.21 | 16 | 0.04 | 5.8 | - | 1.7 | 7.6 | 6330 | 7.48 | 4.04 | <0.025 | 4.7 | 446 | 45.1 | 13.4 |
| LF_TP_52_2.7-3.0 | LF_TP_52 | 2.7-3 | 31/10/2022 | TP | Normal | 580 | 20 | 6.5 | <0.03 | 1.9 | - | 4.4 | 10.4 | - | - | - | 4670 | 4.3 | 3.97 | 0.11 | 12 | 0.04 | 4.8 | - | 1.5 | 4.2 | 5470 | 28 | 3.6 | <0.025 | 3.1 | 374 | 30.3 | 13.4 |
| LF_TP_53_1.4-1.5 | LF_TP_53 | 1.4-1.5 | 31/10/2022 | TP | Normal | 710 | 7 | 6 | <0.03 | 1.5 | - | <3 | 32.5 | - | - | - | 6350 | 5.4 | 6.27 | 0.15 | 5.1 | 0.1 | 6.7 | - | 1.9 | 7.71 | 6600 | 22.6 | 4.7 | <0.025 | 5.52 | 412 | 32.6 | 20.4 |
| LF_TP_53_2.0-2.2 | LF_TP_53 | 2-2.2 | 31/10/2022 | TP | Normal | 320 | 13 | 6.2 | <0.03 | <0.2 | - | <3 | <5 | - | - | - | 4030 | 4.6 | 2.5 | 0.1 | 3.5 | 0.032 | 4.5 | - | 1.9 | 1.4 | 5520 | 1.5 | 4.4 | <0.025 | 2.9 | 307 | 18.1 | 8.92 |
| LF_TP_54_1.8-2.0 | LF_TP_54 | 1.8-2 | 31/10/2022 | TP | Normal | 2500 | 6 | 7.5 | <0.03 | <0.2 | - | 11.1 | 5.22 | - | - | - | 19,400 | 5.4 | 24.4 | 0.39 | 9.2 | 0.26 | 17.7 | - | 6.65 | 12.9 | 13,400 | 24.4 | 9.53 | <0.025 | 43.4 | 499 | 64.2 | 71.5 |
| LF_TP_54_2.7-3.0 | LF_TP_54 | 2.7-3 | 31/10/2022 | TP | Normal | 570 | 19 | 5.9 | <0.03 | 0.68 | - | 4.1 | 37.5 | - | - | - | 4820 | 6.5 | 6.13 | 0.12 | 5.8 | 0.045 | 6.3 | - | 1.1 | 2.3 | 4910 | 4.6 | 2.86 | 0.029 | 3.3 | 322 | 28.2 | 8.66 |
| LF_TP_55_0.6-0.7 | LF_TP_55 | 0.6-0.7 | 31/10/2022 | TP | Normal | 1800 | 9 | 6.4 | <0.03 | 1.7 | - | 61.5 | 18.6 | - | - | - | 7900 | 5.1 | 5.83 | 0.14 | 31 | 0.04 | 5.4 | - | 0.83 | 3.5 | 4640 | 10.1 | 2.3 | <0.025 | 3 | 379 | 48.8 | 8.61 |
| LF_TP_55_1.0-1.4 | LF_TP_55 | 1-1.4 | 31/10/2022 | TP | Normal | 760 | 16 | 6.6 | <0.03 | <0.2 | - | 8.6 | 12.1 | - | - | - | 5020 | 12.8 | 5.06 | 0.13 | 10 | 0.038 | 5.6 | - | 2.4 | 2.2 | 8400 | 3.6 | 5.47 | <0.025 | 3.6 | 440 | 26.4 | 11.6 |
| LF_TP_56_2.3-2.5 | LF_TP_56 | 2.3-2.5 | 31/10/2022 | TP | Normal | 320 | 19 | 6.4 | <0.03 | 0.88 | - | 4 | 13.9 | - | - | - | 3120 | 2.7 | 6.79 | 0.069 | 14 | 0.025 | 2.7 | - | 0.45 | 1.2 | 3060 | 2.8 | 0.73 | <0.025 | 0.95 | 213 | 32.2 | 4.9 |
| LF_TP_56_3.2-3.5 | LF_TP_56 | 3.2-3.5 | 31/10/2022 | TP | Normal | 510 | 18 | 6.7 | <0.03 | <0.2 | - | 9.3 | 7.31 | - | - | - | 5610 | 13 | 5.1 | 0.16 | 12 | 0.074 | 8 | - | 2.58 | 2.6 | 10,500 | 3.4 | 6 | <0.025 | 3.7 | 569 | 34.1 | 12.2 |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
CCME (1991) Interim Canadian environmental quality criteria for contaminated sites (SQG)
ASC NEPM (2013) - National Environmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
## Table C4
## NZAS Landfill Soil Ecological Screening Values

| | | | | | | BTEXN | | | | | TPH | | | | | | | | | | | PAHs | | | | | | | | | | | | | | | | | | | | | | | SVOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Benzene | Toluene | Ethylbenzene | Xylene (o) | Xylene (m & p) | C7-C9 | C10-C14 | C15-C36 | C7-C36 (Total) | C10 - C11 | C12 - C14 | C15 - C20 | C21 - C25 | C26 - C29 | C30 - C44 | C7 - C44 (Total) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | PAHs (Sum of total) - Lab calc | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | Benzo(e)pyrene | Perylene | Benzo(b)fluoranthene | 1-Methylnaphthalene |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.05 | 0.1 | 0.05 | 0.05 | 0.1 | | | | | | | | | | | | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | | 0.01 | 0.03 | 0.01 | | | 0.1 | 0.01 |
| ECOSGV - Commercial | | | | | | | | | | | | | | | 47 | | | | | | | | | | | 47 | | | | | | | | | | | | | 47 | 47 | | | | | |
| ECOSGV - Recreational | | | | | | | | | | | | | | | 22 | | | | | | | | | | | 22 | | | | | | | | | | | | | 22 | 22 | | | | | |
| ECOSGV - Commercial - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSSL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EIL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 370 | | | 47 | | | | | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 170 | | | 22 | | | | | | | |
| SQG - Comercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Commercial Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| A19R 0-1.5m | A19R | 0-1.5 | 13/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | 0.042 | <0.012 | 0.119 | 0.92 | 1.43 | 1.53 | 0.55 | 1.06 | 0.96 | 0.21 | 1.59 | 0.018 | 1.04 | <0.06 | 0.44 | 1.6 | 12.8 | 2.1 | - | <0.012 | 0.85 | 0.39 | - | <0.012 |
| A40D 0-2.5m | A40D | 0-2.5 | 27/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.012 | <0.012 | <0.012 | 0.011 | 0.015 | 0.015 | <0.012 | 0.011 | 0.012 | <0.012 | 0.013 | <0.012 | <0.012 | <0.06 | <0.012 | 0.013 | <0.3 | <0.027 | - | <0.012 | 0.011 | <0.012 | - | <0.012 |
| A40D 17.5-20m | A40D | 17.5-20 | 27/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.07 | <0.013 | <0.013 | <0.3 | <0.03 | - | <0.013 | <0.013 | <0.013 | - | <0.013 |
| A54D 1-2m | A54 | 1-2 | 12/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.026 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A54D 4.5-5m | A54 | 4.5-5 | 12/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.06 | <0.012 | <0.012 | <0.3 | <0.028 | - | <0.012 | <0.012 | <0.012 | - | <0.012 |
| A55D 7-8m | A55 | 7-8 | 15/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.06 | <0.012 | <0.012 | <0.3 | <0.029 | - | <0.012 | <0.012 | <0.012 | - | <0.012 |
| A55D 2.6-3m | A55D | 2.6-3 | 15/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.05 | <0.01 | <0.01 | <0.3 | <0.025 | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A5AR 1-2m | A5AR | 1-2 | 8/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 116 | 121 | - | - | - | - | - | - | - | 0.05 | <0.011 | 0.143 | 1.83 | 2.2 | 3.3 | 1.06 | 1.61 | 2.1 | 0.37 | 2.3 | 0.031 | 1.65 | <0.06 | 0.62 | 2.1 | 22 | 3.4 | - | <0.011 | 1.63 | 0.58 | - | <0.011 |
| A5AR 8-8.6m | A5AR | 8-8.6 | 8/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.012 | <0.012 | <0.012 | 0.02 | 0.027 | 0.03 | 0.012 | 0.022 | 0.027 | <0.012 | 0.026 | <0.012 | 0.02 | <0.06 | <0.012 | 0.019 | <0.3 | 0.04 | - | <0.012 | 0.017 | 0.013 | - | <0.012 |
| A60 0-3m | A60 | 0-3 | 10/10/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | 0.013 | 0.015 | - | <0.01 | 0.01 | 0.014 | <0.01 | 0.015 | <0.01 | 0.01 | <0.05 | <0.01 | 0.015 | <0.3 | - | - | <0.01 | 0.013 | <0.01 | - | <0.01 |
| A60 4.5-6m | A60 | 4.5-6 | 10/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.012 | <0.012 | <0.012 | 0.019 | 0.03 | 0.033 | 0.014 | 0.02 | 0.021 | <0.012 | 0.028 | <0.012 | 0.019 | <0.06 | <0.012 | 0.024 | <0.3 | 0.039 | - | <0.018 | 0.018 | 0.012 | - | <0.012 |
| A61 0-3m | A61 | 0-3 | 10/10/2022 | MW | Normal | <0.06 | <0.06 | <0.06 | <0.06 | <0.12 | <20 | 21 | 300 | 320 | - | - | - | - | - | - | - | <0.014 | <0.014 | <0.014 | 0.024 | 0.035 | 0.039 | <0.014 | 0.024 | 0.026 | <0.014 | 0.034 | <0.014 | 0.024 | <0.07 | 0.016 | 0.032 | 0.4 | 0.046 | - | <0.03 | 0.023 | 0.068 | - | <0.014 |
| A61 3-4.5m | A61 | 3-4.5 | 10/10/2022 | MW | Normal | <0.06 | <0.06 | <0.06 | <0.06 | <0.11 | <20 | <20 | 173 | 184 | - | - | - | - | - | - | - | <0.013 | <0.013 | <0.013 | 0.013 | 0.02 | 0.02 | <0.013 | <0.013 | <0.013 | <0.013 | 0.018 | <0.013 | <0.013 | <0.07 | <0.013 | 0.016 | <0.4 | <0.032 | - | <0.02 | <0.013 | 0.101 | - | <0.013 |
| A63 2.0-3.0m | A63 | 2-3 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.06 | <0.012 | <0.012 | <0.3 | <0.029 | - | <0.012 | <0.012 | <0.012 | - | <0.012 |
| A64D 5.5-4.8m | A64D | 4.8-5.5 | 3/10/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.05 | <0.01 | <0.01 | <0.3 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A65 3.0-4.5m | A65 | 3-4.5 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | 0.011 | <0.011 | <0.011 | <0.011 | <0.011 | 0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.027 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A66 0-1.5m | A66 | 0-1.5 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | 0.051 | 0.085 | - | 0.035 | 0.075 | 0.056 | 0.013 | 0.091 | <0.01 | 0.07 | <0.05 | 0.028 | 0.088 | 0.8 | - | - | <0.01 | 0.051 | 0.024 | - | <0.01 |
| A66 4.5-6.0m | A66 | 4.5-6 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.026 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A67 0-1.5m | A67 | 0-1.5 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.011 | <0.011 | <0.011 | 0.041 | 0.057 | 0.062 | 0.024 | 0.039 | 0.04 | <0.011 | 0.074 | <0.011 | 0.037 | <0.06 | 0.022 | 0.067 | 0.5 | 0.081 | - | <0.011 | 0.032 | 0.016 | - | <0.011 |
| A67 5.5-6.0m | A67 | 5.5-6 | 26/10/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.025 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A70S 1-2m | A70 | 1-2 | 13/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | 0.012 | 0.017 | 0.019 | <0.011 | 0.01 | 0.011 | <0.011 | 0.013 | <0.011 | <0.011 | <0.06 | <0.011 | 0.013 | <0.3 | 0.026 | - | <0.011 | 0.011 | <0.011 | - | <0.011 |
| A70S 4-5m | A70 | 4-5 | 13/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.026 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A70D 6-7m | A70D | 6-7 | 12/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.012 | <0.06 | <0.012 | <0.012 | <0.3 | <0.029 | - | <0.012 | <0.012 | <0.012 | - | <0.012 |
| A70D 2-2.4m | A70D | 2-2.4 | 12/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.025 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| A71S 1-2m | A71 | 1-2 | 16/12/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.01 | 0.011 | - | <0.01 | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 | <0.01 | <0.05 | <0.01 | 0.01 | <0.3 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A71S 5.6-6m | A71 | 5.6-6 | 16/12/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.05 | <0.01 | <0.01 | <0.3 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A71D 3-4m | A71D | 3-4 | 14/12/2022 | MW | Normal | <0.05 | <0.05 | <0.04 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | - | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.05 | <0.01 | <0.01 | <0.3 | - | - | <0.01 | <0.01 | <0.01 | - | <0.01 |
| A71D 11-12m | A71D | 11-12 | 14/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | - | - | - | <8 | <8 | <8 | <8 | <8 | <20 | <80 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.013 | <0.07 | <0.013 | <0.013 | <0.3 | <0.03 | - | <0.013 | <0.013 | <0.013 | - | <0.013 |
| A7R 1-2m | A7R | 1-2 | 8/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 67 | <80 | - | - | - | - | - | - | - | <0.011 | <0.011 | 0.012 | 0.143 | 0.25 | 0.3 | 0.106 | 0.23 | 0.149 | 0.037 | 0.22 | <0.011 | 0.23 | <0.06 | 0.044 | 0.197 | 2.2 | 0.37 | - | <0.011 | 0.16 | 0.073 | - | <0.011 |
| A7R 6.2-7m | A7R | 6.2-7 | 8/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | <40 | <80 | - | - | - | - | - | - | - | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.011 | <0.06 | <0.011 | <0.011 | <0.3 | <0.025 | - | <0.011 | <0.011 | <0.011 | - | <0.011 |
| CIR 1-2m | C1R | 1-2 | 5/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 530 | 540 | - | - | - | - | - | - | - | 0.68 | <0.011 | 2.3 | 6.9 | 9.5 | 9.4 | 3.4 | 6.9 | 6.2 | 1.13 | 16.3 | 0.58 | 7.2 | 0.15 | 6.8 | 15 | 100 | 13.5 | - | 0.079 | 4.8 | 2.7 | - | 0.058 |
| CIR 5-6m | C1R | 5-6 | 5/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 55 | <80 | - | - | - | - | - | - | - | 0.016 | <0.013 | 0.025 | 0.111 | 0.179 | 0.174 | 0.067 | 0.135 | 0.129 | 0.021 | 0.25 | <0.013 | 0.13 | <0.07 | 0.077 | 0.23 | 1.8 | 0.25 | - | <0.013 | 0.093 | 0.089 | - | <0.013 |
| C3R 2-3m | C3R | 2-3 | 6/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 6700 | 6700 | - | - | - | - | - | - | - | 13.3 | 0.117 | 42 | 260 | 340 | 340 | 134 | 220 | 270 | 41 | 470 | 7.2 | 240 | 2.4 | 145 | 450 | 3300 | 490 | - | 1.93 | 181 | 98 | - | 0.94 |
| C3R 8-9m | C3R | 8-9 | 6/12/2022 | MW | Normal | <0.05 | <0.05 | <0.05 | <0.05 | <0.1 | <20 | <20 | 480 | 490 | - | - | - | - | - | - | - | 2.2 | 0.094 | 5.8 | 14.2 | 14.8 | 18.1 | 6.6 | 11.5 | 13.3 | 2.4 | 32 | 0.6 | 11.8 | 0.17 | 25 | 26 | 198 | 23 | - | 0.21 | 9.1 | 4.3 | - | 0.176 |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
CCME (1991) Interim Canadian environmental quality criteria for contaminated sites (SQG)
ASC NEPM (2013) - National Environmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
# Table C4
# NZAS Landfill Soil Ecological Screening Values

| | | | | | | BTEXN | | | | | PAHs | | | | | | | | | | | | | | | | | | | | | | | SVOCs | | MAH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Benzene | Toluene | Ethylbenzene | Xylene (o) | Xylene (m & p) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | PAHs (Sum of total) - Lab calc | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | Benzo(e)pyrene | Perylene | Benzo(b)fluoranthene | 1-Methylnaphthalene | Dibenzofuran | 1,2,4-trimethylbenzene |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.05 | 0.1 | 0.05 | 0.05 | 0.1 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | | 0.01 | 0.03 | 0.01 | | | 0.1 | 0.01 | 0.3 | 0.05 |
| ECOSGV - Commercial | | | | | | | | | | | | | | | 47 | | | | | | | | | | | | | 47 | 47 | | | | | | | |
| ECOSGV - Recreational | | | | | | | | | | | | | | | 22 | | | | | | | | | | | | | 22 | 22 | | | | | | | |
| ECOSGV - Commercial - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSSL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EIL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | 370 | | | 47 | | | | | | | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | | | | 170 | | | 22 | | | | | | | | | |
| SQG - Comercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Commercial Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field_ID | Location_Code | Sample_Depth_Range | Sampled_Date_Time | Location_Type | Sample_Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TP1 0.2 | LF_TP_1 | 0.2 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | 0.56 | <0.1 | 2 | 15 | 20 | - | 9.1 | 13 | 15 | 2.4 | 24 | 0.3 | 14 | <0.1 | 6.4 | 23 | - | 30 | 30 | <0.1 | - | - | 27 | - | <0.3 | <0.05 |
| TP1 2.0 | LF_TP_1 | 2 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 - 0.14 | <0.1 | 0.2 - 0.6 | 1.2 - 3.6 | 1.7 - 4.9 | - | 0.69 - 2 | 1.3 - 2.7 | 1.3 - 3.2 | 0.16 - 0.45 | 2.6 - 5.6 | <0.1 - 0.14 | 1.1 - 3 | <0.1 - 0.21 | 0.83 - 2.2 | 2.6 - 5.2 | - | 2.4 - 6.8 | 2.4 - 6.8 | <0.1 | - | - | 2.2 - 5.7 | - | <0.3 | <0.05 |
| TP1 3.0 | LF_TP_1 | 3 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | 0.36 | <0.1 | 1 | 4.1 | 5.4 | - | 1.7 | 3.5 | 3.9 | 0.37 | 8.4 | 0.22 | 3.4 | 0.2 | 4.2 | 7.9 | - | 7.5 | 7.5 | <0.1 | - | - | 6.6 | - | <0.3 | <0.05 |
| TP2 0.3 | LF_TP_2 | 0.3 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 | <0.1 | 0.16 | 1.5 | 2.6 | - | 0.85 | 2.5 | 1.3 | 0.35 | 1.8 | <0.1 | 2.7 | <0.1 | 0.51 | 1.8 | - | 3.8 | 3.8 | <0.1 | - | - | 3 | - | <0.3 | <0.05 |
| TP2 0.8 | LF_TP_2 | 0.8 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | 0.1 - 0.12 | <0.1 | 0.37 - 0.38 | 4.2 - 5.8 | 6.4 - 10 | - | 3 - 4.1 | 7.2 - 12 | 5.4 - 5.8 | 0.76 - 1.6 | 5.2 - 6.5 | <0.1 | 5.7 - 9.9 | <0.1 | 1.5 - 1.7 | 5 - 6.5 | - | 9.5 - 15 | 9.5 - 15 | <0.1 | - | - | 9.5 - 13 | - | <0.3 | <0.05 |
| TP2 2.0 | LF_TP_2 | 2 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | 0.66 | <0.1 | 3.3 | 34 | 50 | - | 12 | 34 | 32 | 3.7 | 53 | 0.45 | 36 | <0.1 | 10 | 51 | - | 69 | 69 | <0.1 | - | - | 59 | - | <0.3 | <0.05 |
| TP3 0.25 | LF_TP_3 | 0.25 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | 0.52 | <0.1 | 1.3 | 11 | 16 | - | 7.1 | 11 | 11 | 2.1 | 13 | 0.36 | 12 | <0.1 | 5.1 | 13 | - | 24 | 24 | <0.1 | - | - | 27 | - | <0.3 | <0.05 |
| TP3 0.65 | LF_TP_3 | 0.65 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 | <0.1 | <0.1 | 0.94 | 1.1 | - | 0.46 | 0.8 | 1.5 | 0.2 | 1.8 | <0.1 | 0.96 | <0.1 | 0.23 | 1.3 | - | 1.8 | 1.8 | <0.1 | - | - | 2.2 | - | <0.3 | <0.05 |
| TP3 1.4 | LF_TP_3 | 1.4 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | 0.74 | <0.1 | 3.8 | 12 | 30 | - | 7.1 | 11 | 13 | 1.8 | 51 | 0.59 | 12 | <0.1 | 12 | 45 | - | 39 | 39 | <0.1 | - | - | 38 | - | 0.36 | <0.05 |
| TP3 3.8 | LF_TP_3 | 3.8 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | 0.89 | <0.1 | 3.8 | 21 | 31 | - | 10 | 20 | 21 | 2.6 | 39 | 0.49 | 16 | <0.1 | 9.9 | 38 | - | 43 | 43 | <0.1 | - | - | 38 | - | <0.3 | <0.05 |
| TP4 0.2 | LF_TP_4 | 0.2 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | <0.05 | <0.1 | <0.1 | <0.1 | 0.16 | 1.9 | 3.1 | - | 1.4 | 1.7 | 1.8 | 0.32 | 2.3 | <0.1 | 1.9 | <0.1 | 0.63 | 2.2 | - | 4.3 | 4.3 | <0.1 | - | - | 3.9 | - | <0.3 | <0.05 |
| TP4 0.5 | LF_TP_4 | 0.5 | 7/06/2022 | TP | Normal | <0.05 | <0.1 | <0.05 | 0.061 | <0.1 | 0.5 | 0.2 | 1.3 | 13 | 30 | - | 11 | 18 | 14 | 3.5 | 15 | 0.29 | 18 | <0.1 | 4.1 | 17 | - | 41 | 41 | <0.1 | - | - | 31 | - | <0.3 | 0.21 |
| TP4 3.5 | LF_TP_4 | 3.5 | 7/06/2022 | TP | Normal | 0.063 | <0.1 | <0.05 | <0.05 | <0.1 | 1.5 | <0.1 | 4.6 | 12 | 14 | - | 7.4 | 8.1 | 14 | 1.5 | 44 | 1.2 | 8.8 | 0.31 | 16 | 38 | - | 22 | 22 | 0.15 | - | - | 33 | - | 1.1 | 0.076 |
| LF_TP_5_0.2-0.3 | LF_TP_5 | 0.2-0.3 | 25/10/2022 | TP | Normal | - | - | - | - | - | 0.49 | 0.047 | 1.4 | 35 | 35 | 140 | 33 | 51 | 54 | 9.3 | 27 | 0.34 | 48 | 0.039 | 3.2 | 15 | - | 71 | 71 | 0.029 | - | - | - | 0.026 | - | - |
| LF_TP_5_0.9-1.0 | LF_TP_5 | 0.9-1 | 25/10/2022 | TP | Normal | - | - | - | - | - | 0.096 | 0.031 | 0.92 | 30 | 33 | 120 | 15 | 44 | 47 | 8.7 | 23 | 0.067 | 38 | 0.015 | 2.2 | 22 | - | 62 | 62 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_6_0.2-0.3 | LF_TP_6 | 0.2-0.3 | 25/10/2022 | TP | Normal | - | - | - | - | - | 2.1 | 0.054 | 7.2 | 32 | 41 | 42 | 13 | 17 | 26 | 4.1 | 62 | 1.3 | 28 | 0.58 | 22 | 61 | - | 58 | 58 | 0.17 | - | - | - | 0.13 | - | - |
| LF_TP_6_1.8-2.0 | LF_TP_6 | 1.8-2 | 25/10/2022 | TP | Normal | - | - | - | - | - | 8.1 | 0.17 | 23 | 96 | 110 | 120 | 41 | 57 | 79 | 13 | 200 | 5 | 61 | 3.2 | 84 | 190 | - | 160 | 160 | 0.84 | - | - | - | 0.72 | - | - |
| LF_TP_7_0.2-0.3 | LF_TP_7 | 0.2-0.3 | 28/10/2022 | TP | Normal | - | - | - | - | - | 0.018 | <0.01 | 0.064 | 0.48 | 0.66 | 0.99 | 0.42 | 0.45 | 0.64 | 0.086 | 0.63 | 0.011 | 0.52 | <0.01 | 0.17 | 0.72 | - | 1 | 1 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_7_1.4-1.5 | LF_TP_7 | 1.4-1.5 | 28/10/2022 | TP | Normal | - | - | - | - | - | 2 | 0.039 | 4.7 | >19 | 63 | 66 | 37 | 37 | 62 | 7.4 | >19 | 1 | 42 | 0.37 | 18 | 69 | - | 87 | 87 | 0.12 | - | - | - | 0.09 | - | - |
| LF_soil_DUP_8 | LF_TP_7 | 1.4-1.5 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_8_0.2-0.3 | LF_TP_8 | 0.2-0.3 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.38 | 0.094 | 1.9 | 15 | 36 | 35 | 12 | 15 | 40 | 3.4 | 22 | 0.19 | 11 | 0.056 | 5.7 | 24 | - | 48 | 48 | 0.022 | - | - | - | 0.015 | - | - |
| LF_TP_8_1.8-2.0 | LF_TP_8 | 1.8-2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 1.8 | 0.043 | 17 | 66 | 160 | 120 | 47 | 97 | 110 | 8.4 | 150 | 0.94 | 84 | 0.25 | 38 | 150 | - | 210 | 210 | 0.5 | - | - | - | 0.42 | - | - |
| LF_TP_8_1.0-1.2 | LF_TP_8 | 1-1.2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.98 | 0.045 | 4.1 | 20 | 48 | 31 | 13 | 14 | 27 | 3.1 | 40 | 0.63 | 12 | 0.23 | 11 | 0.14 | - | 59 | 59 | 0.47 | - | - | - | 0.55 | - | - |
| LF_TP_9_0.2-0.3 | LF_TP_9 | 0.2-0.3 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.019 | <0.01 | 0.049 | 0.37 | 0.58 | 0.62 | 0.26 | 0.39 | 0.58 | 0.089 | 0.56 | 0.016 | 0.32 | <0.01 | 0.25 | 0.6 | - | 0.83 | 0.83 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_9_1.8-2.0 | LF_TP_9 | 1.8-2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.095 | <0.01 | 0.17 | 1.6 | 2.7 | 3.2 | 1.3 | 1.7 | 2.3 | 0.42 | 2 | 0.043 | 1.5 | 0.011 | 0.65 | 2.2 | - | 3.9 | 3.9 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_9_1.0-1.2 | LF_TP_9 | 1-1.2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.041 | <0.01 | 0.079 | 0.73 | 1.2 | 1.3 | 0.56 | 0.69 | 1.1 | 0.17 | 1 | 0.023 | 0.59 | <0.01 | 0.36 | 1.1 | - | 1.7 | 1.7 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_10_0.3-0.4 | LF_TP_10 | 0.3-0.4 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.98 | 0.069 | 3.2 | 58 | 110 | 160 | 52 | 66 | 180 | 9.2 | 81 | 0.46 | 54 | 0.11 | 14 | 76 | - | 150 | 150 | 0.064 | - | - | - | 0.041 | - | - |
| LF_TP_10_1.8-2.0 | LF_TP_10 | 1.8-2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.73 | 0.07 | 2.1 | 24 | 37 | 59 | 20 | 24 | 78 | 5.1 | 32 | 0.4 | 12 | 0.1 | 7.2 | 31 | - | 54 | 54 | 0.056 | - | - | - | 0.043 | - | - |
| LF_TP_10_1.0-1.2 | LF_TP_10 | 1-1.2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.79 | 0.056 | 2 | 18 | 32 | 42 | 14 | 14 | 48 | 3.9 | 25 | 0.4 | 11 | 0.11 | 7.1 | 26 | - | 45 | 45 | 0.067 | - | - | - | 0.051 | - | - |
| LF_TP_11_0.3-0.4 | LF_TP_11 | 0.3-0.4 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.048 | 0.16 | 0.17 | 2 | 3.4 | 4.5 | 1.9 | 2.6 | 3.4 | 0.55 | 1.7 | <0.01 | 2.2 | 0.012 | 0.42 | 5 | - | 5 | 5 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_11_0.9-1.0 | LF_TP_11 | 0.9-1 | 26/10/2022 | TP | Normal | - | - | - | - | - | 5.6 | 0.15 | 11 | 51 | 77 | 84 | 31 | 51 | 56 | 6.6 | 83 | 3.9 | 47 | 2.6 | 37 | 88 | - | 110 | 110 | 0.8 | - | - | - | 0.6 | - | - |
| LF_TP_11_1.8-2.0 | LF_TP_11 | 1.8-2 | 26/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | 0.017 | <0.02 | <0.01 | <0.02 | 0.011 | <0.01 | <0.02 | <0.01 | 0.011 | <0.01 | <0.01 | <0.02 | - | 0.02 | 0.03 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_12_0.2-0.3 | LF_TP_12 | 0.2-0.3 | 1/11/2022 | TP | Normal | - | - | - | - | - | 0.39 | 0.019 | 1.2 | 8.2 | 24 | 28 | 12 | 18 | 34 | 1.4 | 23 | 0.2 | 17 | 0.054 | 3.9 | 21 | - | 33 | 33 | 0.043 | - | - | - | 0.032 | - | - |
| LF_TP_12_0.8-1.0 | LF_TP_12 | 0.8-1 | 1/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_13_0.2-0.3 | LF_TP_13 | 0.2-0.3 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.11 | 0.058 | 0.34 | 4.2 | 4.6 | 9.9 | 2.9 | 4 | 6.2 | 0.94 | 5.2 | 0.066 | 3.3 | 0.037 | 1.2 | 5.4 | - | 7.7 | 7.7 | 0.035 | - | - | - | 0.031 | - | - |
| LF_TP_13_0.8-1.0 | LF_TP_13 | 0.8-1 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.014 | <0.01 | 0.023 | 0.14 | 0.13 | 0.49 | 0.14 | 0.16 | 0.34 | 0.047 | 0.24 | <0.01 | 0.14 | 0.06 | 0.2 | 0.19 | - | 0.28 | 0.28 | 0.021 | - | - | - | 0.013 | - | - |
| LF_TP_13_1.8-2.0 | LF_TP_13 | 1.8-2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.021 | <0.01 | 0.075 | 0.23 | 0.18 | 0.52 | 0.17 | 0.17 | 0.38 | 0.048 | 0.51 | <0.01 | 0.16 | 0.022 | 0.33 | 0.41 | - | 0.35 | 0.35 | 0.014 | - | - | - | <0.01 | - | - |
| LF_TP_14_0.2-0.3 | LF_TP_14 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 1.3 | 0.062 | 3.3 | 71 | 91 | 210 | 79 | 73 | 150 | 21 | 60 | 0.83 | 73 | 0.31 | 13 | 63 | - | 160 | 160 | 0.15 | - | - | - | 0.1 | - | - |
| LF_TP_14_0.8-1.0 | LF_TP_14 | 0.8-1 | 27/10/2022 | TP | Normal | - | - | - | - | - | 11 | 0.069 | 9.4 | 170 | 220 | 270 | 110 | 130 | 230 | 39 | 180 | 9.1 | 150 | 2.3 | 120 | 170 | - | 330 | 330 | 1.3 | - | - | - | 0.85 | - | - |
| LF_TP_15_0.2-0.3 | LF_TP_15 | 0.2-0.3 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.38 | <0.01 | 1 | 7.8 | 11 | 14 | 5.3 | 7.6 | 9.4 | 1.6 | 16 | 0.15 | 6.4 | 0.028 | 3.7 | 16 | - | 17 | 17 | 0.017 | - | - | - | <0.01 | - | - |
| LF_TP_15_0.8-1.0 | LF_TP_15 | 0.8-1 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.49 | 0.016 | 1.4 | 13 | 16 | 20 | 7.8 | 12 | 16 | 2.7 | 15 | 0.25 | 9.8 | 0.093 | 5.3 | 17 | - | 24 | 24 | 0.036 | - | - | - | 0.023 | - | - |
| LF_TP_15_1.8-2.0 | LF_TP_15 | 1.8-2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 18 | 0.13 | 36 | 240 | 280 | 330 | 110 | 170 | 190 | 12 | 230 | 14 | 210 | 1.7 | 140 | 220 | - | 380 | 380 | 1.1 | - | - | - | 1.1 | - | - |
| LF_TP_16_1.0-2.0 | LF_TP_16 | 1-2 | 2/11/2022 | TP | Normal | - | - | - | - | - | <0.04 | <0.04 | 0.047 | 0.53 | 0.55 | 0.76 | 0.24 | <0.04 | 0.58 | <0.04 | 0.77 | <0.04 | 0.34 | <0.04 | 0.21 | 0.76 | - | 0.75 | 0.79 | <0.04 | - | - | - | <0.04 | - | - |
| LF_TP_16_0.2-0.3 | LF_TP_16 | 0.2-0.3 | 2/11/2022 | TP | Normal | - | - | - | - | - | 0.036 | <0.026 | 0.092 | 1 | 0.92 | 1.5 | 0.47 | 0.46 | 1.1 | <0.026 | 1.4 | <0.026 | 0.65 | 0.034 | 0.38 | 1.4 | - | 1.3 | 1.4 | <0.026 | - | - | - | <0.026 | - | - |
| LF_TP_17_0.2-0.3 | LF_TP_17 | 0.2-0.3 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.5 | 0.014 | 0.82 | 7.9 | 8.9 | 15 | 5.4 | 7.3 | 11 | 1.9 | 10 | 0.24 | 6.2 | 0.073 | 3.1 | 10 | - | 14 | 14 | 0.05 | - | - | - | 0.039 | - | - |
| LF_TP_17_1.8-2.0 | LF_TP_17 | 1.8-2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.52 | 0.011 | 1.1 | 12 | 12 | 33 | 7.4 | 8.4 | 16 | 2.2 | 16 | 0.23 | 7.3 | 0.055 | 3.9 | 15 | - | 21 | 21 | 0.04 | - | - | - | 0.024 | - | - |
| LF_TP_17_1.0-1.2 | LF_TP_17 | 1-1.2 | 26/10/2022 | TP | Normal | - | - | - | - | - | 0.15 | <0.01 | 0.32 | 5 | 5 | 11 | 3.5 | 3.8 | 9 | 1.1 | 5.5 | 0.072 | 3.3 | 0.047 | 1.3 | 5.5 | - | 8.5 | 8.5 | 0.028 | - | - | - | 0.016 | - | - |
| LF_TP_18_0.2-0.3 | LF_TP_18 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.014 | <0.01 | 0.026 | 0.14 | 0.18 | 0.23 | 0.097 | 0.094 | 0.19 | 0.02 | 0.21 | <0.01 | 0.12 | <0.01 | 0.077 | 0.21 | - | 0.26 | 0.26 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_18_1.8-2.0 | LF_TP_18 | 1.8-2 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.47 | 0.014 | 1.2 | 11 | 28 | 21 | 11 | 17 | 23 | 1.7 | 15 | 0.23 | 18 | 0.055 | 4.3 | 16 | - | 36 | 36 | 0.029 | - | - | - | 0.019 | - | - |
| LF_TP_19_0.2-0.3 | LF_TP_19 | 0.2-0.3 | 26/10/2022 | TP | Normal | - | - | - | - | - | <0.024 | <0.024 | <0.024 | 0.25 | 0.24 | 0.39 | 0.12 | <0.024 | 0.27 | <0.024 | 0.25 | <0.024 | 0.18 | <0.024 | 0.084 | <0.024 | - | 0.34 | 0.36 | <0.024 | - | - | - | <0.024 | - | - |
| LF_TP_19_1.3-1.5 | LF_TP_19 | 1.3-1.5 | 26/10/2022 | TP | Normal | - | - | - | - | - | <0.019 | <0.019 | <0.019 | <0.02 | <0.019 | <0.02 | <0.019 | <0.02 | <0.019 | <0.019 | <0.02 | <0.019 | <0.019 | <0.019 | <0.019 | <0.02 | - | <0.01 | 0.05 | <0.019 | - | - | - | <0.019 | - | - |
| LF_TP_20_0.2-0.3 | LF_TP_20 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.058 | <0.01 | 0.14 | 1.6 | 1.7 | 3 | 1.2 | 1.1 | 2 | 0.33 | 1.4 | 0.03 | 1.3 | <0.01 | 0.45 | 1.4 | - | 2.7 | 2.7 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_20_1.8-2.0 | LF_TP_20 | 1.8-2 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.16 | <0.01 | 0.39 | 4.2 | 3.4 | 7.1 | 2.7 | 2.2 | 4.2 | 0.75 | 3.3 | 0.094 | 2.7 | 0.03 | 1.5 | 3.1 | - | 5.9 | 5.9 | 0.015 | - | - | - | <0.01 | - | - |
| LF_TP_21_0.2-0.3 | LF_TP_21 | 0.2-0.3 | 2/11/2022 | TP | Normal | - | - | - | - | - | 0.057 | <0.038 | 0.14 | 1.2 | 1.4 | 1.9 | 0.64 | <0.038 | 1.4 | <0.038 | 2.2 | <0.038 | 0.96 | <0.038 | 0.56 | 2.2 | - | 1.9 | 1.9 | <0.038 | - | - | - | <0.038 | - | - |
| LF_TP_21_1.0-1.2 | LF_TP_21 | 1-1.2 | 2/11/2022 | TP | Normal | - | - | - | - | - | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | <0.021 | - | <0.01 | 0.05 | <0.021 | - | - | - | <0.021 | - | - |
| LF_TP_22_0.2-0.3 | LF_TP_22 | 0.2-0.3 | 2/11/2022 | TP | Normal | - | - | - | - | - | 0.038 | <0.01 | 0.074 | 0.64 | 0.78 | 0.95 | 0.34 | 0.39 | 0.67 | 0.099 | 1.1 | 0.019 | 0.56 | <0.01 | 0.26 | 1.1 | - | 1.2 | 1.2 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_22_0.8-1.0 | LF_TP_22 | 0.8-1 | 2/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_23_0.1-0.3 | LF_TP_23 | 0.1-0.3 | 2/11/2022 | TP | Normal | - | - | - | - | - | 0.15 | <0.022 | 0.34 | 3.4 | 4.1 | 6 | 1.9 | 2.2 | 4.3 | 0.53 | 5.2 | 0.079 | 3.1 | <0.022 | 1.4 | 5 | - | 6.2 | 6.2 | <0.022 | - | - | - | <0.022 | - | - |
| LF_TP_23_0.7-1.1 | LF_TP_23 | 0.7-1.1 | 2/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | 0.02 | 0.026 | <0.01 | <0.02 | 0.012 | <0.01 | <0.02 | <0.01 | 0.014 | <0.01 | <0.01 | 0.024 | - | 0.02 | 0.04 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_24_0.3-0.4 | LF_TP_24 | 0.3-0.4 | 2/11/2022 | TP | Normal | - | - | - | - | - | 0.2 | <0.01 | 0.35 | 3.6 | 4.3 | 6.2 | 2.1 | 2.7 | 4.2 | 0.7 | 5.5 | 0.11 | 3.5 | 0.019 | 1.4 | 5.2 | - | 6.7 | 6.7 | 0.019 | - | - | - | <0.01 | - | - |
| LF_TP_24_1.4-1.6 | LF_TP_24 | 1.4-1.6 | 2/11/2022 | TP | Normal | - | - | - | - | - | 0.063 | <0.01 | 0.11 | 1.1 | 0.74 | 1.3 | 0.4 | 0.28 | 1.4 | 0.11 | 1.8 | 0.028 | 0.43 | 0.031 | 0.57 | 1.6 | - | 1.2 | 1.2 | 0.022 | - | - | - | 0.013 | - | - |
| LF_TP_25_1.0-1.2 | LF_TP_25 | 1-1.2 | 1/11/2022 | TP | Normal | - | - | - | - | - | 0.34 | 0.013 | 0.99 | 7.7 | 20 | 14 | 8.9 | 4.2 | 23 | 1.4 | 16 | 0.22 | 13 | 0.021 | 4 | 15 | - | 27 | 27 | 0.02 | - | - | - | 0.013 | - | - |
| LF_soil_DUP_9 | LF_TP_25 | 1-1.2 | 1/11/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_26_0.2-0.3 | LF_TP_26 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.14 | <0.01 | 0.2 | 2 | 1.8 | 3.4 | 1.4 | 1.1 | 2.4 | 0.36 | 2 | 0.088 | 1.4 | <0.01 | 0.72 | 1.8 | - | 3 | 3 | <0.01 | - | - | - | <0.01 | - | - |
| LF_TP_26_1.8-2.0 | LF_TP_26 | 1.8-2 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.03 | <0.01 | 0.078 | 0.91 | 1.1 | 1.7 | 0.77 | 0.64 | 1.3 | 0.18 | 1 | 0.017 | 0.8 | <0.01 | 0.27 | 1 | - | 1.7 | 1.7 | <0.01 | - | - | - | <0.01 | - | - |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
CCME (1991) Interim Canadian environmental quality criteria for contaminated sites (SQG)
ASC NEPM (2013) - National Environmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
## Table C4
## NZAS Landfill Soil Ecological Screening Values

| | | | | | | BTEXN | | | | | PAHs | | | | | | | | | | | | | | | | | | | | | | | SVOCs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Benzene | Toluene | Ethylbenzene | Xylene (o) | Xylene (m & p) | Acenaphthene | Acenaphthylene | Anthracene | Benz(a)anthracene | Benzo(a)pyrene | Benzo[b+j]fluoranthene | Benzo(k)fluoranthene | Benzo(g,h,i)perylene | Chrysene | Dibenz(a,h)anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-c,d)pyrene | Naphthalene-PAH | Phenanthrene | Pyrene | PAHs (Sum of total) - Lab calc | Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc | Total 8 PAHs (as BaP TEQ)(full LOR) - Lab Calc | 2-methylnaphthalene | Benzo(e)pyrene | Perylene | Benzo(b)fluoranthene | 1-Methylnaphthalene | Dibenzofuran |
| | | | | | | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL | | | | | | 0.05 | 0.1 | 0.05 | 0.05 | 0.1 | 0.01 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.02 | | 0.01 | 0.03 | 0.01 | | | 0.1 | 0.01 | 0.3 |
| ECOSGV - Commercial | | | | | | | | | | | | | | | 47 | | | | | | | | | | | | | 47 | 47 | | | | | | |
| ECOSGV - Recreational | | | | | | | | | | | | | | | 22 | | | | | | | | | | | | | 22 | 22 | | | | | | |
| ECOSGV - Commercial - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSGV - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSSL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ECOSL - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EIL - Commercial | | | | | | | | | | | | | | | | | | | | | | | | 370 | | | 47 | | | | | | | | |
| EIL Recreational | | | | | | | | | | | | | | | | | | | | | | | | 170 | | | 22 | | | | | | | | |
| SQG - Comercial | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Commercial Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SQG - Recreational - Indirect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Field_ID | Location_Code | Sample_Depth_Range | Sampled_Date_Time | Location_Type | Sample_Type | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LF_TP_27_0.2-0.3 | LF_TP_27 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.15 | <0.01 | 0.28 | 3.4 | 3.1 | 6.5 | 2.4 | 2 | 4.6 | 0.68 | 2.7 | 0.056 | 2.3 | 0.02 | 0.85 | 2.5 | - | 5.3 | 5.3 | 0.014 | - | - | - | <0.01 | - |
| LF_TP_27_1.8-2.0 | LF_TP_27 | 1.8-2 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.058 | <0.01 | 0.15 | 2.5 | 2.4 | 4.7 | 1.7 | 1.4 | 3.5 | 0.47 | 2.2 | 0.027 | 1.7 | <0.01 | 0.52 | 2.1 | - | 4 | 4 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_28_0.2-0.3 | LF_TP_28 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 2.2 | 0.015 | 8.2 | 60 | 100 | 100 | 44 | 61 | 110 | 3.2 | 80 | 1.8 | 67 | 0.21 | 37 | 75 | - | 130 | 130 | 0.11 | - | - | - | 0.074 | - |
| LF_TP_28_1.3-1.5 | LF_TP_28 | 1.3-1.5 | 27/10/2022 | TP | Normal | - | - | - | - | - | 1.8 | 0.017 | 7.1 | 32 | 58 | 63 | 30 | 35 | 66 | 2.9 | 53 | 1.7 | 39 | 0.11 | 17 | 48 | - | 78 | 78 | 0.074 | - | - | - | 0.059 | - |
| LF_TP_29_0.2-0.3 | LF_TP_29 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.53 | <0.01 | 1 | 10 | 23 | 20 | 10 | 14 | 23 | 1.7 | 13 | 0.27 | 15 | 0.078 | 4.1 | 13 | - | 31 | 31 | 0.036 | - | - | - | 0.022 | - |
| LF_soil_DUP_1 | LF_TP_29 | 0.2-0.3 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_29_1.0-1.1 | LF_TP_29 | 1-1.1 | 27/10/2022 | TP | Normal | - | - | - | - | - | 3.5 | 0.037 | 7.8 | 140 | 140 | 220 | 96 | 71 | 170 | 24 | 100 | 1.6 | 96 | 0.19 | 17 | 100 | - | 220 | 220 | 0.22 | - | - | - | 0.17 | - |
| LF_TP_30_0.2-0.3 | LF_TP_30 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.11 | 0.013 | 0.57 | 9.6 | 18 | 27 | 10 | 11 | 40 | 1.4 | 15 | 0.068 | 4.1 | 0.017 | 2 | 14 | - | 25 | 25 | 0.01 | - | - | - | <0.01 | - |
| LF_TP_30_1.0-1.1 | LF_TP_30 | 1-1.1 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.23 | 0.038 | 1.5 | 45 | 45 | 110 | 38 | 29 | 140 | 3.4 | 58 | 0.13 | 31 | 0.024 | 7.3 | 50 | - | 73 | 73 | 0.017 | - | - | - | 0.013 | - |
| LF_TP_31_0.1-0.2 | LF_TP_31 | 0.1-0.2 | 2/11/2022 | TP | Normal | - | - | - | - | - | 0.067 | <0.01 | 0.17 | 1.6 | 1.9 | 3.1 | 0.92 | 1.1 | 2 | 0.32 | 2.2 | 0.064 | 1.5 | 0.023 | 0.8 | 2.2 | - | 3 | 3 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_31_0.7-1.0 | LF_TP_31 | 0.7-1 | 2/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | 0.014 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_32_0.2-0.3 | LF_TP_32 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.051 | <0.01 | 0.13 | 1.1 | 1.2 | 2 | 0.81 | 0.7 | 1.6 | 0.2 | 1.3 | 0.032 | 0.85 | 0.012 | 0.46 | 1.3 | - | 1.9 | 1.9 | 0.017 | - | - | - | <0.01 | - |
| LF_soil_DUP_4 | LF_TP_32 | 0.2-0.3 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_32_1.8-2.0 | LF_TP_32 | 1.8-2 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.02 | <0.01 | 0.05 | 0.57 | 0.65 | 1.3 | 0.51 | 0.4 | 1.1 | 0.12 | 0.49 | 0.012 | 0.47 | <0.01 | 0.14 | 0.54 | - | 1.1 | 1.1 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_33_0.2-0.3 | LF_TP_33 | 0.2-0.3 | 28/10/2022 | TP | Normal | - | - | - | - | - | 0.048 | <0.01 | 0.17 | 1.6 | 1.8 | 2.4 | 1.1 | 1.1 | 1.8 | 0.25 | 1.8 | 0.026 | 1.3 | <0.01 | 0.55 | 1.8 | - | 2.7 | 2.7 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_33_1.8-2.0 | LF_TP_33 | 1.8-2 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_soil_DUP_7 | LF_TP_33 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_34_0.2-0.3 | LF_TP_34 | 0.2-0.3 | 3/11/2022 | TP | Normal | - | - | - | - | - | 0.017 | <0.01 | 0.063 | 0.49 | 0.65 | 0.77 | 0.25 | 0.36 | 0.49 | 0.076 | 0.87 | <0.01 | 0.47 | <0.01 | 0.2 | 0.89 | - | 0.94 | 0.94 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_34_1.8-2.0 | LF_TP_34 | 1.8-2 | 3/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_35_0.3-0.4 | LF_TP_35 | 0.3-0.4 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.012 | <0.01 | 0.033 | 0.45 | 0.68 | 0.95 | 0.46 | 0.46 | 0.7 | 0.096 | 0.48 | <0.01 | 0.55 | <0.01 | 0.098 | 0.5 | - | 1 | 1 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_35_1.5-1.6 | LF_TP_35 | 1.5-1.6 | 27/10/2022 | TP | Normal | - | - | - | - | - | 1.6 | 0.015 | 2.9 | 5.4 | 3.5 | 7.6 | 2.8 | 2.3 | 7.9 | 0.65 | 10 | 1.8 | 2.8 | 0.75 | 11 | 8.7 | - | 6.2 | 6.2 | 0.29 | - | - | - | 0.19 | - |
| LF_soil_DUP_3 | LF_TP_35 | 1.5-1.6 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_35_2.0-2.2 | LF_TP_35 | 2-2.2 | 31/10/2022 | TP | Normal | - | - | - | - | - | 1.1 | 6.6 | 2.8 | 2.9 | 2.1 | 3.5 | 3.4 | 1.2 | 3.1 | 0.36 | 3.8 | 4.5 | 1.4 | 14 | 9.9 | 4.2 | - | 3.6 | 3.6 | 18 | - | - | - | 12 | - |
| LF_TP_36_0.2-0.3 | LF_TP_36 | 0.2-0.3 | 27/10/2022 | TP | Normal | - | - | - | - | - | 0.063 | <0.01 | 0.31 | 3.6 | 3.1 | 6.2 | 2.5 | 2.1 | 4.1 | 0.61 | 3.2 | 0.024 | 2.6 | <0.01 | 1.2 | 3.2 | - | 5.3 | 5.3 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_36_1.8-2.0 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Normal | - | - | - | - | - | 7 | 12 | 12 | 39 | 53 | 73 | 33 | 36 | 59 | 6.8 | 63 | 16 | 42 | 130 | 45 | 70 | - | 80 | 80 | 120 | - | - | - | 78 | - |
| LF_soil_DUP_2 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_37_0.2-0.3 | LF_TP_37 | 0.2-0.3 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_37_2.0-2.2 | LF_TP_37 | 2-2.2 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_38_0.2-0.3 | LF_TP_38 | 0.2-0.3 | 28/10/2022 | TP | Normal | - | - | - | - | - | 0.019 | <0.01 | 0.045 | 0.27 | 0.42 | 0.43 | 0.23 | 0.24 | 0.41 | 0.045 | 0.42 | <0.01 | 0.29 | <0.01 | 0.11 | 0.44 | - | 0.59 | 0.59 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_38_0.8-1.0 | LF_TP_38 | 0.8-1 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_39_0.2-0.3 | LF_TP_39 | 0.2-0.3 | 3/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | 0.034 | 0.28 | 0.42 | 0.53 | 0.18 | 0.31 | 0.31 | 0.05 | 0.49 | <0.01 | 0.41 | <0.01 | 0.12 | 0.51 | - | 0.62 | 0.62 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_40_1.8-2.0 | LF_TP_40 | 1.8-2 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_soil_DUP_5 | LF_TP_40 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_40_1.0-1.2 | LF_TP_40 | 1-1.2 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | 0.036 | 0.39 | 0.59 | 0.63 | 0.34 | 0.35 | 0.56 | 0.059 | 0.63 | <0.01 | 0.39 | <0.01 | 0.093 | 0.66 | - | 0.83 | 0.83 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_41_1.0-1.2 | LF_TP_41 | 1-1.2 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_41_2.2-2.3 | LF_TP_41 | 2.2-2.3 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | 0.015 | 0.014 | 0.079 | <0.01 | <0.02 | <0.01 | 0.08 | 0.11 | <0.01 | <0.02 | <0.01 | 0.094 | <0.01 | <0.01 | <0.02 | - | 0.02 | 0.04 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_42_0.1-0.3 | LF_TP_42 | 0.1-0.3 | 3/11/2022 | TP | Normal | - | - | - | - | - | 0.055 | <0.01 | 0.11 | 1.3 | 1.6 | 2.3 | 0.71 | 0.84 | 1.5 | 0.23 | 1.7 | 0.03 | 1.1 | <0.01 | 0.48 | 1.6 | - | 2.4 | 2.4 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_42_0.7-1.0 | LF_TP_42 | 0.7-1 | 3/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_43_0.2-0.3 | LF_TP_43 | 0.2-0.3 | 3/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | 0.012 | 0.097 | 0.13 | 0.15 | 0.05 | 0.073 | 0.11 | 0.014 | 0.19 | <0.01 | 0.096 | <0.01 | 0.043 | 0.19 | - | 0.18 | 0.18 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_43_0.8-1.0 | LF_TP_43 | 0.8-1 | 3/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_44_0.2-0.3 | LF_TP_44 | 0.2-0.3 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_44_1.0-1.2 | LF_TP_44 | 1-1.2 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_45_0.2-0.3 | LF_TP_45 | 0.2-0.3 | 3/11/2022 | TP | Normal | - | - | - | - | - | 0.02 | <0.01 | 0.077 | 0.61 | 0.78 | 0.92 | 0.32 | 0.46 | 0.64 | 0.084 | 1.1 | 0.011 | 0.59 | <0.01 | 0.26 | 1.1 | - | 1.1 | 1.1 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_45_1.7-2.0 | LF_TP_45 | 1.7-2 | 3/11/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_46_0.2-0.3 | LF_TP_46 | 0.2-0.3 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | 0.045 | 0.094 | 0.077 | 0.038 | 0.047 | 0.084 | <0.01 | 0.077 | <0.01 | 0.051 | <0.01 | 0.02 | 0.08 | - | 0.12 | 0.13 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_46_1.8-2.0 | LF_TP_46 | 1.8-2 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_soil_DUP_6 | LF_TP_46 | 1.8-2 | 28/10/2022 | TP | Field_D | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| LF_TP_47_0.2-0.3 | LF_TP_47 | 0.2-0.3 | 28/10/2022 | TP | Normal | - | - | - | - | - | 0.24 | <0.01 | 0.76 | 6.7 | 590 | 1200 | 4.2 | 440 | 650 | 1.4 | 640 | 0.11 | 510 | 0.021 | 2.9 | 620 | - | 780 | 780 | 0.013 | - | - | - | <0.01 | - |
| LF_TP_47_1.8-2.0 | LF_TP_47 | 1.8-2 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_48_0.2-0.3 | LF_TP_48 | 0.2-0.3 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | 0.063 | 0.075 | 0.61 | 1.6 | 1.8 | 1.9 | 1.2 | 1.5 | 0.23 | 0.54 | 0.023 | 1.5 | <0.01 | 0.23 | 1.1 | - | 2.4 | 2.4 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_48_1.0-1.2 | LF_TP_48 | 1-1.2 | 28/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | 0.022 | 0.036 | 0.014 | <0.02 | 0.033 | <0.01 | <0.02 | <0.01 | 0.018 | <0.01 | <0.01 | 0.031 | - | 0.03 | 0.04 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_49_1.4-1.5 | LF_TP_49 | 1.4-1.5 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.37 | 0.15 | 0.86 | 4.9 | 3.6 | 5.9 | 5.3 | 2.2 | 7.6 | 0.66 | 4.1 | 0.97 | 2.7 | 1.2 | 4.4 | 3.9 | - | 6.2 | 6.2 | 2.9 | - | - | - | 1.9 | - |
| LF_TP_49_2.3-2.7 | LF_TP_49 | 2.3-2.7 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.13 | 0.44 | 0.37 | 0.26 | 0.23 | 0.26 | 0.14 | 0.1 | 0.36 | 0.025 | 0.52 | 0.73 | 0.13 | 0.76 | 1.3 | 0.66 | - | 0.35 | 0.35 | 1.3 | - | - | - | 0.96 | - |
| LF_TP_50_1.4-1.6 | LF_TP_50 | 1.4-1.6 | 31/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | 0.061 | 0.1 | 0.18 | 0.077 | 0.078 | 0.16 | 0.016 | 0.066 | <0.01 | 0.083 | <0.01 | 0.013 | 0.068 | - | 0.16 | 0.16 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_50_3.0-3.5 | LF_TP_50 | 3-3.5 | 31/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_51_0.9-1.0 | LF_TP_51 | 0.9-1 | 31/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_51_2.7-3.0 | LF_TP_51 | 2.7-3 | 31/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | <0.01 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_52_1.8-2.0 | LF_TP_52 | 1.8-2 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.63 | 1.5 | 1.4 | 2.8 | 2.1 | 3.4 | 3.2 | 1.4 | 3.5 | 0.38 | 3.2 | 2.4 | 1.7 | 1.9 | 7.9 | 3.4 | - | 3.7 | 3.7 | 5.7 | - | - | - | 5 | - |
| LF_TP_52_2.7-3.0 | LF_TP_52 | 2.7-3 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.58 | 0.95 | 1.1 | 2.3 | 2.2 | 2.8 | 2.8 | 1.3 | 3 | <0.36 | 2.9 | 2.4 | 1.6 | 3.2 | 9 | 3.1 | - | 3.2 | 3.5 | 7.4 | - | - | - | 5.8 | - |
| LF_TP_53_1.4-1.5 | LF_TP_53 | 1.4-1.5 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.91 | 3 | 2 | 3.9 | 4.9 | 4.5 | 4 | 2.7 | 7.2 | 0.55 | 3.4 | 2.8 | 3.2 | 7.2 | 8.1 | 3.8 | - | 7.1 | 7.1 | 9.8 | - | - | - | 7.4 | - |
| LF_TP_53_2.0-2.2 | LF_TP_53 | 2-2.2 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.02 | 0.024 | 0.019 | 0.031 | 0.038 | 0.051 | 0.025 | 0.022 | 0.048 | <0.01 | 0.06 | 0.036 | 0.027 | 0.21 | 0.066 | 0.075 | - | 0.05 | 0.06 | 0.12 | - | - | - | 0.1 | - |
| LF_TP_54_1.8-2.0 | LF_TP_54 | 1.8-2 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.011 | <0.01 | 0.03 | 0.28 | 0.4 | 0.54 | 0.25 | 0.29 | 0.42 | 0.062 | 0.36 | <0.01 | 0.31 | <0.01 | 0.089 | 0.37 | - | 0.61 | 0.61 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_54_2.7-3.0 | LF_TP_54 | 2.7-3 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.078 | 0.021 | 0.33 | 1.8 | 2 | 2.7 | 1.3 | 1.3 | 2 | 0.26 | 2.1 | 0.067 | 1.5 | 0.068 | 1 | 2.1 | - | 3.1 | 3.1 | 0.044 | - | - | - | 0.035 | - |
| LF_TP_55_0.6-0.7 | LF_TP_55 | 0.6-0.7 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.081 | 0.021 | 0.23 | 1.4 | 1.5 | 2 | 2.1 | 0.95 | 1.7 | 0.19 | 1.7 | 0.14 | 1.2 | 0.035 | 0.91 | 1.7 | - | 2.4 | 2.4 | 0.14 | - | - | - | 0.1 | - |
| LF_TP_55_1.0-1.4 | LF_TP_55 | 1-1.4 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.025 | 0.018 | 0.017 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | 0.024 | <0.01 | 0.03 | 0.047 | <0.01 | <0.01 | 0.072 | 0.044 | - | <0.01 | 0.03 | <0.01 | - | - | - | 0.037 | - |
| LF_TP_56_2.3-2.5 | LF_TP_56 | 2.3-2.5 | 31/10/2022 | TP | Normal | - | - | - | - | - | <0.01 | <0.01 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | <0.01 | <0.01 | 0.044 | <0.01 | <0.02 | - | <0.01 | 0.03 | <0.01 | - | - | - | <0.01 | - |
| LF_TP_56_3.2-3.5 | LF_TP_56 | 3.2-3.5 | 31/10/2022 | TP | Normal | - | - | - | - | - | 0.07 | 0.052 | 0.032 | <0.02 | <0.01 | <0.02 | <0.01 | <0.02 | <0.01 | <0.01 | <0.02 | 0.099 | <0.01 | 0.084 | 0.092 | <0.02 | - | <0.01 | 0.03 | 0.4 | - | - | - | 0.34 | - |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
CCME (1991) Interim Canadian environmental quality criteria for contaminated sites (SQG)
ASC NEPM (2013) - National Environmental Protection (Assessment of Site Contamination) Measure - (EIL)

**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.

# Appendix C
## Table C4
## NZAS Landfill Soil Ecological Screening Values

|  |  |  |  |  |  | PCBs |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Chlorinated Hydrocarbons |  |  |  | Phthalates |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  | PCB-121 | PCB-141 | PCB-149 | PCB-151 | PCB-159 | PCB-170 | PCB-18 | PCB-187 2,2',3,4',5,5',6-Heptachlorobiphenyl | PCB-194 | PCB-44 | PCB-49 | PCB-60 | PCB-66 2,3',4,4'-Tetrachlorobiphenyl | PCB-8 2,4'-Dichlorobiphenyl | PCB-86 | PCB-156 | PCB-101 | PCB-138 | PCB-153 | PCB-180 | PCB-52 | PCB-105 | Chloromethane | cis-1,2-dichloroethene | Methylene chloride | Vinyl chloride | Bis(2-ethylhexyl) phthalate |
|  |  |  |  |  |  | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg | mg/kg |
| EQL |  |  |  |  |  | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.006 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.006 | 0.005 | 0.003 | 0.003 | 0.005 | 0.003 | 0.003 | 0.003 | 0.003 | 0.1 | 0.05 | 0.2 | 0.1 | 0.5 |
| ECOSGV - Commercial |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ECOSGV - Recreational |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ECOSGV - Commercial - Indirect |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ECOSGV - Recreational - Indirect |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ECOSSL - Commercial |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ECOSL - Recreational |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EIL - Commercial |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EIL Recreational |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SQG - Comercial |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SQG - Recreational |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SQG - Commercial Indirect |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SQG - Recreational - Indirect |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Field_ID** | **Location_Code** | **Sample_Depth_Range** | **Sampled_Date_Time** | **Location_Type** | **Sample_Type** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TP1 0.2 | LF_TP_1 | 0.2 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | 0.79 |
| TP1 2.0 | LF_TP_1 | 2 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | <0.5 |
| TP1 3.0 | LF_TP_1 | 3 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | <0.5 |
| TP2 0.3 | LF_TP_2 | 0.3 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | <0.5 |
| TP2 0.8 | LF_TP_2 | 0.8 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | <0.5 |
| TP2 2.0 | LF_TP_2 | 2 | 7/06/2022 | TP | Normal | 0.0066 | <0.003 | 0.0074 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | 0.0031 | <0.003 | <0.003 | <0.003 | <0.006 | 0.006 | <0.003 | 0.017 | 0.014 | 0.0093 | <0.003 | 0.006 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | <0.5 |
| TP3 0.25 | LF_TP_3 | 0.25 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | 0.55 |
| TP3 0.65 | LF_TP_3 | 0.65 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | 0.0032 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | 0.005 | 0.0059 | 0.0036 | <0.003 | <0.003 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | <0.5 |
| TP3 1.4 | LF_TP_3 | 1.4 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | <0.5 |
| TP3 3.8 | LF_TP_3 | 3.8 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | 0.013 | <0.003 | <0.003 | 0.0086 | 0.0072 | <0.003 | 0.0077 | <0.006 | <0.005 | <0.003 | 0.0033 | <0.005 | <0.003 | <0.003 | 0.0076 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | <0.5 |
| TP4 0.2 | LF_TP_4 | 0.2 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | <0.1 | <0.05 | <0.2 | <0.1 | <0.5 |
| TP4 0.5 | LF_TP_4 | 0.5 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | 0.0063 | 0.004 | <0.003 | 0.0065 | <0.006 | <0.005 | <0.003 | 0.0053 | 0.0055 | 0.0032 | <0.003 | 0.0056 | <0.003 | <0.1 | 0.074 | <0.2 | <0.1 | <0.5 |
| TP4 3.5 | LF_TP_4 | 3.5 | 7/06/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | 0.011 | <0.003 | <0.003 | 0.0043 | 0.0042 | <0.003 | 0.0049 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | 0.0033 | <0.003 | <0.1 | 0.13 | <0.2 | <0.1 | <0.5 |
| LF_TP_35_2.0-2.2 | LF_TP_35 | 2-2.2 | 31/10/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | - | - | - | - | - |
| LF_TP_36_1.8-2.0 | LF_TP_36 | 1.8-2 | 27/10/2022 | TP | Normal | 0.0076 | 0.0094 | 0.025 | 0.0067 | 0.0043 | 0.014 | 0.0077 | 0.0092 | 0.0069 | 0.01 | 0.0056 | 0.01 | 0.0069 | <0.006 | 0.0067 | 0.0064 | 0.025 | 0.051 | 0.033 | 0.021 | 0.0077 | 0.0086 | - | - | - | - | - |
| LF_TP_48_1.0-1.2 | LF_TP_48 | 1-1.2 | 28/10/2022 | TP | Normal | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.003 | <0.006 | <0.005 | <0.003 | <0.003 | <0.005 | <0.003 | <0.003 | <0.003 | <0.003 | - | - | - | - | - |

**References**

Landcare Research (2019) - Development of Soil Guidelines for the protection of ecological receptors (ECO SGVs) : Technical Document
USEPA- Ecological Soil Screening Level Documents (ECOSSL)
CCME (1999) - Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (SQG)
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**Notes**

If biomagnification is not considered, the EIL for a contaminant is calculated as follows: Eco-SGV = ABC + ACL (2)
where ABC is the ambient background concentration (mg/kg) and ACL is the added contaminant limit (mg/kg).
If biomagnification is considered and is significant for that contaminant, the EIL is calculated as follows: Eco-SGV = ABC + ACLBM (3)
where ACLBM is the contaminant added limit that accounts for biomagnification.