

Clarks Beach Wastewater Treatment Plant 2025-2026 Annual Report

Final September 2026

Watercare

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CONSENT CHANGE AND MONITORING HISTORY

Change type	Description	Effective date	Reference / condition	Reporting / monitoring implications
Consent Issuance	R/REG/2015/4227-A (CST60083001-A) issued by Auckland Council for treated wastewater discharge to Manukau Harbour. Includes effluent quality limits (Condition 18), flow limits (Condition 16), and monitoring/reporting requirements.	15 June 2016	Consent R/REG/2015/4227-A	Established core performance parameters (BOD_5, TSS, NH_4-N, TIN, faecal coliforms) with median and 92%ile limits. Required weekly sampling and annual reporting.
Monitoring Plan	Clarks Beach WWTP Management Plan prepared and approved, outlining procedures for effluent sampling, monitoring locations, reporting, and roles/responsibilities.	March 2020 (Rev 1 issued)	Management Plan (Condition 12)	Established operational procedures for sampling frequency, QA/QC, contractor responsibilities, and data reporting workflows. No REMP was required under the consent.
Decommissioning	Gravel bed closed and sand filters decommissioned in late 2024 as part of the upgrade works. A temporary ultrafiltration unit was installed to maintain treatment levels while the new MABR system is prepared.	November 2024	Not specified (operational change)	Changed the final treatment pathway, shifting nutrient polishing from gravel/sand filtration to ultrafiltration. No change in monitoring design but prompted close performance tracking.

Change type	Description	Effective date	Reference / condition	Reporting / monitoring implications
Upgrade Works Begin	A temporary MABR unit was installed to maintain treatment performance during the winter 2025. Upgrade to Clarks Beach WWTP initiated, including new tanks, electrical systems, and temporary treatment units. Aim is to significantly improve effluent quality and reliability.	2024–2025 construction year	Watercare delivery team	Upgrade supports growth in Clarks Beach and Glenbrook Beach. No new monitoring yet but works flagged in reporting due to potential performance variability.
Discharge	Discharges from the plant upgrades through the new marine outfall begin from 18 June 2026. These are intermittent and small as part of the commissioning process, and the original outfall remains the predominant infrastructure in use.	18 June 2026	CST60082600-A	Consent has been given effect to. 2025-2026 annual report includes preliminary results.

EXECUTIVE SUMMARY

This report provides an overview of the operational performance and compliance status of the Clarks Beach Wastewater Treatment Plant (WWTP) for the period from 1 July 2025 to 30 June 2026 against the provisions of consents R/REG/2015/4227-A, CST60082600-A and CST60082302-A. Whilst the bulk of the report is focused on the Clarks Beach WWTP operations under consent R/REG/2015/4227-A, the preliminary results of the plant performance upgrades, which were in commissioning but not yet fully operational, are provided. Key findings during the reporting period include:

- **Effluent volumes:** While routine treated effluent discharges remained within consented limits, with an average daily flow of 747 m^3, an emergency bypass event during July 2025 released a combined total of approximately 5,200 m^3 of partially treated wastewater. This event exceeded the maximum daily discharge volume under Condition 16 and breached effluent quality limits. The bypass event highlights the plant's vulnerability under high inflow conditions. The ongoing treatment plant upgrade will substantially increase treatment capacity and improve resilience to peak inflows, reducing the likelihood of emergency bypasses during high-flow conditions. **Effluent quality:** Routine monitoring showed full compliance under Condition 18 when assessed on an annual basis. Faecal coliforms, biochemical oxygen demand (BOD_5), total suspended solids (TSS) and total inorganic nitrogen (TIN) were elevated following the emergency bypass, and ammonia increased following high summer inflows.
- **Plant upgrades:** Several small discharges have occurred through the upgraded section of the WWTP and the new marine outfall as part of the commissioning process. Discharge volumes have been within the consented limits, and all effluent parameters except total nitrogen have been within the consented limits. The elevated total nitrogen is the result of initial difficulties with acetic dosing control, which has since been resolved by installing a nitrate probe. The 2-year baseline receiving environmental monitoring has been completed.
- **Complaints:** No complaints were received in the reporting period.

Overall, the WWTP generally complied with the applicable resource consent requirements during the 2025–2026 reporting period. A non-compliance occurred during the wet-weather event in July 2025, when high inflows resulted in an emergency bypass and exceedance of the applicable discharge volume limit. Outside this event, routine discharge volumes and annual statistical effluent quality requirements were met.

The latter part of the reporting period marked the transition into commissioning of the upgraded WWTP and new marine outfall, with both the existing and new discharge systems operating during this phase. Initial commissioning results indicate generally satisfactory treatment performance.

TABLE OF CONTENTS

1 Introduction 8
1.1 Resource consents and management plans 8
1.2 Scope 9
2 Operational details 10
2.1 Treatment plant upgrades 10
2.2 Changes in reporting year 10
2.3 Future changes 11
3 Methodology 12
3.1 Monitoring 12
3.2 Data handling and analysis 12
3.3 Compliance criteria 12
4 Results 14
4.1 Effluent volume 14
4.2 Six-year analyses (2020-2026) 15
4.3 Effluent quality 17
4.3.1 Compliance summary (2025-2026) 17
4.3.2 Concentration patterns (2025-2026) 20
4.3.3 Six-year analyses (2020-2026) 23
4.3.4 Effluent quality summary 26
4.4 Complaints and incidents 26
4.4.1 Complaints 26
4.4.2 Incidents 26
5 Plant upgrade performance 27
5.1 Effluent volumes 27
5.2 Effluent quality 28
5.3 Receiving environment monitoring programme 30
6 Conclusion 31

Appendix A. Assessment of Compliance
Appendix B. Effluent Volume and Quality Data
Appendix C. Data Sources
Appendix D. Incident Report
Appendix E. Receiving environment monitoring programme reports

LIST OF FIGURES

Figure 2-1. Approximate locations of the existing and new marine outfall discharges. 11
Figure 4-1: Rainfall and routine total daily effluent volumes discharged from Clarks Beach WWTP outfall to Manukau Harbour (2025-2026). The bypass discharge (BD) event date is marked in orange. 15
Figure 4-2. Seasonal variability in daily discharge volumes at Clarks Beach WWTP (2020–2026). 16
Figure 4-3. Five-year rainfall cycle (2020–2026) at Clarks Beach WWTP 17
Figure 4-4. Time-series plots of effluent nutrient parameters at Clarks Beach WWTP (2025–2026). ..21
Figure 4-5. Time-series plots for effluent physical and microbiological parameters at Clarks Beach WWTP (2025–2026). 22
Figure 4-6. Significant ($p < 0.05$) long-term trends in effluent quality parameters at Clarks Beach WWTP (2020–2026). 24
Figure 4-7. Significant ($p < 0.05$) seasonal differences in effluent quality parameters at Clarks Beach WWTP (2020–2026). 25

LIST OF TABLES

Table 1-1: Abbreviations vii
Table 1-1. Clarks Beach WWTP resource consents 8
Table 3-1: Compliance assessment criteria 13
Table 4-1. Monthly compliance with Condition 18b (July 2025 - June 2026). 18
Table 4-2: Clarks Beach WWTP effluent quality results (1 July 2025 – 30 June 2026) 19
Table 5-1. Daily discharge volumes from the new marine outfall 28
Table 5-2. Effluent quality results for wastewater discharged from the new plant upgrades and marine outfall (14 – 30 July 2026) 29
Table 6-1: Download location of environmental monitoring data used in this report 63

ABBREVIATIONS

For ease of reading, this report uses abbreviations for some technical terms. Table 1-1 lists these abbreviations.

Table 1-1: Abbreviations

Abbreviation	Description
BOD_5	5-day biochemical oxygen demand
$cBOD_5$	5-day carbonaceous biochemical oxygen demand
DO	Dissolved oxygen
NH_4-N	Ammoniacal nitrogen (as NH_4^+), reported in mg N/L
TIN	Total inorganic nitrogen (sum of NH_4^+-N, NO_2^--N, and NO_3^--N)
TN	Total nitrogen
TP	Total phosphorus
TSS	Total suspended solids
WWTP	Wastewater treatment plant
UV	Ultraviolet (disinfection)
MABR	Membrane Aerated Biofilm Reactor

1 INTRODUCTION

The Clarks Beach Wastewater Treatment Plant (WWTP) discharges treated wastewater into the Manukau Harbour under permit R/REG/2015/4227-A. This report documents Watercare's compliance with that permit for the period 1 July 2025 to 30 June 2026, including results from effluent quality monitoring, flow volumes, incidents, and operational updates.

Two discharge consent regimes were relevant to the Clarks Beach WWTP during the 2025–2026 reporting period. For the majority of the reporting period, treated wastewater was discharged through the existing Clarks Beach discharge system under R/REG/2015/4227, as varied by CST60083001-A. Commissioning discharges of the upgraded WWTP and new marine outfall commenced on 18 June 2026 under CST60082600 and CST60082302.

The commencement of the new discharge represented a commissioning and transition phase. During this period, the existing treatment and discharge infrastructure remained operational while intermittent commissioning discharges were also made through the new marine outfall. Consequently, both discharge pathways, and the respective consent requirements applying to them, were relevant during the latter part of the reporting period.

This annual report therefore assesses compliance with the existing Clarks Beach consent requirements for discharges made under that consent and separately assesses the applicable requirements of the new Southwest Project consents for commissioning discharges through the new outfall. As commissioning was ongoing at the end of the reporting period, some requirements under the new consent, particularly those dependent on longer-term or rolling monitoring datasets, cannot yet be fully assessed.

1.1 Resource consents and management plans

Discharges and operations at the WWTP are currently authorised under active consents issued by Auckland Council (Table 1-1). These include consents for treated wastewater discharge, temporary construction discharges, coastal occupation, stormwater discharges, and air discharges.

The WWTP operates under a Watercare WWTP Management Plan (Rev. 1, 2020) and a Discharge to Coastal, Bulk Outfall (DTCBO) document, both of which outline the operational and environmental controls associated with the treatment system and its planned upgrades.

Table 1-1. Clarks Beach WWTP resource consents

Consent Number	Description	Expiry Date
DIS60221613	Discharge of treated wastewater to the Waiuku Channel	30 Aug 2038
DIS60069647	Temporary discharge to land (construction dewatering)	27 Feb 2027
CST60221618	Occupation of coastal marine area (outfall structure)	30 Aug 2053
CST600826300-A	Discharge of treated wastewater to the Waiuku Channel	27 June 2053
CST60082302-A	Occupation of coastal marine area (outfall structure)	27 June 2053
DIS60069649	Discharge of stormwater to land	27 Feb 2033
DIS60069648	Discharge of odour to air	27 Feb 2033

1.2 Scope

This annual report fulfils Condition 18 of consent R/REG/2015/4227-A, which requires an annual report covering the following items:

a. A summary of the results of all of the treated wastewater discharge samples collected in the previous year in accordance with this consent;
b. An analysis and interpretation of all reporting data required by this consent for the past year;
c. The level of compliance with each monitoring consent condition, with recommendations and a timetable for rectifying any non-compliance;
d. General WWTP performance, including, but not limited to:
    iii. Any trends in changes in the discharge quality standards over time; and
    iv. The concentration of indicator bacteria;
e. Any trends and status of stormwater Inflow and Infiltration (I andI) effects on total flow volumes and comment on flows during any peak storm events;
f. A review of any changes in influent load to the WWTP;
g. Any key system maintenance and/or upgrade work completed within the prior year and proposed in the forthcoming year;
h. A review on the performance and improvements of the WWTP achieved in the past year;
i. An updated Register of any trade wastes connected to the WWTP, as required by condition 8 of the general consent conditions; and
j. Details of any complaints received in accordance with general condition 8 of the general consent conditions

Additionally, the consents for the southwest marine outfall (CST600826300-A and CST60082302-A condition 10) require the following:

a. Collate, analyse and interpret the monitoring results required by the conditions of these consents for the previous year from 1 July to 30 June;
b. Report the calculated Average Dry Weather Flow (ADWF) and rainfall data for the previous year from 1 July to 30 June;
c. Include comment on WWTP performance in relation to the quality of the treated wastewater discharge and any significant trends in changes in the discharge volume and/or the discharge quality over time;
d. Comment on compliance with each consent condition and evaluate against the Auckland Council's standard compliance scoring protocol; and
e. Identify any actions required and submit a timetable to rectify any non- compliance.

Discharges from the new plant and outfall began on 22 June 2026 as part of the commissioning process. As such the plant was not under routine operation during the reporting period. Due to the limited period of operation in which to report on, the reporting requirements, as stated above, are provided within a dedicated section for the south-west plant upgrades and outfall.

2 OPERATIONAL DETAILS

The WWTP is located on designated land adjacent to the Clarks Beach Golf Club, opposite 97 Stella Drive, Clarks Beach. The plant originally consisted of an inlet screen, oxidation pond, two subsurface-flow rock filters, three sand filter beds, and a 16-lamp UV disinfection unit.

During the previous reporting year (July 2024 – June 2025), significant changes were made to the treatment process as part of planned upgrades:

- Subsurface gravel beds and sand filters were decommissioned in November 2024 to enable the construction of new infrastructure.
- A temporary ultrafiltration (UF) unit was installed and began operating in November 2024, providing an interim tertiary treatment solution.
- In autumn 2025, a winter Membrane Aerated Biofilm Reactor (MABR) was introduced to improve treatment performance during colder months, particularly for nitrogen removal.

The WWTP also includes a side-stream Membrane Bioreactor (MBR) system, which processes up to ~200 m^3/day of screened influent. The MBR-treated stream is blended with flows processed through the oxidation pond and temporary UF system before undergoing UV disinfection.

Treated effluent exits the plant via a maintenance manhole on the golf course, flowing through a stormwater drain into a constructed wetland system. From there, it enters a series of irrigation reservoirs before being discharged to the lower Waiuku River via a marine outfall.

2.1 Treatment plant upgrades

The WWTP is currently undergoing a significant upgrade to ensure it can continue to meet consent conditions and accommodate population growth in the south-west Auckland region. This investment will support improved environmental outcomes for the Manukau Harbour and strengthen the long-term resilience of the network.

The upgraded treatment plant will have the capacity to process up to 5,200 m^3/day, more than tripling the current capacity of 1,600 m^3/day. This expansion responds to forecasted growth in the Clarks Beach, Glenbrook Beach, Waiuku, and Kingseat communities.

As part of the upgrade, membrane-based treatment technologies (MABR and ultrafiltration) are being introduced to improve effluent quality and enhance nutrient removal, especially under variable flow conditions. This will increase reliability during colder months and wet-weather periods.

A temporary treatment unit was commissioned in June 2025 to maintain compliance while the main plant is under construction.

2.2 Changes in reporting year

A new harbour outfall pipeline was constructed, designed to discharge highly treated effluent approximately 100 m into the Waiuku Channel. This high-energy tidal environment allows for rapid dispersion and dilution. A map presenting the locations of the original and new outfall discharge points is in Figure 2-1.

In June 2026, commissioning of the upgraded WWTP and the new southwest marine outfall began, with discharges from both the new and old outfalls during the commissioning phase.

2.3 Future changes

In the 2026-2027 reporting period, commissioning of the WWTP and outfall upgrades will continue. Over the subsequent years the oxidation pond will be decommissioned and the permanent emergency storage and tidal storage for the southwest wastewater servicing scheme will be installed onsite. The treated effluent pipeline from Waiuku will also be connected to the tidal storage and outfall.



Figure 2-1. Approximate locations of the existing and new marine outfall discharges.

3 METHODOLOGY

3.1 Monitoring

Environmental monitoring undertaken during the July 2025 to June 2026 reporting period comprised measurement of treated effluent discharge volumes, effluent quality and rainfall. Daily discharge volumes were continuously recorded using flow meters located at the wastewater treatment plant outlet and stored within Watercare's PI Historian system. The source of rainfall data was changed from the 'Waitangi @ Diver Road' rain gauge to the 'Clarks Beach at Golf Course' from 31 January 2024, from when data became available, which provides representative coverage for the Clarks Beach area.

Effluent quality monitoring was undertaken at the outlet of the UV disinfection system and before the treated wastewater discharge pumping station. Samples were collected weekly or fortnightly, at or above the required frequency (fortnightly or monthly) required by Condition 11 of the consent. The samples were analysed by an IANZ-accredited laboratory (Watercare Laboratory Services). The parameters comprised physiochemical parameters, nutrients and faecal coliforms.

3.2 Data handling and analysis

All operational and compliance monitoring data were collated from Watercare's Pi Historian system and laboratory records (IANZ-accredited). All environmental monitoring data and associated data IDs/tags used in this report are listed in Appendix C.

Laboratory results were reviewed for quality flags, detection limits, and chain-of-custody consistency. Outliers were assessed against operational context (e.g., rainfall events, maintenance activities) and retained unless evidence indicated analytical or transcription error. Where values were below detection, half the detection limit was applied for statistical analyses, consistent with previous annual reporting practice.

Descriptive statistics were calculated for the 2025-2026 reporting period and compared with the applicable consent criteria. Where consent compliance is defined using a specified number of consecutive samples, compliance was assessed using the methodology prescribed by the relevant consent rather than calculated sample percentiles alone.

Long-term temporal trends were assessed using the non-parametric Mann–Kendall trend test. Kendall's Tau (τ) was used to indicate the direction and strength of monotonic change, with positive values indicating increasing concentrations or flows and negative values indicating decreasing concentrations or flows. Seasonal differences were assessed using the non-parametric Kruskal-Wallis test. Statistical significance was assessed at $\alpha = 0.05$ ($p < 0.05$). Results with $p \geq 0.05$ were not considered statistically significant. Analyses used available valid monitoring results between July 2020 and June 2026.

3.3 Compliance criteria

The assessment of the WWTP performance considers:

- Results of compliance monitoring
- Recorded incidents and complaints.

Watercare assesses compliance with the consent using the same compliance rating system utilised by Auckland Council (Table 3-1).

Table 3-1: Compliance assessment criteria

Rating	Detail
Category 1	Watercare has complied with the consent condition. Where a resource consent condition refers to a provision in a Management Plan, then the plan has been referred to in assessing consent compliance.
Category 2	Watercare has not complied with the consent condition. Watercare has assessed the non-compliance as technical or having no more than minor adverse effect.
Category 3	Watercare has not complied with the consent condition. Watercare has assessed the non-compliance having the potential to result in more than minor adverse effects on the environment. Alternatively, since the last audit, there is evidence of repeat Category 2 non-compliance.
Category 4	Watercare has not complied with the consent condition. Watercare has assessed the non-compliance as having the potential to cause significant adverse effects on the environment. Alternatively, since the last audit, there is evidence of repeat Category 3 non-compliance.

4 RESULTS

As the reporting period included commissioning of the upgraded WWTP and new marine outfall, two sets of discharge requirements were relevant during 2025–2026. The results presented in Sections 4.1 to 4.4 primarily relate to operation of the existing Clarks Beach treatment and discharge system and are assessed against the applicable requirements of R/REG/2015/4227-A.

Commissioning discharges through the upgraded treatment system and new marine outfall commenced on 18 June 2026 and are assessed separately in Section 5 against the applicable requirements of CST60082600-A and CST60082302-A. During commissioning, both discharge pathways remained in use; consequently, results have been assessed against the consent requirements applicable to the relevant treatment and discharge pathway rather than applying a single set of standards across the reporting period.

4.1 Effluent volume

Figure 4-1 shows the daily treated effluent discharge volumes and rainfall between 1 July 2025 and 30 June 2026.

- **Routine treated effluent**: During the reporting year, the WWTP discharged a total of 272,633 m^3 of treated effluent, with an average daily flow of 747 m^3/day and a maximum daily flow of 2,173 m^3/day. All routine daily values remained within the consented maximum discharge limit of 2,500 m^3/day.
- **Non-routine bypass discharge**: In addition to normal operations, an emergency bypass discharge occurred during 30 to 31 July 2025 under relatively high wet weather inflow conditions. In this event, approximately 5,200 m^3 bypassed filtration and UV treatment, exceeding the 2,500 m^3/day flow limit in Condition 16. As this event exceeded consented flow limits, it was assessed as non-compliant. Environmental monitoring for microbial and nutrient parameters at Clarks Beach and Waiau Beach were conducted following the incident. Results found rapid recovery and strong buffering capacity in the harbour, with total suspended solids highlighted as the key short-lived impact of the bypass. Section 4.4.2 and Appendix D provide further incident details.

Peaks in routine discharge continued to coincide with rainfall events, particularly in January, April and June 2026, however all other routing discharges remained within consent thresholds. Compared with the previous year (2024-2025; total 217,299 m^3, average 595 m^3), routine treated effluent volumes increased.

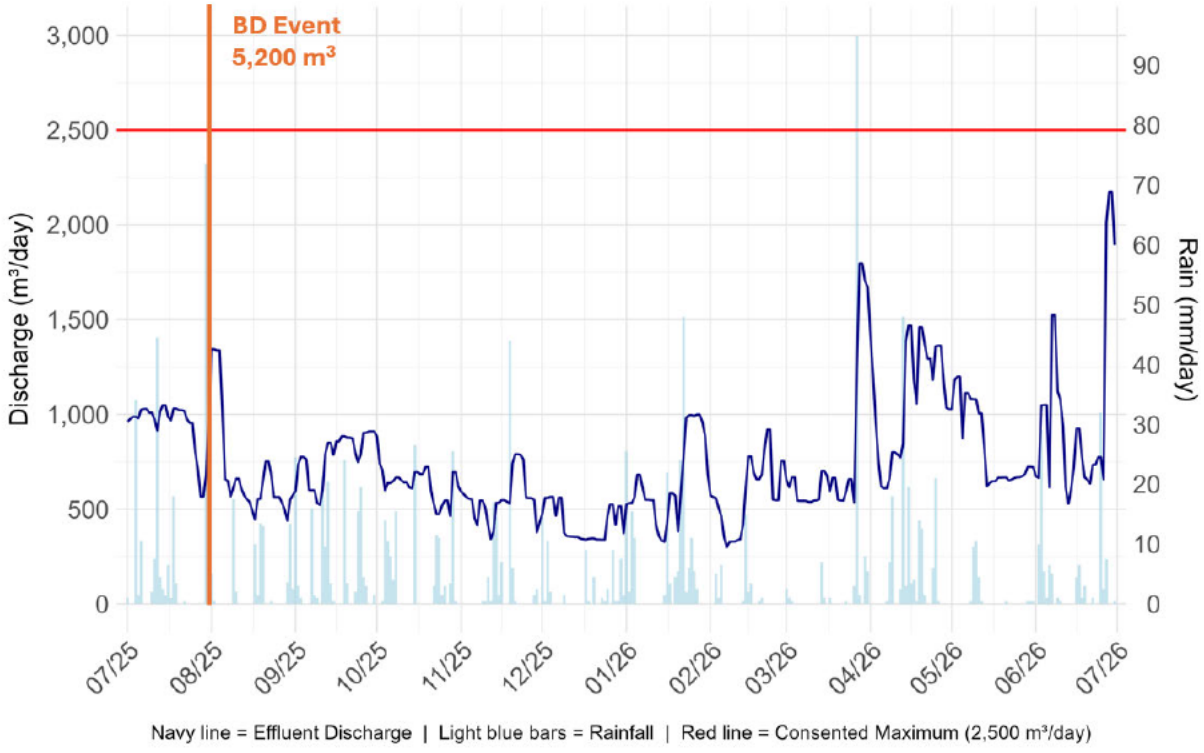


Figure 4-1: Rainfall and routine total daily effluent volumes discharged from Clarks Beach WWTP outfall to Manukau Harbour (2025-2026). The bypass discharge (BD) event date is marked in orange.

4.2 Six-year analyses (2020-2026)

Long term analyses illustrate the seasonal and inter-annual variability of discharge volumes.

- **Seasonality:** WWTP discharge data from the past six years show strong seasonality, closely linked to rainfall trends (Figure 4-2). Winter and early spring months (May–October) experience consistently higher discharge volumes, with monthly means ranging from approximately 553 to 695 m³/day, reflecting increased inflow and infiltration (I and I) during the wet season. In contrast, summer and early autumn (November–April) flows are lower, stabilising around 443–481 m³/day. This seasonal discharge pattern closely mirrors the regional rainfall cycle (Figure 4-3), with peak rainfall also occurring between June and October.
- **Inter-annual trend:** Over the six-year period from July 2020 to July 2026, average daily discharge volumes have shown a weak but increasing trend (Mann–Kendall Tau = 0.061; p = 0.083). Annual means have grown from approximately 450 m³/day in 2020–2021 to 747 m³/day in 2025–2026, superseding the previous mean peak (735 m³/day recorded in 2023–2024). This trajectory reflects gradual growth in the Clarks Beach catchment but is only significant at a lower confidence interval ($p < 0.1$).
- **Compliance:** Routine discharges have consistently remained well within the consented daily maximum of 2,500 m³/day across the six-year period. However, occasional emergency bypass discharges were triggered during intense rainfall events; notably two instances in 2025 and similar wet-weather events in 2022–2023. These bypasses are managed in accordance with consent conditions and reported through incident reports and follow-up sampling.

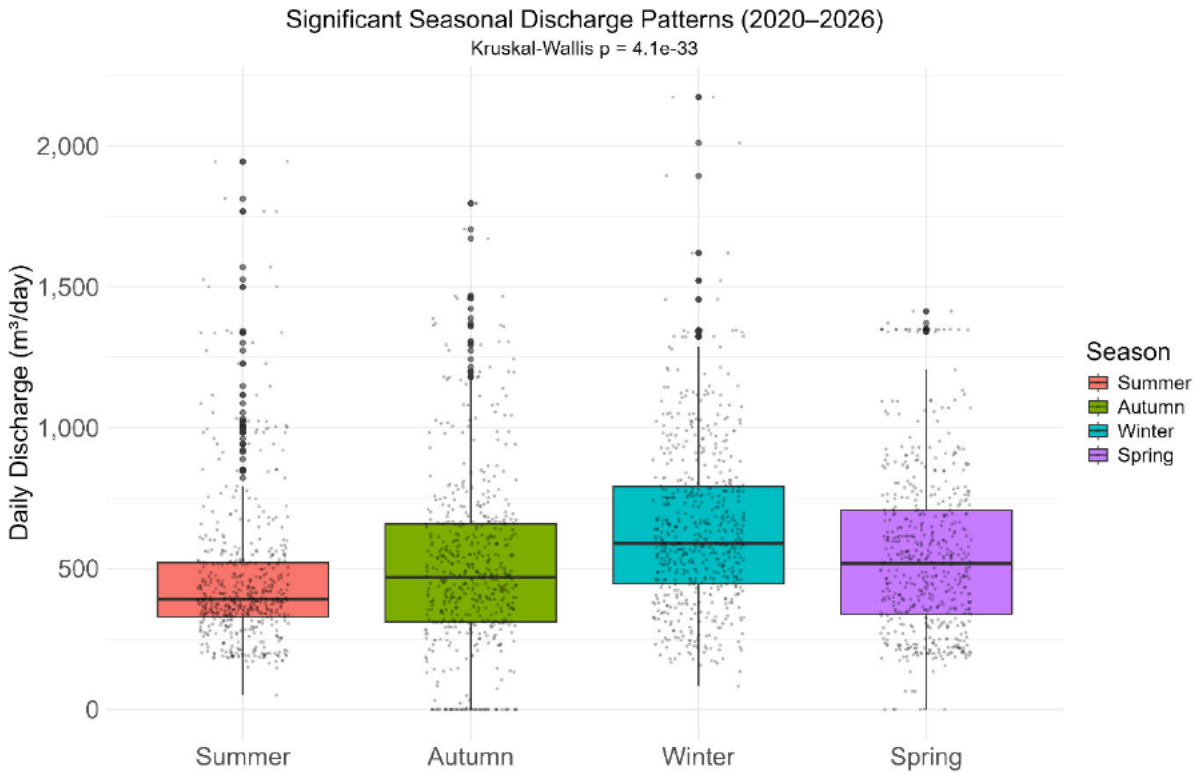


Figure 4-2. Seasonal variability in daily discharge volumes at Clarks Beach WWTP (2020–2026). *Statistical testing (Kruskal–Wallis, $p < 0.001$) confirmed that seasonal differences in discharge volumes are significant.*

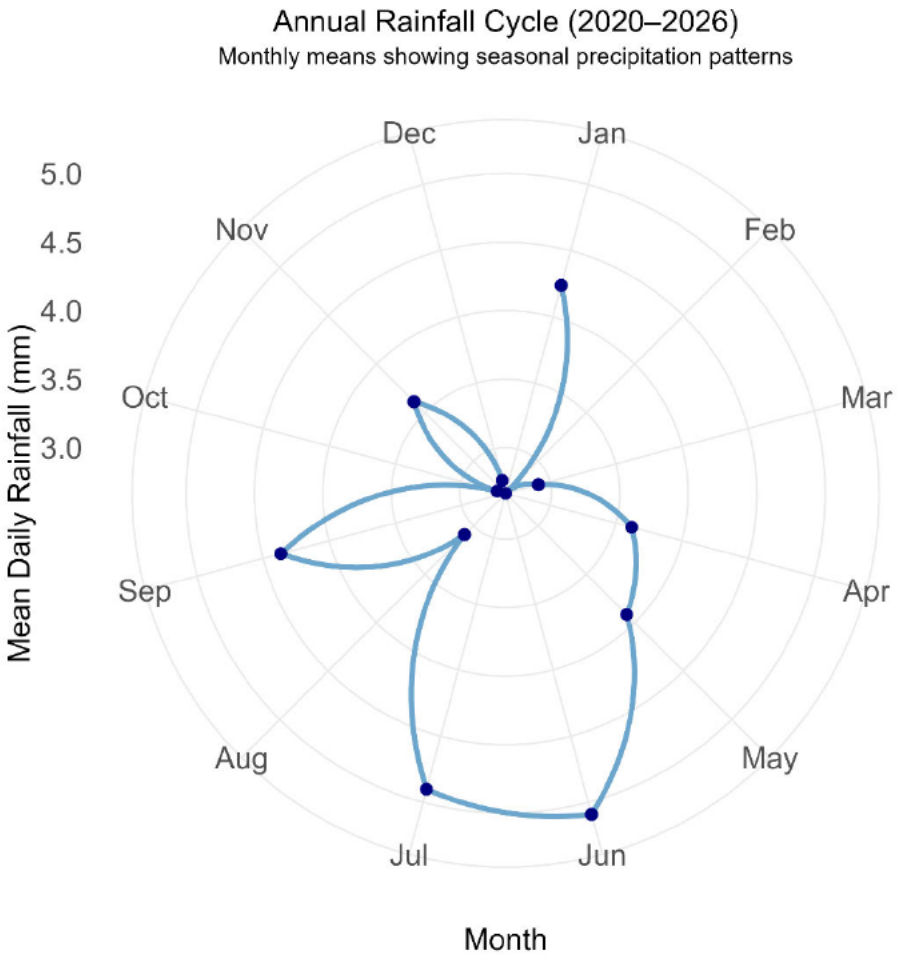


Figure 4-3. Five-year rainfall cycle (2020–2026) at Clarks Beach WWTP
Radial distance from the centre represents mean daily rainfall; outward peaks indicate wetter months; inward dips indicate drier months.

4.3 Effluent quality

4.3.1 Compliance summary (2025-2026)

All parameters were compliant with their consented median and 92nd percentile limits under Condition 18 and 18b in 2025-2026.

A faecal coliforms result of 69,000 cfu/100mL on 1 August 2025, resulted from the weather event on 30 and 31 July impacting treatment processes. As this was a single elevated sample with all other results ranging from 1.6 to 16 cfu/100mL, the median and 92nd percentile limits were not exceeded for the reporting period. This was also reflected in the results for biochemical oxygen demand (BOD_5), total suspended solids (TSS) and total inorganic nitrogen (TIN). Total nitrogen and total phosphorus were also elevated; however, these parameters do not have any associated consented medians or 92nd percentiles. Table 4-1 presents when individual sample results were elevated above the consented limit each month, irrespective of whether the overall 92nd percentile and median limits were met.

Table 4-1. Monthly compliance with Condition 18b (July 2025 - June 2026).

A tick (✓) indicates all samples in that month complied with the consent limit(s); a cross (✗) indicates at least one exceedance of the consent limit.

Month	BOD_5	TSS	NH_4-N	TIN	Faecal coliforms
Jul-25	✓	✓	✓	✓	✓
Aug-25	✗	✗	✓	✗	✗
Sep-25	✓	✓	✓	✓	✓
Oct-25	✓	✓	✓	✓	✓
Nov-25	✓	✓	✓	✓	✓
Dec-25	✓	✓	✓	✓	✓
Jan-26	✓	✓	✗	✓	✓
Feb-26	✓	✓	✓	✓	✓
Mar-26	✓	✓	✓	✓	✓
Apr-26	✓	✓	✓	✓	✓
May-26	✓	✓	✓	✓	✓
Jun-26	✓	✓	✗	✓	✓

Table 4-2: Clarks Beach WWTP effluent quality results (1 July 2025 – 30 June 2026)

Parameter	n	Minimum	Average	Maximum	Median	Consented Median	Median Compliant	92nd Percentile	Consented 92nd Percentile	92nd Percentile Compliant
BOD_5 (mg/L)	27	0.5	2.5	43	0.8	20.0	✓	1.6	45.0	✓
TSS (mg/L)	27	1.0	6.5	129	1.2	30.0	✓	4.7	90.0	✓
Ammoniacal nitrogen (mg/L)	27	0.04	4.4	24	1.7	10.0	✓	17.7	20.0	✓
Total inorganic nitrogen (mg/L)	26	1.6	12.0	25	11	20.0	✓	20.0	–	–
Faecal coliforms (cfu/100 mL)	27	1.6	2,557.9	69,000	1.6	14.0	✓	4.9	43.0	✓
Dissolved oxygen (mg/L)	56	4.1	6.9	10.3	6.6	–	No Limit	9.8	–	No Limit
pH	56	5.8	7.0	7.6	7.0	–	No Limit	7.3	–	No Limit
Temperature (°C)	56	11.6	19.6	25.1	21.2	–	No Limit	24.1	–	No Limit
Total nitrogen (mg/L)	26	2.1	14.0	26	12.5	–	No Limit	23	–	No Limit
Total phosphorus (mg/L)	27	1.0	4.3	7.5	4.5	–	No Limit	6.8	–	No Limit

4.3.2 Concentration patterns (2025-2026)

Figure 4-4 and Figure 4-5 present time-series plots for key effluent quality parameters during the reporting period. These provide insight into short-term variability and seasonal responses beyond statistical summaries in Table 4-2.

- **BOD_5:** Concentrations were consistently low across the year, with most results below 2 mg/L. A result on 1 August 2025 of 43 mg O_2/L exceeded the typical concentrations levels, occurring after heavy rainfall and the bypass event on 30 and 31 July 2025. Concentrations returned to normal levels in the subsequent samples, and there was no notable seasonal variability.
- **TSS:** Results were typically <5 mg/L throughout the year, confirming effective solids removal. An elevated concentration occurred on 1 August 2025 (up to 129 mg/L), coinciding with wet-weather conditions and high inflows. These results remained below the 92nd percentile consent limit of 90 mg/L but highlight the system's sensitivity under hydraulic stress.
- **Ammoniacal nitrogen (NH_4-N):** Concentrations were moderately low for most of the year (<5 mg/L), indicating effective nitrification. One elevated result of 24 mg/L occurred on 24 January 2026, related to higher holiday influent volumes. A cluster of elevated results was observed in June 2026, with the peak reaching 18 mg/L on the 12th and 26th June. Despite these exceedances, the 12-month median (1.7 mg/L) and 92nd percentile (17.7 mg/L) remained within consent limits, consistent with temporary stress on the biological process during wetter months.
- **Total inorganic nitrogen (TIN):** Values varied between 1.6-25 mg/L. Consistent with ammoniacal nitrogen, a peak of 25 m/L occurred on 14 January 2026, but the annual median (11.0 mg/L) remained compliant with the 20 mg/L limit.
- **Faecal coliforms:** Most results were at or near the detection limit (1.6 cfu/100 mL). An elevated concentration relating to the July bypass occurred on 1 August 2025. As this was a singular event, the median (1.6 cfu/100mL) and 92nd percentile was at and slightly above the detection limit respectively, remaining compliant under Condition 18.

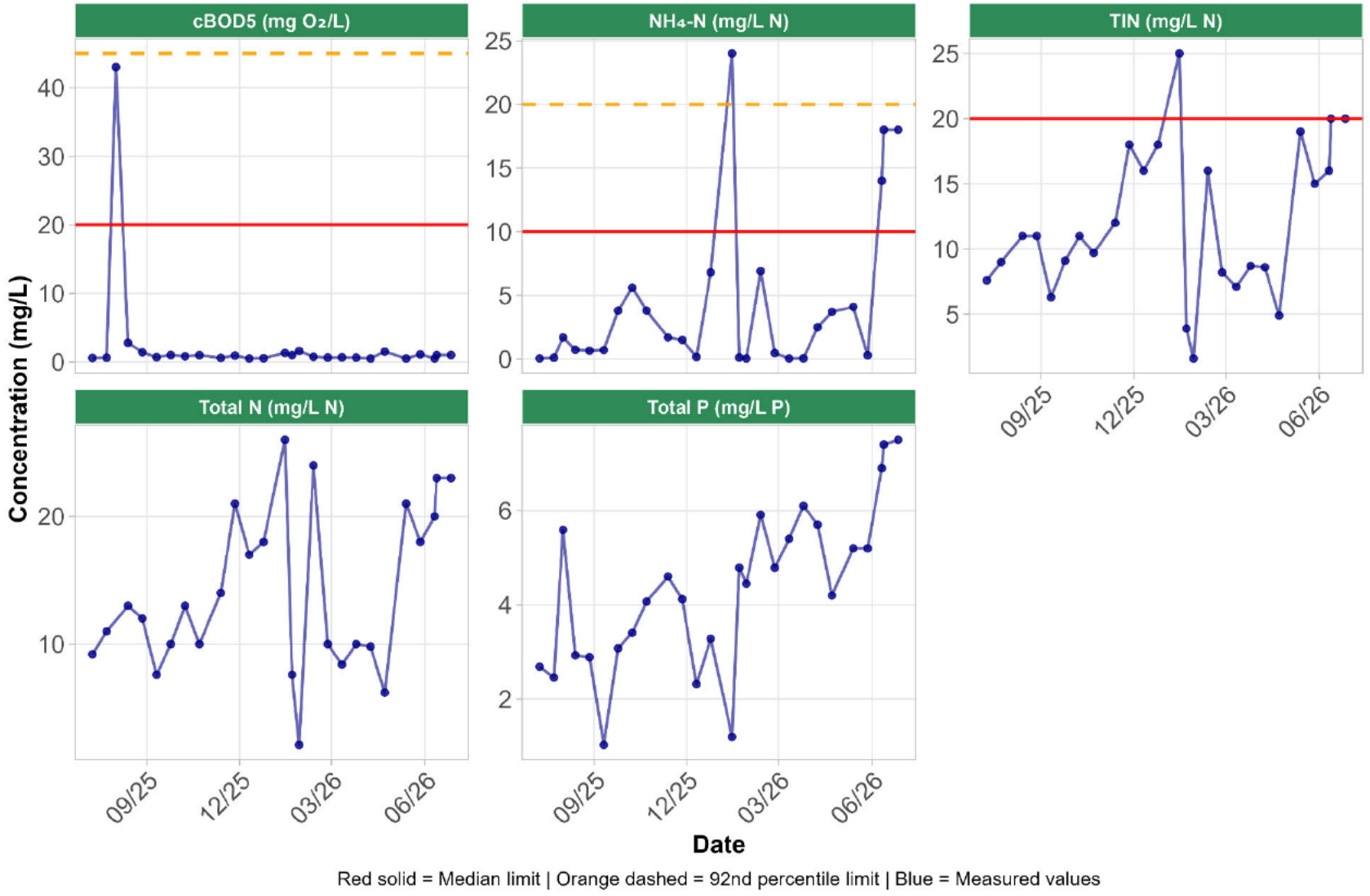


Figure 4-4. Time-series plots of effluent nutrient parameters at Clarks Beach WWTP (2025–2026).

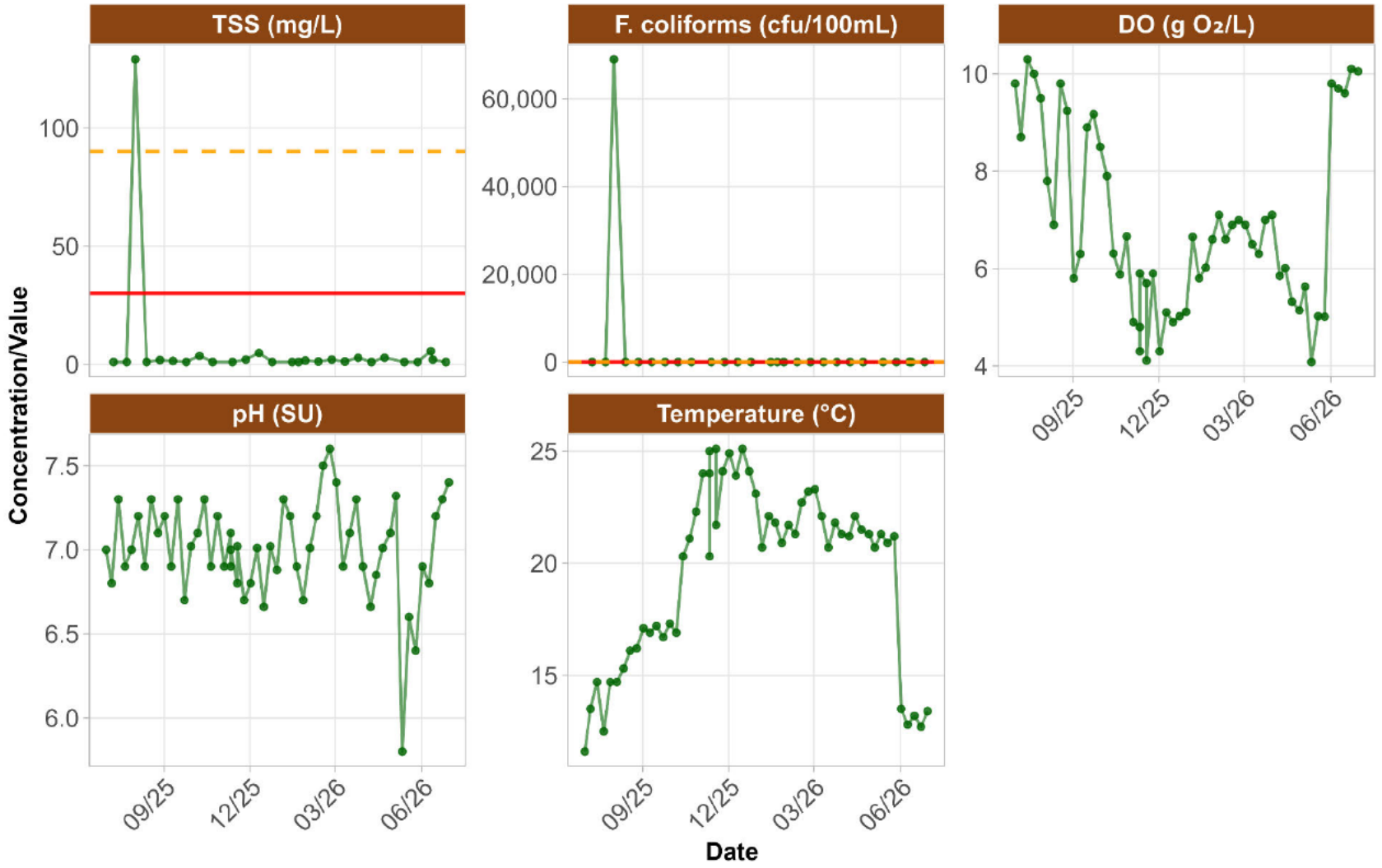


Figure 4-5. Time-series plots for effluent physical and microbiological parameters at Clarks Beach WWTP (2025–2026).

4.3.3 Six-year analyses (2020-2026)

Long-term datasets provide context on how effluent quality has changed over the past five years. Figure 4-6 and Figure 4-7 present only those parameters where statistically significant patterns were measured. Mann–Kendall trend tests (Figure 4-6) were applied to all monitored parameters to measure the significance of temporal changes (trends), and seasonal variability and magnitude was assessed with Kruskal–Wallis tests (Figure 4-7). Only parameters with statistically significant changes ($p < 0.05$) are shown for both seasonal and temporal trend analyses.

Note: Dissolved oxygen (DO), temperature, and pH were excluded from the six-year analyses due to insufficient historical data; reliable records for these parameters have only been available since mid-2022. These will be included within the trend analyses once five years of data is available.

- **$cBOD_5$:** No significant trends were detected. Comparatively, the five-year analysis (2020-2025) found a slight but statistically significant upward trend was observed. This highlights the very low levels of $cBOD_5$ in 2025-2026 with only one exceedance. Overall, concentrations remained very low (typically <5 mg/L) and well within consent limits. Seasonal analysis showed statistically significant seasonality (Kruskal–Wallis, $p < 0.05$), with reduced organic matter removal effectiveness in winter, however remaining within the consented limits.
- **TSS:** A significant downward trend was detected, indicating gradual improvement in solids removal efficiency over time. Seasonal differences were small, with only slightly higher variability in winter months linked to wet-weather inflows.
- **Ammoniacal nitrogen (NH_4-N):** No significant trends were detected. Monthly compliance checks reveal that exceedances of the 20 mg/L limit are typically confined to the colder months (winter–spring), when microbial activity in the oxidation ponds is reduced. These seasonal exceedances were statistically confirmed (Kruskal–Wallis, $p < 0.05$), indicating the system's sensitivity to temperature-driven variability.
- **Total inorganic nitrogen (TIN):** A modest but statistically significant upward temporal trend and large seasonal variability was detected, with peaks (>25 mg/L) more frequent in spring months. This pattern likely reflects the influence of bacterial nutrient removal, which is lower during colder months.
- **Total nitrogen (TN):** A slight but significant upward trend was also identified, consistent with the observations for TIN. Seasonal differences were moderate, but higher values in spring and early summer suggest incomplete nutrient removal during periods of higher loading.
- **Total phosphorus (TP):** Although not subject to consent conditions, TP showed no significant trend or seasonality.

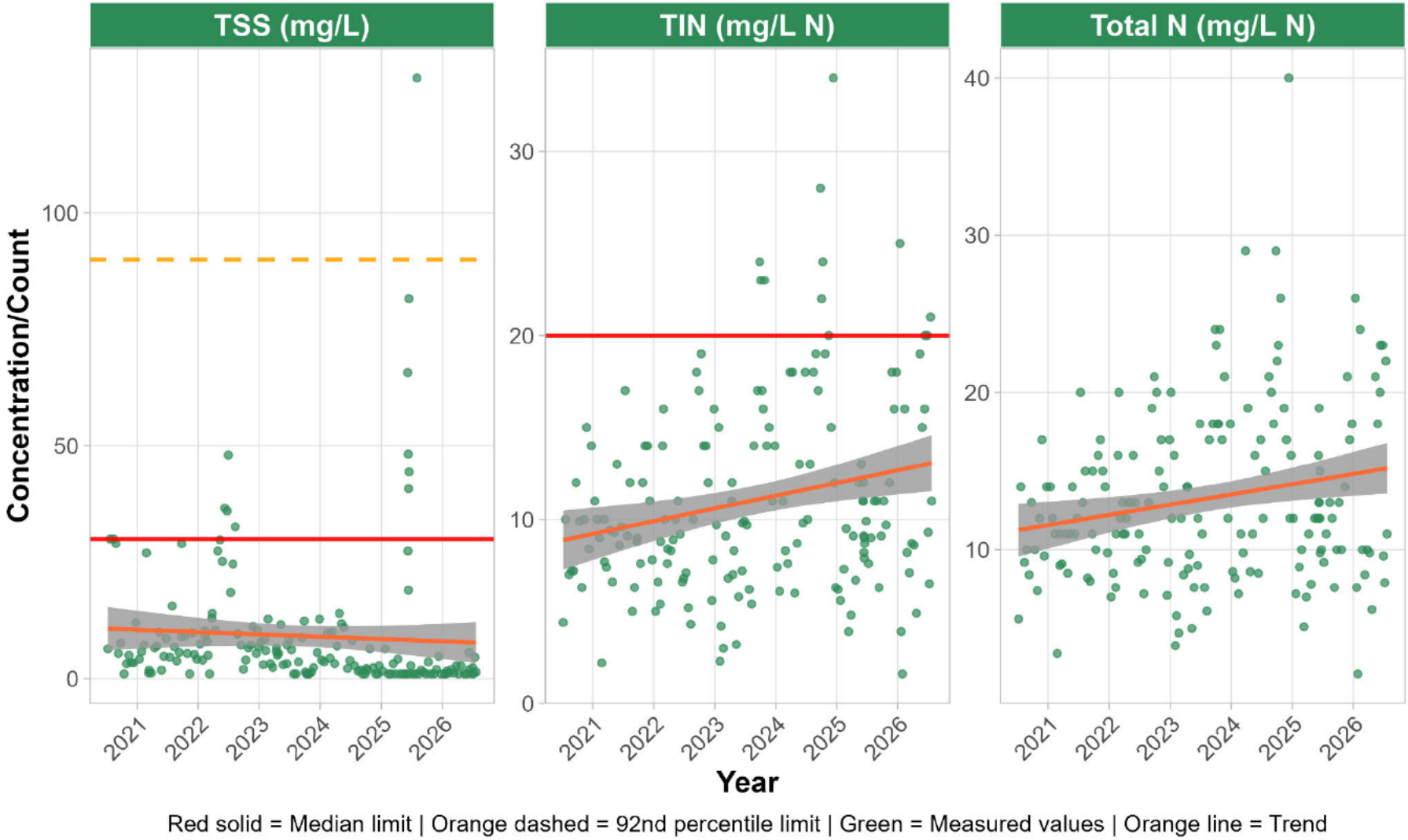


Figure 4-6. Significant (p < 0.05) long-term trends in effluent quality parameters at Clarks Beach WWTP (2020–2026).

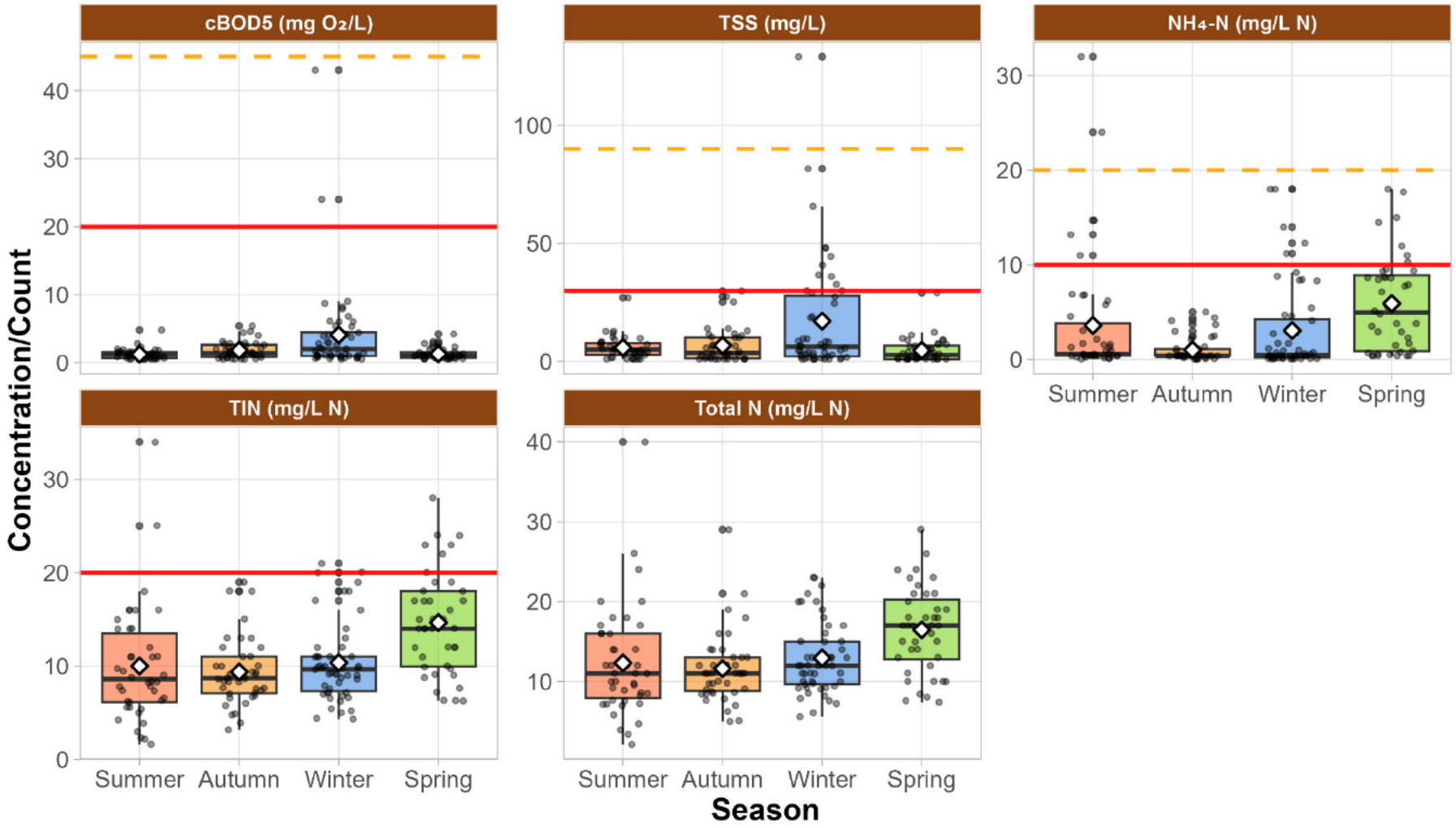


Figure 4-7. Significant (p < 0.05) seasonal differences in effluent quality parameters at Clarks Beach WWTP (2020–2026).

4.3.4 Effluent quality summary

Effluent quality monitoring in 2025–2026 confirmed compliance with all consented median and 92nd percentile limits under Condition 18 and 18b. A single elevated faecal coliform, BOD and TSS result event occurred following a significant rainfall and a bypass event on 30–31 July 2025, and a high ammonia result in January; however, these were isolated events and did not affect annual compliance. Additionally, colder temperatures and subsequent reduced biological activity resulted in increased ammoniacal nitrogen in June 2026. Across the whole period however, effluent quality remained consistently high, with low BOD_5 and TSS concentrations indicating effective organic matter treatment and solids removal.

Long-term trend analysis (2020–2026) identified continued improvement in solids removal (decreasing TSS trend) and stable organic matter treatment, with $cBOD_5$ remaining at very low concentrations. Nutrient parameters showed greater seasonal variability, with increasing trends in total inorganic nitrogen and total nitrogen likely reflecting temperature-driven reductions in biological nutrient removal efficiency during colder months. Seasonal patterns were most evident for ammoniacal nitrogen and nitrogen parameters, with elevated concentrations occurring during winter and spring but remaining within consented limits. These findings highlight the oxidation pond system's resilience under typical operating conditions while reinforcing the need for the plant upgrades, the results of which are detailed in Section 5.

4.4 Complaints and incidents

4.4.1 Complaints

No complaints relating to Clarks Beach WWTP were received during the 2025–2026 reporting period.

4.4.2 Incidents

An emergency bypass occurred on 30-31 July 2025, associated with extreme rainfall and subsequent high inflows to the Clarks Beach WWTP. This bypass resulted in the release of an estimated 5,200 m^3 of partially treated wastewater to the Manukau Harbour over 10 hours. This event bypassed the filtration and UV treatment steps and coincided with high tide, which aided dilution and was classified as a non-compliant event. Consent breaches, and elevated water quality exceedances include:

- Discharge volume exceeded 2,500 m^3/day, breaching Condition 16
- Elevated faecal coliform, TSS and $cBOD_5$ demand concentrations were subsequently recorded; however, these individual results did not result in non-compliance with the statistical effluent-quality requirements of Condition 18 for the reporting period.
- Condition 1 may be considered breached due to the bypass operating outside the design specifications and treatment train described in the Management Plan.

The incident was reported to Auckland Council in accordance with consent requirements and is further detailed in in the incident report (Appendix D).

The planned upgrades to the plant with enhanced treatment are expected to eliminate the need for emergency bypasses and improve compliance under high-flow conditions.

5 PLANT UPGRADE PERFORMANCE

The WWTP is undergoing a significant upgrade as part of the south-west servicing scheme, which ensures it can continue to meet consent conditions and accommodate population growth in the south-west Auckland region. These upgrades are expected to:

- Improve treatment performance under high inflow conditions
- Reduce the likelihood of emergency bypass discharges
- Enhance nutrient removal during colder months
- Support continued compliance with discharge limits
- Enable the Clarks Beach WWTP to serve a population of ~6,000 in the near term, with flexibility for future staged expansions.

Resource consents CST60082600-A and CST60082302-A authorise the discharge of treated wastewater and an outfall within the Waiuku Estuary. Condition 10 of these consents require an annual performance report, which shall contain the following:

f. Collate, analyse and interpret the monitoring results required by the conditions of these consents for the previous year from 1 July to 30 June;
g. Report the calculated Average Dry Weather Flow (ADWF) and rainfall data for the previous year from 1 July to 30 June;
h. Include comment on WWTP performance in relation to the quality of the treated wastewater discharge and any significant trends in changes in the discharge volume and/or the discharge quality over time;
i. Comment on compliance with each consent condition and evaluate against the Auckland Council's standard compliance scoring protocol; and
j. Identify any actions required and submit a timetable to rectify any non- compliance.

Discharges from the upgraded portion of the plant through the new outfall began in June 2026, within the current reporting period. These discharges occurred during the commissioning of the plant, which involves systematic testing and running of the upgrades prior to being in routine operation. This commissioning also includes the integration of the new infrastructure into the digital platforms where process data, including discharge volumes, are stored. During this time, the existing plant infrastructure and outfall remained in use, as the primary treatment infrastructure, with only occasional, short discharges through the new outfall.

5.1 Effluent volumes

Condition 22 of the consent requires that the discharge shall not exceed a maximum volume of 20,250 m^3 of treated wastewater per day, with a maximum flow rate of 727.5 litres per second, with an average dry weather flow of 6,750 m^3 per day. In the 2026-2027 reporting period, following commencement of full operation of the plant, effluent volumes, flow rates and average dry weather flows will be available. Table 5-1 presents the discharge volumes for the 2025-2026 reporting period.

Table 5-1. Daily discharge volumes from the new marine outfall

Date	Volume (m^3)
23/06/2026	810.80
24/06/2026	362.90
25/06/2026	213.07
26/06/2026	15.47
27/06/2026	0.3

5.2 Effluent quality

Table 5-2 presents the 24-hour flow proportioned effluent quality results, collected post-UV at the tidal storage facility with an autosampler. The samples were taken for performance testing during commissioning and therefore do not represent the full suite of parameters required as part of Condition 19. The samples were taken near-daily across a 17-day period, and as such, not all results reflect the effluent quality on the day of discharges, however, have been included to display the overall quality of effluent the plant is able to produce. Compliance with the median and 92nd percentile limits are intended to be across 24 consecutive weekly samples, and therefore a complete analysis of compliance is not yet available.

The sample results available to date indicate that all parameters are well within the expected consent limits prior to the plant being in full operation, apart from total nitrogen. The elevated total nitrogen is the result of initial difficulties with acetic dosing control, which has since been resolved by installing a nitrate probe.

Table 5-2. Effluent quality results for wastewater discharged from the new plant upgrades and marine outfall (14 – 30 July 2026)

Parameter	n	Minimum	Average	Maximum	Median	Consented Median	92nd Percentile	Consented 92nd Percentile
BOD_5 (mg/L)	15	0.58	1.23	2.8	1	5	2.48	20
TSS (mg/L)	15	1.2	2.22	3.4	2	5	3.08	20
Ammoniacal nitrogen (mg/L)	16	0.03	0.16	0.47	0.05	2	0.46	15
Total nitrogen (mg/L)	16	13	22.88	32	24	5	30.4	20
pH	16	7	7.5	7.7	7.6	–	7.7	–

*The median and 92nd percentiles have not been calculated in the manner specified by the consent (24 consecutive weekly samples), therefore an accurate compliance analysis will be provided within the 2026-2027 annual report.

5.3 Receiving environment monitoring programme

A receiving environment monitoring programme (REMP) was submitted to Auckland Council in 2024. The full extent of the monitoring results is in Appendix E, but is summarised here

A two-year baseline monitoring period was required prior to the commencement of the discharge of treated wastewater under the consent. Monitoring commenced in June 2024 and was designed to establish baseline environmental conditions prior to operation of the new outfall. The monitoring programme is designed to deliver ecologically meaningful results and be statistically robust enough to detect potential changes.

The programme includes:

- Coastal water quality monitoring
- Sediment quality monitoring
- Benthic ecology monitoring
- Shellfish monitoring
- Reef ecology monitoring
- Vegetation mapping
- Dissolved oxygen profiling
- Phytoplankton monitoring

Key findings from the baseline reports include:

- Benthic community composition at Tokaroa Point Reef were consistently structured by tidal height and transect location, reflecting rocky reef zonation within a sediment-influenced harbour environment.
- Reef communities exhibited interannual variability in species richness, abundance and dominant taxa, particularly for sessile assemblages. The trends appeared to reflect a combination of natural variability, sediment dynamics and habitat patchiness rather than evidence of any clear directional trend or ecological degradation.
- Intertidal vegetation mapping demonstrated that the surveyed area is characterised by an extensive and well-established seas grass meadow, relatively stable mangrove habitat and variable but generally low levels of nuisance macroalgae and sea lettuce.
- Shellfish metal concentrations were elevated, particularly for arsenic (total), copper, lead and zinc. Polycyclic aromatic hydrocarbons were below the European Union reference values.
- Microbial analysis of shellfish found faecal coliforms and enterococci concentrations were regularly high, and concentrations increased and decreased concurrently between sites. The results suggested that rainfall may contribute to elevated bacterial concentrations in the Waiuku Estuary under some conditions, however the influence of rainfall was not consistent throughout the monitoring period. No viruses were detected.
- Water quality and phytoplankton were variable between sites, with some elevated results throughout the monitoring period, with peaks of enterococci and total nitrogen, but consistent chlorophyll *a*, and temporal patterns of DRP, TSS and other parameters. No baseline difference upstream or downstream of the WWTP was identified
- Benthic ecology patterns were consistent with the environmental gradient from tidal river to central harbour intertidal flats, and variation in subtidal seabed substrates.

6 CONCLUSION

During the 2025–2026 reporting period, the WWTP consistently met its consent conditions under normal operating circumstances. Routine effluent volumes remained well below the 2,500 m^3/day limit, and all monitored water quality parameters were compliant under Condition 18, including during seasonal fluctuations.

Individual result non-compliances were limited to emergency bypass discharges during extreme rainfall events in July 2025, and peak summer inflows. While the bypass incidents required the release of partially treated wastewater, they were promptly reported and managed in accordance with consent requirements.

Long-term data indicate that treatment performance has generally improved or remained stable for most parameters, particularly BOD_5, TSS, and TP. However, upward trends in nitrogen species (TIN, TN) point to the limits of pond-based nutrient removal under present day conditions.

No complaints were received for the reporting period.

The ongoing plant upgrade, including expanded treatment capacity, membrane aeration, and a new harbour outfall, will directly address these constraints. Once fully operational in 2026-2027, the upgraded facility will significantly improve resilience to inflow peaks, reduce the likelihood of bypass events, and support continued compliance as the serviced population grows.

Appendix A. Assessment of Compliance

Table A-1 Assessment of Compliance with Consent Conditions – Clarks Beach Discharge to Water (#R/REG/2015/4228-A)

Condition Number	Consent Condition Clarks Beach Discharge to Water (#R/REG/2015/4227-A)	Compliance Rating	Comments
01	The discharges to the coastal environment, land or water, and air associated with the processing of wastewater at the Clarks Beach Wastewater Treatment Plan shall be carried out in accordance with the plans and all information submitted with the application, detailed below, and all referenced by the authorising agency as consent number R/REG/2015/4227, R/REG/2015/4228 and R/REG/2017/844 and as varied by CST60083001-A, DIS60084111-A, DIS60084200-A: Please refer to page 7/12 of the consent document for further details.	2	Emergency bypass discharges occurred in July 2025 under high inflow conditions. As bypasses are not described in the submitted management plan or consented discharge route, these events are considered a technical non-compliance. Both were reported to Auckland Council.
02	Consent R/REG/2017/4227 for the coastal permit to discharge contaminants to the general coastal marine environment shall expire 10 years from the date it is granted unless it has been surrendered or been cancelled at an earlier date pursuant to the RMA.	1	Compliant.
05	The servants or agents of the Council shall be permitted to have access to the relevant parts of the WWTP and treated wastewater discharge facilities at all reasonable times for the purpose of carrying out inspections, surveys, investigations, tests, measurements or take samples while adhering to the consent holder's health and safety polices.	1	Compliant.
06	The consent holder shall maintain a register of the authorised trade waste connections to the Clarks Beach WWTP, and shall provide a copy of the updated register with the Annual Report required by general condition 15.	N/A	We do not have any customers requiring Trade Waste Agreements in the Clarks Beach catchment. However, under the Auckland Council Trade Waste Bylaw 2013, we do not require 'low risk' customers such as cafes, takeaways, hairdressers etc to hold Trade Waste Agreements.
07	The conditions of these consents may be reviewed by the Council Manager pursuant to section 128 of the Act, by giving notice pursuant to section 129; Please refer to page 8/12 of the consent document for further details.	1	Compliant.
08	Any complaints received by the consent holder about the discharges shall be logged immediately. The information shall include: Please refer to page 8/12 of the consent document for further details	1	Compliant.
09	The consent holder shall ensure a flow meter is maintained in place to measure the total wastewater inflow to the WWTP and the total treated wastewater discharge volume from the WWTP. The discharge volume meter shall be maintained to ensure an accuracy of plus or minus five percent.	1	Ongoing.

Condition Number	Consent Condition Clarks Beach Discharge to Water (#R/REG/2015/4227-A)	Compliance Rating	Comments
10	The consent holder shall collect and keep data of the daily rainfall levels at a location that provides representative indications of rainfall levels at the WWTP. This data shall be made available to the Council Manager on request.	1	Ongoing.
11	The consent holder shall collect monitoring data and samples from the outlet of the UV disinfection system and before the treated wastewater discharge pumping station at a point agreed to between the consent holder and the Council Manager, and shall record and analyse the samples for the following parameters, to the required detection limits and at the specified frequency: Please refer to page 9/12 of the consent document for further details.	1	Ongoing.
12	The consent holder shall ensure that the samples required by condition 11 of the Coastal Permit are collected and analysed in accordance with the 22nd edition of the 'Standard Methods for the Examination of Water and Wastewater' (Standard Methods) published by the American Public Health Association (APHA), the Water Environment Federation (WEF), and the American Water Works Association (AWWA) or any subsequent edition or equivalent as may be approved in writing by the Council Manager.	1	Compliant.
13	In the event of two consecutive results for any single parameter of samples collected in accordance with general condition 11 and 12, not complying with the limits specified in condition 18 of the Coastal Permit, the consent holder shall as soon as practicable on receipt of the second result notify the Council Manager of the exceedance in writing, outline the mitigation measures taken, and advise any further measures proposed to ensure compliance. If so, instructed by the Council Manager, the consent holder shall increase the frequency of monitoring for that parameter to weekly for a specified period agreed to by the consent holder and the Council Manager.	1	Compliant.
14	The consent holder shall ensure that the results of the monitoring undertaken in accordance with general conditions 9 and 10 (discharge flows and rainfall) and condition 18 of the Coastal Permit (discharge qualities) are reported to the Council Manager quarterly within 20 working days of the period ending 31 December, 31 March, 30 June and 30 September each year.	1	Compliant.
15	The consent holder shall prepare an Annual Report and provide it to the Council Manager by 30 September each year. The Annual Report is to cover: Please refer to page 10/12 of the consent document for further details.	N/A	This report
16	The consent holder shall ensure that the volume of wastewater entering the artificial combined stormwater and wastewater channel does not exceed a maximum flow of 2,500m3/day, plus any incidental flow from rainfall on the Clarks Beach WWTP oxidation pond, rock filter and sand filters.	2	A bypass discharge on 30–31 July 2025 released ~5,200 m^3 over 24 hours, exceeding the 2,500 m^3/day limit. This constitutes a technical non-compliance with Condition 16.

Condition Number	Consent Condition Clarks Beach Discharge to Water (#R/REG/2015/4227-A)	Compliance Rating	Comments
17	Wastewater shall enter the existing constructed combined stormwater and wastewater channel located within the Clarks Beach Golf Course area at or about Grid Reference NZTM: NZTM:- Easting: 1751164.86 / Northing: 5888012.29.	1	Ongoing.
18	The consent holder shall ensure that the quality of the wastewater discharged is equal to or better than the following parameter concentrations.	2	Complied under routine operations. Exceedances occurred during emergency bypass events in July 2025 and during high summer inflows.

Table A-2 Assessment of Compliance with Consent Conditions – Clarks Beach Discharge to Land (#R/REG/2015/4228-A)

Condition Number	Consent Condition Clarks Beach Discharge to Land (#R/REG/2015/4228-A)	Compliance Rating	Comments
01	The discharges to the coastal environment, land or water, and air associated with the processing of wastewater at the Clarks Beach Wastewater Treatment Plan shall be carried out in accordance with the plans and all information submitted with the application, detailed below, and all referenced by the authorising agency as consent number R/REG/2015/4227, R/REG/2015/4228 and R/REG/2017/844 and as varied by CST60083001-A, DIS60084111-A, DIS60084200-A: Please refer to page 7/12 of the consent document for further details.	1	Compliant.
03	Consent R/REG/2015/4228 for the discharge of contaminants to land or water shall expire 10 years from the date it is granted unless it has been surrendered or been cancelled at an earlier date pursuant to the RMA.	1	Compliant.
05	The servants or agents of the Council shall be permitted to have access to the relevant parts of the WWTP and treated wastewater discharge facilities at all reasonable times for the purpose of carrying out inspections, surveys, investigations, tests, measurements or take samples while adhering to the consent holder's health and safety polices.	1	Compliant.
06	The consent holder shall maintain a register of the authorised trade waste connections to the Clarks Beach WWTP, and shall provide a copy of the updated register with the Annual Report required by general condition 15.	N/A	We do not have any customers requiring Trade Waste Agreements in the Clarks Beach catchment. However, under the Auckland Council Trade Waste Bylaw 2013, we do not require 'low risk' customers such as cafes, takeaways, hairdressers etc to hold Trade Waste Agreements.

Condition Number	Consent Condition Clarks Beach Discharge to Land (#R/REG/2015/4228-A)	Compliance Rating	Comments
07	The conditions of these consents may be reviewed by the Council Manager pursuant to section 128 of the Act, by giving notice pursuant to section 129; Please refer to page 8/12 of the consent document for further details.	1	Compliant.
08	Any complaints received by the consent holder about the discharges shall be logged immediately. The information shall include: Please refer to page 8/12 of the consent document for further details	1	Compliant. Please refer to 3.4.1
09	The consent holder shall ensure a flow meter is maintained in place to measure the total wastewater inflow to the WWTP and the total treated wastewater discharge volume from the WWTP. The discharge volume meter shall be maintained to ensure an accuracy of plus or minus five percent.	1	Ongoing.
10	The consent holder shall collect and keep data of the daily rainfall levels at a location that provides representative indications of rainfall levels at the WWTP. This data shall be made available to the Council Manager on request.	1	Ongoing.
11	The consent holder shall collect monitoring data and samples from the outlet of the UV disinfection system and before the treated wastewater discharge pumping station at a point agreed to between the consent holder and the Council Manager and shall record and analyse the samples for the following parameters, to the required detection limits and at the specified frequency: Please refer to page 9/12 of the consent document for further details.	1	Ongoing.
12	The consent holder shall ensure that the samples required by condition 11 of the Coastal Permit are collected and analysed in accordance with the 22nd edition of the 'Standard Methods for the Examination of Water and Wastewater' (Standard Methods) published by the American Public Health Association (APHA), the Water Environment Federation (WEF), and the American Water Works Association (AWWA) or any subsequent edition or equivalent as may be approved in writing by the Council Manager.	1	Compliant.
13	In the event of two consecutive results for any single parameter of samples collected in accordance with general condition 11 and 12, not complying with the limits specified in condition 18 of the Coastal Permit, the consent holder shall as soon as practicable on receipt of the second result notify the Council Manager of the exceedance in writing, outline the mitigation measures taken, and advise any further measures proposed to ensure compliance. If so instructed by the Council Manager, the consent holder shall increase the frequency of monitoring for that parameter to weekly for a specified period agreed to by the consent holder and the Council Manager.	1	Compliant.
14	The consent holder shall ensure that the results of the monitoring undertaken in accordance with general conditions 9 and 10 (discharge flows and rainfall) and condition 18 of the Coastal Permit (discharge qualities) are reported to the Council Manager quarterly within 20 working days of the period ending 31 December, 31 March, 30 June and 30 September each year.	1	Compliant.

Condition Number	Consent Condition Clarks Beach Discharge to Land (#R/REG/2015/4228-A)	Compliance Rating	Comments
15	The consent holder shall prepare an Annual Report and provide it to the Council Manager by 30 September each year. The Annual Report is to cover: Please refer to page 10 of the consent document for further details.	N/A	This report.
19	The consent holder shall manage and maintain the integrity of the oxidation pond, rock filter and sand filters and other structures that form part of the wastewater treatment process so as to minimise the volume of seepage from such structures as far as practicable.	1	Ongoing.

Table A-3 Assessment of Compliance with Consent Conditions – Clarks Beach Discharge to Air (#R/REG/2017/844-A)

Condition Number	Consent Condition Clarks Beach Discharge to Air (#R/REG/2017/844-A)	Compliance Rating	Comments
01	The discharges to the coastal environment, land or water, and air associated with the processing of wastewater at the Clarks Beach Wastewater Treatment Plan shall be carried out in accordance with the plans and all information submitted with the application, detailed below, and all referenced by the authorising agency as consent number R/REG/2015/4227, R/REG/2015/4228 and R/REG/2017/844 and as varied by CST60083001-A, DIS60084111-A, DIS60084200-A: Please refer to page 7/12 of the consent document for further details.	1	Compliant.
04	Consent R/REG/2017/844 for the discharge of contaminants to air shall expire 10 years from the date it is granted unless it has been surrendered or been cancelled at an earlier date pursuant to the RMA.	1	Compliant.
05	The servants or agents of the Council shall be permitted to have access to the relevant parts of the WWTP and treated wastewater discharge facilities at all reasonable times for the purpose of carrying out inspections, surveys, investigations, tests, measurements or take samples while adhering to the consent holder's health and safety polices.	1	Compliant.
06	The consent holder shall maintain a register of the authorised trade waste connections to the Clarks Beach WWTP, and shall provide a copy of the updated register with the Annual Report required by general condition 15.	1	We do not have any customers requiring Trade Waste Agreements in the Clarks Beach catchment. However, under the Auckland Council Trade Waste Bylaw 2013, we do not require 'low risk' customers such as cafes, takeaways, hairdressers etc to hold Trade Waste Agreements.
07	The conditions of these consents may be reviewed by the Council Manager pursuant to section 128 of the Act, by giving notice pursuant to section 129; Please refer to page 8/12 of the consent document for further details.	1	Compliant.

Condition Number	Consent Condition Clarks Beach Discharge to Air (#R/REG/2017/844-A)	Compliance Rating	Comments
08	Any complaints received by the consent holder about the discharges shall be logged immediately. The information shall include: Please refer to page 8/12 of the consent document for further details	1	Compliant. Please refer to 3.2.4.
09	The consent holder shall ensure a flow meter is maintained in place to measure the total wastewater inflow to the WWTP and the total treated wastewater discharge volume from the WWTP. The discharge volume meter shall be maintained to ensure an accuracy of plus or minus five percent.	1	Ongoing.
10	The consent holder shall collect and keep data of the daily rainfall levels at a location that provides representative indications of rainfall levels at the WWTP. This data shall be made available to the Council Manager on request.	1	Ongoing.
11	The consent holder shall collect monitoring data and samples from the outlet of the UV disinfection system and before the treated wastewater discharge pumping station at a point agreed to between the consent holder and the Council Manager, and shall record and analyse the samples for the following parameters, to the required detection limits and at the specified frequency: Please refer to page 9/12 of the consent document for further details.	1	Ongoing.
12	The consent holder shall ensure that the samples required by condition 11 of the Coastal Permit are collected and analysed in accordance with the 22nd edition of the 'Standard Methods for the Examination of Water and Wastewater' (Standard Methods) published by the American Public Health Association (APHA), the Water Environment Federation (WEF), and the American Water Works Association (AWWA) or any subsequent edition or equivalent as may be approved in writing by the Council Manager.	1	Compliant.
13	In the event of two consecutive results for any single parameter of samples collected in accordance with general condition 11 and 12, not complying with the limits specified in condition 18 of the Coastal Permit, the consent holder shall as soon as practicable on receipt of the second result notify the Council Manager of the exceedance in writing, outline the mitigation measures taken, and advise any further measures proposed to ensure compliance. If so instructed by the Council Manager, the consent holder shall increase the frequency of monitoring for that parameter to weekly for a specified period agreed to by the consent holder and the Council Manager.	1	Compliant.
14	The consent holder shall ensure that the results of the monitoring undertaken in accordance with general conditions 9 and 10 (discharge flows and rainfall) and condition 18 of the Coastal Permit (discharge qualities) are reported to the Council Manager quarterly within 20 working days of the period ending 31 December, 31 March, 30 June and 30 September each year.	1	Compliant.
15	The consent holder shall prepare an Annual Report and provide it to the Council Manager by 30 September each year. The Annual Report is to cover: Please refer to page 10/12 of the consent document for further details.	N/A	This report - sent in September 2026.

Condition Number	Consent Condition Clarks Beach Discharge to Air (#R/REG/2017/844-A)	Compliance Rating	Comments
20	The consent holder shall ensure that all processes on site are operated, maintained, supervised, monitored and controlled to ensure that emissions authorised by this consent are maintained at the minimum practicable level.	1	Compliant.
21	The consent holder shall ensure that no air discharges from any activity on the WWTP site are in the opinion of a Council enforcement officer noxious, dangerous, offensive or objectionable beyond the designated WWTP boundary.	1	Ongoing
22	The consent holder shall ensure that all staff and contractors undertaking works at the WWTP site are aware of, and adhere to, all conditions of this consent.	1	Ongoing
23	The consent holder shall ensure that wind direction and the proximity to neighbouring properties are considered prior to undertaking any potentially odorous activities at the site.	1	Ongoing
24	The Council Manager shall be advised in writing no less than 10 working days prior to the commencement of any desludging or other activities that could cause odour release. The written notice shall include: Please refer to pages 11/12 and 12/12 of the consent document for further details.	1	Compliant
25	When a periodic maintenance procedure has the potential to produce noxious, offensive or objectionable odour such as cleaning the rock filter media, the consent holder shall at least ten months prior to undertaking the proposed works discuss these works with the Council Manager and if deemed necessary shall apply for a short-term air discharge consent to cover said works.	1	Compliant
26	The consent holder shall ensure that a Council Manager is notified as soon as practicable in the event of any significant discharge to air which has potential to result in a breach of these conditions or to cause adverse effects on the environment. The following information shall be provided: a. details of the nature of the discharge; b. an explanation of the cause of the incident; and c. details of remediation action taken.	1	Compliant
27	All records, monitoring and test results required by the conditions of this consent shall be made available on request, during operating hours, to a Council enforcement officer and shall be kept by the consent holder for a minimum period of two years from the date of each entry for the duration of the consent.	1	Compliant

Table A-3 Assessment of Compliance with Consent Conditions – Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A).

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
01	The wastewater treatment process at the WWTP and physical discharge facilities shall be designed, operated and maintained, and receiving environment monitoring shall be, in general accordance with the information provided with the application, subsequent variation to the conditions of consent, and all referenced by the Council as consent numbers CST60082600 and CST60082302, and as modified by any subsequent variation as follows:	1	
02	Under section 125 of the RMA, these consents lapse eight years after the date they are granted unless, before the lapse date: (a) The consents are given effect to; or (b) The Council extends the period after which the consent lapse.	1	
03	The consent holder shall pay the Council an initial consent compliance monitoring charge of $1,200 inclusive of GST, plus any further monitoring charge or charges to recover the actual and reasonable costs incurred to ensure compliance with the conditions attached to this consent/s.	1	
04	The agents of the Auckland Council shall be permitted to have access to the WWTPs and discharge facilities at all reasonable times for the purpose of carrying out monitoring procedures, inspections, surveys, investigations, tests, measurements or take samples while adhering to the consent holder's health and safety policies.	1	
05	No later than six months after the commencement of these consents, the consent holder shall invite stakeholders including, but not limited to, one representative each from Te Ara Rangatu o Te Iwi o Ngati Te Ata Waiohua, Ngati Tamaoho Trust, Te Akitai o Waiohua, Te Ahiwaru (Makaurau Marae), Te Kawerau a Maki, the Manukau Harbour Restoration Society, the Ornithological Society of New Zealand Inc (BirdsNZ), and the Auckland Regional Public Health Service to establish, in association with the consent holder, a Community Liaison Group. A general invitation shall be made by way of public notice in the Franklin Country News and the Post (Franklin & North Waikato) and on the consent holder's website.	1	
06	The consent holder shall provide reasonable organisation and administrative support to facilitate the development and on-going role of this Community Liaison Group for the duration of the consent. The Community Liaison Group and the Auckland Council Team Leader – Southern Monitoring or delegate shall be invited to meet at least six monthly to exercise the functions set out in Condition 7. Upon agreement with the Community Liaison Group and the Auckland Council's Team Leader – Southern Monitoring, the meeting frequency may be reduced. All reports shall be provided to the Community Liaison Group in electronic format unless specified otherwise and be hosted on the consent holder's website or an alternative information sharing web application.	1	Meeting on 8 October 2025. All required reports distributed by a designated secretary.

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
07	The functions of the Community Liaison Group shall include, but not be limited to, the following matters: (a) Reviewing the performance of the WWTPs and discharge facilities in relation to the quality of the treated wastewater discharge and compliance with the consent conditions; (b) Reviewing the results of monitoring and the associated assessment of monitoring information carried out in accordance with the conditions of these consents; (c) Receiving and commenting on the following documents: i. Receiving Environment Monitoring Programme and Receiving Environment Monitoring Report; ii. Annual Performance Report; iii. Offshore Outfall Construction Management Plan; iv. Operations and Management Plan; v. Offshore Outfall Inspection Report; vi. Monitoring and Technology Review Report; vii. Emerging Contaminants Risk Assessment; and viii. Complaints Register. (d) The consent holder shall provide the Draft Receiving Environment Monitoring Programme, Draft Operations and Management Plan, and Draft Emerging Contaminants Risk Assessment to the Community Liaison Group for comment prior to being submitted to the Council's Team Leader – Southern Monitoring for certification. (e) The consent holder shall make the authors of the Receiving Environment Monitoring Report, the Monitoring and Technology Review Report and the Emerging Contaminants Risk Assessment available to the Community Liaison Group, upon request. (f) Making suggestions to the consent holder and/or Auckland Council as to any practical physical measures and other initiatives further needed to address actual or potential adverse effects of the treated wastewater discharge; (g) Making suggestions as to any additional investigations the consent holder might undertake in respect of actual or potential adverse effects of the treated wastewater discharge; and (h) Considering any other issues of concern to the Community Liaison Group relating to the WWTP treated wastewater discharge. Any comments or suggestions provided for under (c), (f) or (g) above shall be provided to the consent holder and Auckland Council within 30 working days of any meeting of the Community Liaison Group or within such other timeframe as agreed by the Group.	1	
08	The consent holder shall provide minutes of each Community Liaison Group meeting to the Auckland Council and the members of the Community Liaison Group within 60 working days of each meeting in electronic format unless specified otherwise and be hosted on the consent holder's website or an alternative information sharing web application. The minutes shall include: (a) A record of discussions and attendance at the meeting; (b) A record of any suggestions provided or issues raised by the members of the Community Liaison Group including:	1	

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
	i. What actions are proposed by the consent holder to respond to suggestions made or issues raised by the Community Liaison Group as they relate to the functions of the Community Liaison Group as set out in Condition 7; and ii. Where no actions are proposed to respond to suggestions or issues, the reasons why not. iii. Where actions are proposed by the consent holder to respond to suggestions or issues, the ongoing status of those actions, including whether they have been completed. A Peer Reviewer(s), who is suitably qualified and knowledgeable in the following fields: i. Operation of wastewater treatment plants and assessment of alternative wastewater technologies; ii. Wastewater chemistry (including emerging contaminants) and marine water quality; iii. Marine ecology. shall be appointed and briefed by the Council's Team Leader - Southern Monitoring. The functions of the Peer Reviewer(s) shall be: i. To attend the meeting of the Community Liaison Group held to consider the draft versions of the Receiving Environment Monitoring Report, the Monitoring and Technology Review Report and the Emerging Contaminants Risk Assessment provided to the Community Liaison Group for comment, in order to contribute to the Community Liaison Group's understanding of those draft reports; and ii. To advise the Council on the certification of the reports and assessment in (i) above as required by Conditions 30, 11, and 34 respectively. In performing function (i) above, the Peer Reviewer(s) will summarise to the Community Liaison Group the key conclusions in the draft reports, comment on the adequacy of the information contained in those reports, and inform the Group of any issues arising, and answer any questions. The Consent Holder shall provide the Peer Reviewer(s) with all records, plans, designs and other information that the Peer Reviewer(s) requires to be able to carry out its functions. All costs related to the appointment of the Peer Reviewer(s) shall be borne by the consent holder.		
09	All complaints received by the consent holder about the treated wastewater discharge shall be logged immediately in the WWTP Complaints Register. The Register shall record: (a) The date, time, location, duration and nature of the alleged event/ incident; (b) Name, phone number and address of the complainant unless the complainant wishes to remain anonymous; (c) Any remedial action taken by the consent holder in response to the complaint and when it was undertaken, and if no remedial action was considered necessary by the consent holder, the reasons for taking no remedial action; (d) The possible cause of the relevant event/ incident that lead to the complaint; (e) The weather conditions at the time of the relevant event/ incident including estimates of wind direction, wind strength, temperature and cloud cover; (f) The date and name of the person making the entry; and	1	No complaints.

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
	(g) Details of any complaints received that may indicate non-compliance with the conditions of these consents shall be provided to the Council's Team Leader - Southern Monitoring within 24 hours of receipt of the complaint or on the next working day. All other complaints shall be included in the Annual Performance Report required by Condition 10.		
10	An Annual Performance Report shall be submitted by the consent holder to the Council's Team Leader - Southern Monitoring and the Community Liaison Group as per Condition 7 by September 30 of each year in which the treated wastewater discharge is occurring. The report shall: (a) Collate, analyse and interpret the monitoring results required by the conditions of these consents for the previous year from 1 July to 30 June; (b) Report the calculated Average Dry Weather Flow (ADWF) and rainfall data for the previous year from 1 July to 30 June; (c) Include comment on WWTP performance in relation to the quality of the treated wastewater discharge and any significant trends in changes in the discharge volume and/or the discharge quality over time; (d) Comment on compliance with each consent condition and evaluate against the Auckland Council's standard compliance scoring protocol; and (e) Identify any actions required and submit a timetable to rectify any noncompliance.	1	This report. The plant is not in routine operation during the reporting period.
11	The consent holder shall engage an independent suitably qualified person to prepare and submit a Monitoring and Technology Review Report to the Council's Team Leader – Southern Monitoring by the 5th, 10th, 15th, 20th, 25th and 30th anniversaries of the commencement of these consents. The Review Report shall be provided to the Community Liaison Group as per Condition 7, with a request for comments to be provided to the consent holder and Auckland Council within 60 working days. After receiving comments from the Community Liaison Group (or in the case that no comments are forthcoming, after 60 working days), the Report shall be submitted to the Team Leader – Southern Monitoring for certification it has been produced in accordance with the requirements of these conditions.	1	First report due 2031.
12	The Monitoring and Technology Review Report shall include the following: (a) An assessment of ongoing compliance with the requirements of these resource consents particularly in relation to any reported non-compliance with consent conditions; (b) An assessment of compliance/consistency with any relevant national or regional water quality policies, environmental standards or guidelines in effect at the time; (c) An assessment of the results of the consent holder's monitoring undertaken in accordance with these consents, including the adequacy and scope of such monitoring; (d) A summary of any residual actual or potential adverse effects of the treated wastewater discharge, particularly effects of the treated wastewater discharge on total nitrogen and total phosphorus concentrations in the receiving environment and the relationship of total nitrogen and total phosphorus to	1	

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
	limiting algal growth, irrespective of whether the discharge complies with the conditions of these consents; (e) An outline of significant technological changes and advances in relation to wastewater management, inflow reduction, treatment, discharge and beneficial reuse technologies (including Managed Aquifer Recharge) that could be of relevance for possible future use in the South-west Sub-regional Wastewater Scheme treatment and discharge facilities. Specific information shall be included on: i. options the consent holder has investigated for wastewater reduction and/or reuse, including Managed Aquifer Recharge and industrial re-use, and any actions taken as a result of those investigations; and ii. any discharge volume reduction that has been achieved as a result of those actions, since the commencement of these consents, when assessed on a per domestic connection equivalent basis, as reported by the discharge monitoring in Condition 25. (f) An assessment of whether any newly available technology option/s or combination of options identified through (e) above represent the Best Practicable Option (BPO) to minimise the potential and actual adverse effects of the treated wastewater discharge and whether the consent holder intends to adopt that BPO and incorporate such technologies. Those matters listed in 12(a) to (d) shall not be required in the Monitoring and Technology Review Report until after the discharge of treated wastewater has commenced.		
13	The conditions of these consents may be reviewed by the Council's Team Leader - Southern Monitoring pursuant to section 128 of the RMA, by giving notice pursuant to section 129, on the fifth anniversary of the commencement of the discharge of treated wastewater and subsequently at five yearly intervals thereafter in order: (a) To deal with any adverse effect on the environment arising from the exercise of the consent, which is more than minor, which was not foreseen at the time the application was considered and which is appropriate to deal with at the time of review, including more than minor adverse effects of the treated wastewater discharge on receiving water quality, shellfish quality and marine ecology, identified in the Receiving Environment Monitoring Report under Condition 29; or, (b) To consider developments in technology and management practices that would enable practical reductions in the discharge of contaminants, in particular where any technology option/s identified through Condition 12(e) represent the BPO in Condition 12(f) to minimise the potential and actual adverse effects of the treated wastewater discharge; or (c) To alter the monitoring requirements, including requiring further monitoring, or increasing or reducing the frequency of monitoring. The conditions of these consents may be reviewed by the Council's Team Leader - Southern Monitoring pursuant to section 128 of the RMA, by giving notice pursuant to section 129, on 30 June 2032, being six months prior to the expiry of the discharge permit for the Mangere Wastewater Treatment Plant in order: (a) To consider the effects on the environment arising from the exercise of this consent in combination	1	

Condition Number	***Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)***	Compliance Rating	Comments
	with the proposed effects on the environment of any replacement consent that may be sought for the discharges into the Manukau Harbour of the Mangere Wastewater Treatment Plant, which are appropriate to deal with at the time of review; (b) To alter the contaminant discharge limits, monitoring requirements (including requiring further monitoring), or increasing or reducing the frequency of monitoring.		
14	The treated wastewater compliance monitoring point for the purpose of monitoring compliance with Conditions 15 and 16 shall be at the point immediately following the UV disinfection system at the WWTPs: 5888069N and 1750746E (NZTM) at Clarks Beach WWTP; and /or 5879106N and 1753497E (NZTM) at Waiuku WWTP.	1	
15	The consent holder shall ensure that the quality of the treated wastewater at the treated wastewater compliance monitoring point does not exceed the limits as set out in Table 2. For the purposes of this condition, to determine compliance with median limits no more than 12 samples out of any 24 consecutive weekly samples shall exceed the specified limit. To determine compliance with the 92nd percentile limit, no more than two samples out of any 24 consecutive weekly samples shall exceed the specified limit.	N/A	Insufficient weekly monitoring results were available at the end of the reporting period to assess compliance against the 24-consecutive-sample criteria. Individual total nitrogen results exceeded the median criterion; however, this does not in itself establish non-compliance with Condition 15. Compliance will be assessed once sufficient monitoring results are available.
16	The consent holder shall ensure that a validated UV dose of 35 mWs/cm2 is delivered by the UV disinfection facility for 99% of the time (calculated on the basis of a 15-minute average) over each calendar month.	1	
17	The consent holder shall take 24 hour flow proportioned samples of the treated wastewater on a weekly basis from the treated wastewater compliance monitoring point, for the purposes of determining compliance with Condition 15 and monitoring under Condition 19	1	
18	All wastewater quality analyses shall be undertaken by an IANZ accredited or equivalent laboratory. All methods used shall be appropriate for the wastewater analyses undertaken.	1	
19	The consent holder shall take 24 hour flow proportioned samples (taken in accordance with Condition 17) of the treated wastewater on a weekly basis from the treated wastewater compliance monitoring point and analyse for the parameters set out in Table 3.	1	
20	The consent holder shall monitor on a three-monthly basis (by grab samples) the treated wastewater at the treated wastewater monitoring compliance point for the parameters set out in Table 4 below for two	1	

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
	years following commencement of the discharge of treated wastewater. After two years of monitoring the frequency of monitoring shall be reduced to 6 monthly (by grab samples) for the duration of the consent.		
21	The consent holder shall take a 24 hour flow proportioned sample of the treated wastewater on a weekly basis from a point after the tidal holding facility at the Clarks Beach site and prior to discharge to the coastal marine area and analyse for the parameters set out in Table 5.	1	
22	The discharge shall not exceed a maximum volume of 20,250m3 of treated wastewater per day, with a maximum flow rate of 727.5 litres per second (calculated as an average over each tidal discharge cycle) and average dry weather flow (ADWF) of 6,750m3 per day.	1	
23	The discharge location shall be in the Waiuku Channel at or about grid reference 5887800N and 1750600E (NZTM).	1	
24	The discharge of treated wastewater at the discharge location shall not commence until one hour after any high tide and must cease no later than five hours after any high tide.	1	
25	The consent holder shall monitor the flow rate of treated wastewater leaving the tidal holding facility at the Clarks Beach site (prior to the discharge location) and shall record the total daily discharge volume. The discharge volume meters must be maintained to ensure an accuracy of plus or minus 5 percent.	1	
26	The consent holder shall monitor and record the daily rainfall in millimetres (mm) at the Waiuku WWTP site.	1	
27	The consent holder shall prepare a Receiving Environment Monitoring Programme (REMP) as follows: (a) Prior to monitoring commencing the REMP shall be submitted to the Council's Team Leader – Southern Monitoring for certification that it has been produced in accordance with the requirements of these conditions. The REMP shall be in general accordance with the requirements listed in (b)(i) to (xii) below and the Draft Receiving Environment Monitoring Programme, a copy of which is attached as Appendix One. The certified REMP shall also be provided to the Community Liaison Group by the consent holder. (b) The purpose of the REMP is to detect and delineate any obvious temporal trends in Manukau Harbour water quality, shellfish quality and marine ecology related to the discharge of wastewater from the WWTPs. The REMP shall include/address: i. Coastal water quality monitoring (initially from 10 sites); ii. Diurnal measurements of dissolved oxygen (at one site); iii. Phytoplankton monitoring (initially 4 sites); iv. Shellfish monitoring for microbial contaminants (initially from four sites); v. Benthic ecology monitoring (initially from nine sites and reef ecology from one site); vi. Shellfish monitoring (initially from six sites for scallops, five sites for cockles and five sites for oysters); vii. A procedure for modifying the REMP; viii. Records of comments received from the Community Liaison Group; ix. Spatial and temporal extent of the key biogenic habitats (scallop beds, sponge gardens, horse mussel beds, seaweed forests) within 1km from the proposed outfall; x. Benthic community (fauna and flora) abundance and diversity; xi. Sediment quality analysis (heavy metals, grain size, organic content, anoxic layer/redox potential); xii. Spatial and temporal	1	REMP prepared and certified in 2024.

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
	extent of algal blooms; xiii. Suitability of kaimoana species for harvesting and human consumption. This shall include species, size and number of samples to monitor; and xiv. Reporting procedures. Monitoring design for the above aspects is to include the number of samples, spacing of sample stations in relation to the position of the outfall, frequency of sampling, methodology and reporting. The monitoring programme should be designed to deliver ecologically meaningful results and be statistically robust enough to detect potential changes to those matters listed above.		
28	As a minimum, for two years prior to and two years following commencement of the discharge of treated wastewater to the Waiuku Channel as authorised by this resource consent, the consent holder shall undertake the monitoring in accordance with the REMP as described in Condition 27 and shall provide a report to the Auckland 14 CST60082302-A & CST600823600-A Consolidated Conditions Council on an annual basis for the first three years of implementing the REMP (prior to the preparation of the Receiving Environment Monitoring Report as per Condition 29). The report shall provide all the raw data collected and a summary interpretation of the results of the REMP.	1	Baseline REMP monitoring completed.
29	On completion of two years of receiving environment monitoring following commencement of the treated wastewater discharge, and every five years thereafter, the consent holder shall engage an independent suitably qualified person to prepare a Receiving Environment Monitoring Report. The Receiving Environment Monitoring Report shall as a minimum: (a) Summarise the results of the REMP against relevant standards and/or guidelines; (b) Critically assess any significant trends in the results of the receiving environment monitoring; (c) Assess any significant adverse effects of the treated wastewater discharge on receiving water quality, shellfish quality and marine ecology, irrespective of whether the discharge complies with the conditions of this consent; and (d) Recommend that the frequency of sampling and/or number of sites specified in Condition 27 be maintained, increased or reduced as appropriate.	1	REMP report required in 2028.
30	The consent holder shall provide the Receiving Environment Monitoring Report to the Council's Team Leader – Southern Monitoring for certification that the report meets the requirements of Condition 29, and that any recommendations under Condition 29(d) accord with the purpose of the REMP as stated in Condition 27(b). If they do accord with that purpose, certification of the report constitutes acceptance of the recommendations, and the REMP shall be amended accordingly. The Receiving Environment Monitoring Report shall also be provided to the Community Liaison Group as per Condition 7.	1	
31	Within six months of the commencement of the discharge of treated wastewater, the consent holder shall prepare an Operations and Management Plan (OMP). The objective of the OMP is to provide a framework for the operation and management of the WWTP and discharge facilities to ensure compliance with the conditions of consent. The OMP shall be submitted to the Council's Team Leader – Southern Monitoring for certification that it is consistent with the requirements of this condition and Condition 32. The OMP	1	Not yet required

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
	shall be reviewed and updated every three years by the consent holder and as required as a result of any significant changes in WWTP and discharge facilities' operation or management that could affect the quality and quantity of the discharge to the coastal marine area. An electronic copy of the OMP shall be provided to the Council's Team Leader – Southern Monitoring within 10 working days of a request to do so.		
32	As a minimum, the OMP shall include: (a) An overview description of the WWTP and discharge facilities; (b) A description and schedule of the routine inspection, monitoring and maintenance procedures to be undertaken to ensure operation of the WWTP and discharge facilities, complies with this consent; (c) A description of the sampling location/s and methodology for sampling the treated wastewater discharge; (d) A schedule of the critical aspects of the WWTP and the detailed response and contingency plans to remedy any possible variations from normal plant operation that could potentially affect discharge quality; (e) Details of contingency plans and procedures to address a critical power or equipment failure at the WWTP; (f) Procedures for recording routine maintenance and all major repairs that are undertaken; and (g) The consent holders chain of command, responsibility and notification protocols.	1	
33	Any improvement or review of the OMP shall be consistent with the objective of the OMP and submitted to the Council's Team Leader – Southern Monitoring for certification.	1	
34	The consent holder shall engage an independent suitably qualified person to undertake an Emerging Contaminants Risk Assessment (ECRA) by 30 September 2022 and five yearly intervals thereafter. The ECRA as a minimum include: (a) A review of the state of knowledge of emerging contaminants relevant to the WWTP since the commencement of these consents or the previous ECRA; (b) Consideration of whether additional samples are required for the purposes of the ECRA; (c) Measurement of emerging contaminants if determined necessary and the results of any samples collected; (d) An assessment of the risks to the environment from emerging contaminants in the treated wastewater discharged from the WWTP; (e) The ECRA shall be forwarded to the Council (Team Leader – Southern Monitoring) by 30 September of each year that it is required for certification that it meets the requirements of (a) to (d) above.	1	
35	The outfall and diffuser structure shall be located in the Waiuku Channel at or about coordinates 5887800N and 1750600E (NZTM).	1	
36	The diffuser structure shall be a 40 port diffuser outfall pipeline, or an alternative outfall structure providing, as a minimum, an equivalent dilution factor as presented in the AEE, to the satisfaction of the Council's Team Leader – Southern Monitoring.	1	
37	No later than 30 working days prior to the commencement of construction the consent holder shall prepare an Offshore Outfall Construction Management Plan (OOCMP) for the construction of the offshore outfall pipeline and diffuser structure within the coastal marine area and submit the OOCMP to the Council's Team Leader – Southern Monitoring for certification it has been produced in accordance with the	1	

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
	requirements of this condition. No later than 30 working days prior to providing the OOCMP to the Council, the OOCMP shall be provided to the Community Liaison Group for review and comment, as per Condition 7. The objective of the OOCMP is to confirm the detailed construction methodology for the outfall/diffuser and the measures proposed to mitigate potential adverse effects during construction. The OOCMP shall include: (a) Pipeline(s) profile and diffuser structure and design concept; (b) Type of construction method being adopted and material types; (c) Method of backfilling and the nature of trench backfill material, including that the material is free from contaminants and sized to prevent scour and remobilisation; (d) Threshold levels for total suspended solids in the water column, monitoring and response procedures, and methods to remedy disturbance resulting from the construction works; (e) Hydrostatic and any other testing of the pipeline(s); (f) The proposed timeframe for construction (including contingency); (g) Contingency plans in case of discharges to the coastal marine area; (h) Site management; including details of: i. Site access; ii. Signage during the construction works; iii. Methods to be used to minimise the need for cleaning, refuelling, maintenance and storage of equipment and machinery in the coastal marine area; iv. Procedures for cleaning, refuelling, maintenance or storage of equipment or machinery in any part of the coastal marine area if this is required, and measures to avoid discharges of contaminants during cleaning, refuelling, and maintenance activities in the coastal marine area; and v. Site clean-up following completion of the construction works. (i) Identification of all construction access points to the coastal marine area and along the foreshore; (j) Health and safety and access matters relating to general public accessing and using the coastal marine area and along the foreshore; (k) Minimisation as far as is reasonably practical the footprint of the disturbed area; (l) A vegetation restoration and maintenance programme including an inter-tidal shoreline restoration plan (only required if the inter-tidal rock platform is cut and disturbed); (m) Measures proposed to minimise disruption to water related recreational activities (including boating) in the vicinity of the construction activities; and (n) Measures to minimise underwater noise effects during construction. The consent holder shall ensure that the outfall construction is undertaken generally in accordance with the OOCMP.		
38	The consent holder shall notify the Council's Team Leader – Southern Monitoring in writing of the date of the proposed commencement of works at least 10 working days prior to the proposed start date.	1	
39	The Harbourmaster's Office (Auckland Transport Harbourmasters Office, HarbourMaster@aucklandtransport.govt.nz or Private Bag 92250, Auckland 1142) shall be notified by the consent holder in writing at least 10 working days prior to construction activity commencing in the coastal marine area.	1	

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
40	A Drilling Fluid Management Plan shall be prepared by an appropriately qualified person and submitted to the Council's Team Leader – Southern Monitoring for certification that it meets the purpose stated in this condition no later than 30 working days prior to commencement of construction activities in the coastal marine area. The purpose of the Drilling Fluid Management Plan is to demonstrate how drilling fluid will be used, stored and disposed of in a manner designed to prevent unlawful discharges into the environment.	1	
41	During installation of the off-shore outfall pipeline and diffuser, the consent holder shall provide monthly reports to the Council's Team Leader – Southern Monitoring regarding details of the monitoring undertaken to demonstrate the activities are in accordance with the OOCMP.	1	
42	In the event of the detection of any system failure of the offshore outfall and diffuser structure while under construction or in operation, the Council's Team Leader – Southern Monitoring shall be notified within 24 hours of such a system failure and provided with details of: (a) The nature of any failure including effects; and (b) Any remedial works to be carried out.	1	
43	All practicable measures shall be undertaken to ensure that the construction of the offshore outfall and diffuser does not exacerbate erosion within the coastal marine area.	1	
44	In the event of erosion occurring as a direct result of the construction or operation of the offshore outfall and diffuser, the consent holder shall, in consultation with the Council's Team Leader – Southern Monitoring, undertake all practicable measures to remedy any damages caused and minimise the potential for future erosion.	1	
45	The consent holder shall, within one month following the completion of works, remove all temporary structures from the coastal marine area and shall ensure that all disturbed areas are returned to a state generally consistent with the surrounding seabed and foreshore, to the satisfaction of the Council's Team Leader - Southern Monitoring.	1	
46	The Council's Team Leader – Southern Monitoring shall be notified in writing of the date of completion of the works, within one week of the completion date.	1	
47	Within one month of the completion of the proposed works, a complete set of "as built" plans shall be supplied to the Council's Team Leader - Southern Monitoring.	1	
48	The consent holder shall remove the existing redundant outfall at the Waiuku WWTP and associated structures located within the coastal marine area within 12 months of the operation of the WWTP.	1	
49	The use of the offshore outfall pipeline and the diffuser structure, which may include any temporary structures associated with the installation, repair and maintenance of the offshore outfall pipeline and diffuser structure, shall be limited to the conveyance and discharge of treated wastewater.	1	

Condition Number	*Consent Condition Clarks Beach Discharge to and occupation of Coastal Marine Area (CST600826300-A & CST60082302-A)*	Compliance Rating	Comments
50	The right to occupy part of the common marine and coastal area shall be limited to the area constructed under this permit and temporary staging works identified in the documents listed in Condition 1.	1	
51	The right to occupy part of the common marine and coastal area with constructed structures under this permit shall not be an exclusive right.	1	
52	The consent holder shall provide to the Council's Team Leader – Southern Monitoring and the Community Liaison Group, as per Condition 7, every five years from the commencement of the treated wastewater discharge a report prepared by a suitably qualified and experienced person(s) to demonstrate that the offshore outfall and diffuser structure is: (a) In sound repair and the diffuser ports are clear of any significant marine growths and that there are no significant losses occurring from the system; and (b) The offshore outfall pipeline is not exposed above the seabed floor other than the diffuser structure. In the event that the consent holder is aware that the offshore outfall pipeline is identified as having become exposed (other than the diffuser section that is designed to be exposed), either as a result of an inspection carried out or at any other time, the Council's Team Leader – Southern Monitoring and The Harbourmaster's Office (Auckland Transport Harbourmasters Office, Private Bag 92250, Auckland, 1142 or HarbourMaster@aucklandtransport.govt.nz) shall be notified immediately and provided with a report providing an assessment of effects and any proposed remediation or risk management to be undertaken within 10 working days.	1	Due 2031.
53	Within twenty (20) working days of the completion of the construction works, the consent holder shall supply a copy of the 'as built' plans to the Council's Team Leader – Southern Monitoring and the New Zealand Hydrographic Authority (Land Information New Zealand, Private Box 5501, Wellington 6011 or customersupport@linz.govt.nz). The 'as built' plans shall include a location plan, a plan which shows the area of occupation, outfall dimensions, and cross sections.	1	
54	The structures permitted to occupy part of the common marine and coastal area by this consent shall be maintained in a good and sound condition, and any repairs that are necessary shall be made, subject to obtaining any necessary resource consents	1	

Appendix B. Effluent Volume and Quality Data

Date	Discharge Volume (m^3)	Rainfall (mm)	Date (continued)	Discharge Volume (m^3)	Rainfall (mm)
1/07/2025	962	0	1/01/2026	526	3
2/07/2025	976	0	2/01/2026	532	20
3/07/2025	988	34.5	3/01/2026	532	22
4/07/2025	988	2.5	4/01/2026	562	0
5/07/2025	980	14.5	5/01/2026	681	0
6/07/2025	1,024	0	6/01/2026	681	0
7/07/2025	1,028	0	7/01/2026	611	0
8/07/2025	1,028	0	8/01/2026	550	0
9/07/2025	1,008	1.5	9/01/2026	550	0
10/07/2025	1,008	7	10/01/2026	548	0
11/07/2025	973	40.5	11/01/2026	548	0
12/07/2025	916	3.5	12/01/2026	413	0
13/07/2025	1,013	3.5	13/01/2026	358	0
14/07/2025	1,048	3	14/01/2026	335	1.5
15/07/2025	1,048	8.5	15/01/2026	328	16.1
16/07/2025	987	0.5	16/01/2026	431	6.8
17/07/2025	969	20.5	17/01/2026	583	0
18/07/2025	1,030	2.5	18/01/2026	583	2.5
19/07/2025	1,030	0	19/01/2026	571	4
20/07/2025	1,022	0.5	20/01/2026	382	17
21/07/2025	1,022	0	21/01/2026	577	46.5
22/07/2025	1,017	0	22/01/2026	767	2
23/07/2025	974	0	23/01/2026	982	3.5
24/07/2025	955	0	24/01/2026	996	7.5
25/07/2025	955	0	25/01/2026	996	3
26/07/2025	804	0	26/01/2026	992	4.5
27/07/2025	708	0	27/01/2026	999	4.5
28/07/2025	567	0	28/01/2026	999	0
29/07/2025	567	66	29/01/2026	961	0
30/07/2025	680	2	30/01/2026	888	0
31/07/2025	1,002	4	31/01/2026	684	0
1/08/2025	1,344	0.51	1/02/2026	573	0
2/08/2025	1,344	0	2/02/2026	564	9
3/08/2025	1,338	0	3/02/2026	559	1
4/08/2025	1,338	0	4/02/2026	507	3

Date	Discharge Volume (m^3)	Rainfall (mm)	Date (continued)	Discharge Volume (m^3)	Rainfall (mm)
5/08/2025	1,012	0	5/02/2026	463	0
6/08/2025	657	0	6/02/2026	354	0
7/08/2025	648	0	7/02/2026	299	0
8/08/2025	568	14.7	8/02/2026	327	0
9/08/2025	613	2.54	9/02/2026	329	0
10/08/2025	660	0	10/02/2026	329	0
11/08/2025	660	2.5	11/02/2026	337	0
12/08/2025	607	0	12/02/2026	341	0
13/08/2025	573	0	13/02/2026	416	10.5
14/08/2025	554	0	14/02/2026	611	1.5
15/08/2025	538	0	15/02/2026	777	1
16/08/2025	494	12	16/02/2026	777	0.5
17/08/2025	446	5.5	17/02/2026	692	1
18/08/2025	553	7.5	18/02/2026	657	0.7
19/08/2025	555	14.5	19/02/2026	657	0.3
20/08/2025	653	0	20/02/2026	684	0
21/08/2025	752	0	21/02/2026	821	0
22/08/2025	752	0	22/02/2026	920	0
23/08/2025	683	0	23/02/2026	920	0
24/08/2025	564	0	24/02/2026	551	0
25/08/2025	564	0	25/02/2026	548	0
26/08/2025	564	0	26/02/2026	548	0
27/08/2025	534	0	27/02/2026	754	0
28/08/2025	496	1.5	28/02/2026	754	0
29/08/2025	439	18.5	1/03/2026	652	2
30/08/2025	551	0.5	2/03/2026	616	1
31/08/2025	574	17.5	3/03/2026	668	0
1/09/2025	595	1	4/03/2026	668	0
2/09/2025	737	0.5	5/03/2026	545	0
3/09/2025	775	0	6/03/2026	544	0
4/09/2025	775	0	7/03/2026	544	0
5/09/2025	763	0	8/03/2026	544	0
6/09/2025	600	29	9/03/2026	539	2.5
7/09/2025	599	2	10/03/2026	538	0
8/09/2025	599	0	11/03/2026	545	0

Date	Discharge Volume (m^3)	Rainfall (mm)	Date (continued)	Discharge Volume (m^3)	Rainfall (mm)
9/09/2025	533	0	12/03/2026	547	0
10/09/2025	522	15.5	13/03/2026	551	4.5
11/09/2025	602	8.7	14/03/2026	701	2
12/09/2025	793	20.3	15/03/2026	701	0
13/09/2025	850	7	16/03/2026	675	0.5
14/09/2025	850	1	17/03/2026	594	0
15/09/2025	787	2.5	18/03/2026	664	0.5
16/09/2025	858	0	19/03/2026	664	0
17/09/2025	858	0	20/03/2026	550	0
18/09/2025	885	15	21/03/2026	546	0
19/09/2025	885	1	22/03/2026	546	0
20/09/2025	878	0.5	23/03/2026	592	0
21/09/2025	878	0	24/03/2026	657	0
22/09/2025	873	2	25/03/2026	657	1
23/09/2025	798	19	26/03/2026	537	87.9
24/09/2025	748	20	27/03/2026	1,243	2.6
25/09/2025	787	3.5	28/03/2026	1,796	0
26/09/2025	903	3.5	29/03/2026	1,796	7.1
27/09/2025	903	0	30/03/2026	1,704	4.9
28/09/2025	910	0	31/03/2026	1,671	0
29/09/2025	910	5.5	1/04/2026	1,422	0
30/09/2025	910	0.5	2/04/2026	1,198	2
1/10/2025	884	0	3/04/2026	956	0
2/10/2025	740	2.4	4/04/2026	746	0
3/10/2025	707	15.9	5/04/2026	619	0
4/10/2025	598	15.9	6/04/2026	610	0
5/10/2025	637	6.3	7/04/2026	610	0
6/10/2025	637	3.8	8/04/2026	661	5
7/10/2025	647	17.8	9/04/2026	800	15.5
8/10/2025	667	0	10/04/2026	800	0
9/10/2025	667	0	11/04/2026	788	0
10/10/2025	652	0.48	12/04/2026	773	2
11/10/2025	641	0	13/04/2026	845	47
12/10/2025	641	0	14/04/2026	1,388	8
13/10/2025	614	0	15/04/2026	1,467	13.2

Date	Discharge Volume (m^3)	Rainfall (mm)	Date (continued)	Discharge Volume (m^3)	Rainfall (mm)
14/10/2025	609	25.2	16/04/2026	1,467	5.3
15/10/2025	695	0	17/04/2026	1,181	1.5
16/10/2025	695	0	18/04/2026	1,056	1
17/10/2025	685	0	19/04/2026	1,459	15.5
18/10/2025	685	0	20/04/2026	1,459	12.5
19/10/2025	722	0.52	21/04/2026	1,370	2
20/10/2025	722	0	22/04/2026	1,294	0
21/10/2025	594	0	23/04/2026	1,294	0
22/10/2025	529	8.2	24/04/2026	1,182	4
23/10/2025	475	14.4	25/04/2026	1,360	12
24/10/2025	475	1.03	26/04/2026	1,363	0
25/10/2025	518	0	27/04/2026	1,363	0
26/10/2025	546	0	28/04/2026	1,175	0
27/10/2025	546	7.2	29/04/2026	1,034	0.5
28/10/2025	465	28.3	30/04/2026	1,027	0
29/10/2025	695	0.51	1/05/2026	1,027	0
30/10/2025	695	0.52	2/05/2026	1,180	0
31/10/2025	618	0	3/05/2026	1,199	0
1/11/2025	592	3.6	4/05/2026	1,199	0
2/11/2025	578	0	5/05/2026	873	0
3/11/2025	564	0	6/05/2026	1,112	0
4/11/2025	555	0	7/05/2026	1,112	1.5
5/11/2025	553	0	8/05/2026	1,081	9.5
6/11/2025	454	0	9/05/2026	1,079	5
7/11/2025	414	0	10/05/2026	1,079	2.5
8/11/2025	545	0	11/05/2026	1,005	1
9/11/2025	545	0.52	12/05/2026	1,005	2.5
10/11/2025	506	6.2	13/05/2026	827	0
11/11/2025	413	0.51	14/05/2026	621	0
12/11/2025	343	17.0	15/05/2026	637	0
13/11/2025	382	12.9	16/05/2026	647	0
14/11/2025	533	3.6	17/05/2026	647	0
15/11/2025	534	4.1	18/05/2026	666	0
16/11/2025	548	0	19/05/2026	666	0
17/11/2025	548	0	20/05/2026	667	0

Date	Discharge Volume (m^3)	Rainfall (mm)	Date (continued)	Discharge Volume (m^3)	Rainfall (mm)
18/11/2025	540	45.9	21/05/2026	667	0
19/11/2025	529	6.18	22/05/2026	650	0
20/11/2025	742	0	23/05/2026	656	0
21/11/2025	790	0	24/05/2026	663	0
22/11/2025	790	0	25/05/2026	668	0
23/11/2025	786	0	26/05/2026	668	0
24/11/2025	763	0	27/05/2026	675	0.5
25/11/2025	562	0	28/05/2026	687	0
26/11/2025	559	0	29/05/2026	723	0.5
27/11/2025	559	1.54	30/05/2026	723	0
28/11/2025	550	1.55	31/05/2026	721	0.5
29/11/2025	378	0	1/06/2026	673	12
30/11/2025	431	13.4	2/06/2026	665	20
1/12/2025	474	0	3/06/2026	1,047	7
2/12/2025	560	9.0	4/06/2026	1,049	1
3/12/2025	560	9	5/06/2026	1,049	7
4/12/2025	565	1	6/06/2026	615	11
5/12/2025	565	0	7/06/2026	1,522	0.5
6/12/2025	466	0	8/06/2026	1,522	0.5
7/12/2025	561	0	9/06/2026	1,122	0
8/12/2025	561	0	10/06/2026	1,079	0
9/12/2025	374	0	11/06/2026	940	0
10/12/2025	358	0	12/06/2026	613	0.5
11/12/2025	356	0	13/06/2026	529	0
12/12/2025	355	0	14/06/2026	605	1.5
13/12/2025	353	0	15/06/2026	722	1
14/12/2025	353	0	16/06/2026	927	7.5
15/12/2025	344	0	17/06/2026	927	1.5
16/12/2025	342	10	18/06/2026	777	1.5
17/12/2025	338	1.5	19/06/2026	667	0
18/12/2025	343	0	20/06/2026	655	0
19/12/2025	345	3	21/06/2026	635	2.5
20/12/2025	345	0	22/06/2026	734	0.5
21/12/2025	339	0	23/06/2026	734	1
22/12/2025	339	3	24/06/2026	774	33

Date	Discharge Volume (m^3)	Rainfall (mm)	Date (continued)	Discharge Volume (m^3)	Rainfall (mm)
23/12/2025	338	1.5	25/06/2026	774	2.5
24/12/2025	338	1.5	26/06/2026	657	5
25/12/2025	463	0	27/06/2026	2,011	0.5
26/12/2025	526	8.5	28/06/2026	2,173	0
27/12/2025	526	11.5	29/06/2026	2,173	0
28/12/2025	417	0	30/06/2026	1,893	0
29/12/2025	515	3			
30/12/2025	515	1.5			
31/12/2025	373	23			

Date	cBOD5 (mg/L)	TSS (mg/L)	NHx-N (mg/L)	TIN (mg/L)	TN (mg/L)	TP (mg/L)	F. coliforms (cfu/100mL)	DO (mg/L)	pH (SU)	Temp (°C)
1/07/2025								9.8	7	11.6
7/07/2025	0.58							8.7	6.8	13.5
14/07/2025								10.3	7.3	14.7
21/07/2025								10	6.9	12.5
23/07/2025	0.62	1	0.1	9	11	2.46	1.6			
28/07/2025								9.5	7	14.7
1/08/2025	43	129	1.7			5.59	69,000			
4/08/2025								7.8	7.2	14.7
11/08/2025								6.9	6.9	15.3
13/08/2025	2.8	1	0.72	11	13	2.93	1.6			
18/08/2025								9.8	7.3	16.1
25/08/2025								9.24	7.1	16.2
27/08/2025	1.4	1.8	0.65	11	12	2.89	1.6			
1/09/2025								5.8	7.2	17.1
8/09/2025								6.3	6.9	16.9
10/09/2025	0.69	1.4	0.7	6.3	7.6	1.03	1.6			
15/09/2025								8.9	7.3	17.2
22/09/2025								9.17	6.7	16.7
24/09/2025	1	1	3.8	9.1	10	3.08	1.7			
29/09/2025								8.5	7.02	17.3
6/10/2025								7.9	7.1	16.9
8/10/2025	0.82	3.6	5.6	11	13	3.41	5			
13/10/2025								6.31	7.3	20.3
20/10/2025								5.88	6.9	21.1
22/10/2025	0.98	1	3.8	9.7	10	4.07	1.7			
27/10/2025								6.66	7.2	22.3
3/11/2025								4.9	6.9	24
10/11/2025								4.8	7.1	24
10/11/2025								4.3	6.9	20.3
10/11/2025								5.9	7	25
12/11/2025	0.59	1	1.7	12	14	4.6	1.6			
17/11/2025								5.7	6.8	25.1
17/11/2025								4.11	7.02	21.7
24/11/2025								5.9	6.7	24.1
26/11/2025	0.92	2	1.5	18	21	4.12	1.6			

Date	cBOD5 (mg/L)	TSS (mg/L)	NHx-N (mg/L)	TIN (mg/L)	TN (mg/L)	TP (mg/L)	F. coliforms (cfu/100mL)	DO (mg/L)	pH (SU)	Temp (°C)
1/12/2025								4.3	6.8	24.9
8/12/2025								5.1	7.01	23.9
10/12/2025	0.5	4.8	0.16	16	17	2.32	1.6			
15/12/2025								4.9	6.66	25.1
22/12/2025								5.02	7.02	24.1
24/12/2025	0.54	1	6.8	18	18	3.28	1.7			
29/12/2025								5.11	6.88	23.1
5/01/2026								6.65	7.3	20.7
12/01/2026								5.8	7.2	22.1
14/01/2026	1.3	1	24	25	26	1.2	1.6			
19/01/2026								6.02	6.9	21.8
21/01/2026	0.99	1	0.12	3.9	7.6	4.79	1.6			
26/01/2026								6.6	6.7	20.9
28/01/2026	1.6	1.6	0.044	1.6	2.1	4.45	1.7			
2/02/2026								7.1	7.01	21.7
9/02/2026								6.6	7.2	21.3
11/02/2026	0.75	1.2	6.9	16	24	5.91	1.7			
16/02/2026								6.9	7.5	22.7
23/02/2026								7	7.6	23.2
25/02/2026	0.64	2	0.46	8.2	10	4.79	1.6			
2/03/2026								6.9	7.4	23.3
9/03/2026								6.5	6.9	22.1
11/03/2026	0.67	1.2	0.038	7.1	8.4	5.4	1.7			
16/03/2026								6.3	7.1	20.7
23/03/2026								7	7.3	21.8
25/03/2026	0.63	2.8	0.05	8.7	10	6.1	1.7			
30/03/2026								7.1	6.9	21.3
7/04/2026								5.85	6.66	21.2
08/04/2026	0.5	1	2.5	8.6	9.8	5.7	3.3			
13/04/2026								6.01	6.85	22.1
20/04/2026								5.32	7.01	21.5
22/04/2026	1.5	2.8	3.7	4.9	6.2	4.2	1.7			
28/04/2026								5.14	7.1	21.3
4/05/2026								5.63	7.32	20.7
11/05/2026								4.08	5.8	21.3

Date	cBOD5 (mg/L)	TSS (mg/L)	NHx-N (mg/L)	TIN (mg/L)	TN (mg/L)	TP (mg/L)	F. coliforms (cfu/100mL)	DO (mg/L)	pH (SU)	Temp (°C)
13/05/2026	0.5	1	4.1	19	21	5.2	1.7			
18/05/2026								5.02	6.6	20.9
25/05/2026								5.01	6.4	21.2
27/05/2026	1.1	1	0.29	15	18	5.2	1.6			
1/06/2026								9.8	6.9	13.5
8/06/2026								9.7	6.8	12.8
10/06/2026	0.5	5.6	14	16	20	6.9	16			
12/06/2026	1	2	18	20	23	7.4	1.6			
15/06/2026								9.6	7.2	13.2
22/06/2026								10.1	7.3	12.7
26/06/2026	1	1	18	20	23	7.5	1.6			
29/06/2026								10.05	7.4	13.4

New WWTP upgrade and marine outfall sample results

Date	cBOD5 (mg/L)	TSS (mg/L)	NHx-N (mg/L)	TN (mg/L)	pH
14/07/2026	2.6	1.4	0.063	23	7.5
15/07/2026	1	1.4	0.054	26	7.6
17/07/2026	1.1	2.4	0.054	24	7
18/07/2026	2.8	2.6	0.032	24	7
19/07/2026	0.78	<1.0	0.46	24	7.4
20/07/2026	0.73	2.4	0.45	16	7.7
21/07/2026	1.4	3.2	0.048	15	7.7
22/07/2026	0.8	<1.0	0.033	13	7.6
23/07/2026	1	1.2	0.036	16	7.4
24/07/2026	1.2	2.6	0.43	18	7.4
25/07/2026	-	1.6	0.044	22	7.6
26/07/2026	1.2	1.6	0.17	28	7.6
27/07/2026	0.58	3.4	0.47	27	7.6
28/07/2026	0.82	<1.0	0.077	27	7.6
29/07/2026	0.79	2.6	0.031	32	7.6
30/07/2026	1.6	2.4	0.041	31	7.1

Appendix C. Data Sources

Table 6-1: Download location of environmental monitoring data used in this report

Category	Parameter	Source platform	Tag/ID or Form
Effluent volume	Daily effluent discharge (outfall)	Pi	DTCBO_52_FT_1001_FM_VOL_DAY
Effluent volume	Daily effluent discharge (new outfall)	SCADA	DTCBO_55_FIT_X02.Volume24h
Environmental – External	Rainfall (1/7/2020 – 30/1/2024)	Auckland Council Environmental Data Portal	Location – *Waitangi @ Diver Road*
Environmental – External	Rainfall (31/1/2024 – 30/6/2026)	Auckland Council Environmental Data Portal	Location – *Clarks Beach at Golf Course*
Effluent quality	$cBOD_5$	Pi	DTCBO_48_13_S4UVE_CBOD5
Effluent quality	TSS	Pi	DTCBO_48_13_S4UVE_TSS
Effluent quality	NH_4-N (Ammoniacal N)	Pi	DTCBO_48_13_S4UVE_NH4N
Effluent quality	TIN (NOx + NH_4-N)	Pi	DTCBO_48_13_S4UVE_TIN
Effluent quality	TN	Pi	DTCBO_48_13_S4UVE_TN
Effluent quality	TP	Pi	DTCBO_48_13_S4UVE_TP
Effluent quality	Faecal coliforms	Pi	DTCBO_48_13_S4UVE_FC
Effluent quality	DO (Dissolved oxygen)	Infrastructure Data – Field Data Form	DTCBO Field data
Effluent quality	pH	Infrastructure Data – Field Data Form	DTCBO Field data
Effluent quality	Temperature	Infrastructure Data – Field Data Form	DTCBO Field data
Effluent quality	New plant upgrades all parameters	Project Manager, Operations Controller	

Appendix D. Incident Report

INCIDENT REPORT
Emergency Bypass Discharge at Clarks Beach WWTP
Heavy Rain Events - June and July 2025

EXECUTIVE SUMMARY

Clarks Beach Wastewater Treatment Plant (WWTP) experienced two emergency bypass discharges during winter 2025 when heavy rainfall caused pond levels to exceed safe operating thresholds.

- **Event 1 (12–13 June 2025):** ~1,500 m³ over 6 h 45 min
- **Event 2 (30–31 July 2025):** ~5,200 m³ over 10 h
- **Combined volume:** ~6,700 m³ of partially treated wastewater discharged to the Manukau Harbour (screened and aerated, without filtration or UV).

Both events exceeded several discharge quality parameters. Event 1 exceeded limits for TSS, TN, and faecal coliforms; Event 2 exceeded faecal coliform and BOD limits. Ammonia and pH remained compliant during both events.

Environmental monitoring at Clarks Beach and Waiau Beach showed that enterococci levels remained below the recreational guideline (<200 cfu/100 mL) throughout both events and returned to background within 1–3 days. Faecal coliforms were elevated on Day 1 but are not the primary indicator for recreational water safety. Physico-chemical parameters demonstrated strong resilience: nutrients (TN and TP) were diluted more than 100-fold relative to source concentrations, BOD was detectable only on Days 1–2 before dropping below detection, and dissolved oxygen and pH remained within normal marine ranges. Suspended solids were the only parameter to remain elevated for several days, representing the most persistent short-term effect. Overall, the results confirm rapid recovery and strong buffering capacity in the harbour, while highlighting suspended solids as the key short-lived impact of the bypasses.

The Manukau Harbour demonstrated resilience, with microbial and nutrient indicators recovering quickly and no evidence of oxygen stress. However, the short interval between bypasses indicates recurring capacity limitations at the plant, increasing the risk of cumulative impacts on ecological health and cultural values.

Emergency procedures, public health warnings, and monitoring were implemented effectively. The long-term resolution is the planned WWTP upgrade (expected July 2026), which will increase capacity from 1,600 m³/day to 5,200 m³/day and is expected to significantly reduce the likelihood of bypass events under storm conditions.

TABLE OF CONTENTS

1. BACKGROUND AND CONSENT CONTEXT 3
2. EVENT DESCRIPTIONS 4
2.1 Event 1 – 12–13 June 2025 4
2.2 Event 2 – 30–31 July 2025 4
3. CONSENT COMPLIANCE ASSESSMENT 5
4. ENVIRONMENTAL MONITORING 6
4.1 Monitoring Network Design 6
4.2 Microbiological Recovery 6
5.3 Physico-Chemical Parameters 7
4.4 Environmental Impact Interpretation 8
5. CUMULATIVE ENVIRONMENTAL IMPACT 9
5.1 Combined Discharge Metrics 9
5.2 Ecosystem Stress Assessment 9
5.3 Cultural and Community Considerations 9
5.4 Overall Assessment 9
6. ROOT CAUSE ANALYSIS 10
7. CORRECTIVE AND PREVENTIVE ACTIONS 11
7.1 Immediate Actions (Completed) 11
7.2 Short-term Measures (Next 12 months) 11
7.3 Long-term Solution 11
8. CONCLUSION 12

1. BACKGROUND AND CONSENT CONTEXT

- **Consents:** R/REG/2015/4227 (coastal), R/REG/2015/4228 (land/water), R/REG/2017/844 (air)
- **Design capacity:** 1,600 m^3/day
- **Average dry weather flow:** ~450 m^3/day
- **Consent maximum:** 2,500 m^3/day (plus incidental rainfall)

Recent storm events have regularly exceeded design and consented capacity, e.g. January 2023 (~2,000 m^3/day), June 2025, and July 2025.

2. EVENT DESCRIPTIONS

2.1 Event 1 – 12–13 June 2025

- Duration: 18:30 (12 June) to 01:15 (13 June), 6 h 45 min
- Volume: ~1,500 m³
- Cause: 56.6 mm rainfall over 48 h raised pond to 60 mm below crest
- Treatment bypassed: Filtration and UV disinfection
- Consent compliance: TSS, TN, and faecal coliform limits exceeded (see Section 5 and Appendix A)

2.2 Event 2 – 30–31 July 2025

- **Duration:** 22:00 (30 July) to 08:00 (31 July), 10 h
- **Volume:** ~5,200 m³ (3.5 × larger than Event 1)
- **Cause:** Heavy rainfall; discharge coincided with high tide, aiding dilution
- **Treatment bypassed:** Filtration and UV disinfection
- **Consent compliance:** Source water data not available, but exceedances were probable given volume, duration, and bypass type

3. CONSENT COMPLIANCE ASSESSMENT

Table 3- 1. Summary of discharge quality against consent limits

Parameter	Consent Limit (Condition 18)	Event 1 (13 June 2025)	Event 2 (31 July 2025)	Compliance Note
TSS	30 mg/L	184 mg/L	n/a (not sampled)	Exceeded limit (Event 1); Event 2 unknown
Total Nitrogen (TN)	20 mg/L	21 mg/L	19 mg/L	Event 1 above limit; Event 2 within limit
Ammonia (NH_4-N)	10 mg/L	0.15 mg/L	0.27 mg/L	Both well within limit
cBOD$_5$	20 mg/L (median)*	35 mg/L	40 mg/L	Both above median threshold*
Faecal coliforms	14 cfu/100 mL	140,000 cfu/100 mL	270,000 cfu/100 mL	Both far above limit
pH	6–9	7.8–8.1	6.7	Both within limit
Total Phosphorus	Not specified in consent	5.68 mg/L	5.54 mg/L	Not regulated

*BOD consent compliance is based on median and 92nd percentile across 12 monthly samples. Here values are reported as exceedances of the single-sample median threshold for incident context.

4. ENVIRONMENTAL MONITORING

4.1 Monitoring Network Design

Monitoring was undertaken at two recreational sites (Figure 6-1):

1. **Clarks Beach boat ramp** (near-field)
2. **Waiau Beach boat ramp** (far-field)

Parameters monitored included pH, conductivity, dissolved oxygen (DO), $cBOD_5$, NH_4-N, Total Nitrogen (TN), Total Phosphorus (TP), Total Suspended Solids (TSS), faecal coliforms, and enterococci.



Figure 4-1. Environmental monitoring locations around Clarks Beach WWTP.

4.2 Microbiological Recovery

Enterococci levels were consistently below the recreational guideline of 200 cfu/100 mL and returned to background conditions within 1–3 days (Table 1). Event 2 showed faster recovery, with

Waiau Beach reaching <1.6 cfu/100 mL by Day 2. This difference is likely related to discharge timing at high tide, which enhanced dilution.

Faecal coliforms were analysed only on Day 1 at recreational sites (Table 6-1). Results were elevated (17 and 7 cfu/100 mL in Event 1; 46 and 46 cfu/100 mL in Event 2), exceeding the consent limit (14 cfu/100 mL). Monitoring was not continued beyond Day 1, as enterococci are the preferred microbiological indicator for recreational water safety.

Table 4-1 Microbiological results at monitoring sites

Event	Site	Day 1 Enterococci	Day 2 Enterococci	Day 3 Enterococci	Faecal Coliforms (Day 1)	Notes
1 (June 12–13)	Clarks Beach	40	26	3.3	17	All results below guideline
	Waiau Beach	39	28	6.5	7	All results below guideline
2 (July 30–31)	Clarks Beach	4.9	4.9	<1.6	46	Below guideline, background by Day 3
	Waiau Beach	13	<1.6	<1.6	46	Below guideline, background by Day 2

Note: Faecal coliforms were analysed only on Day 1 at recreational sites. Enterococci were monitored daily until levels confirmed safe, as they are the primary indicator for recreational water safety.

5.3 Physico-Chemical Parameters

Physico-chemical results are summarised in Table 6- 2.

- **TSS:** Elevated after both events (45–62 mg/L), gradually reducing but remaining above background for at least 3 days. This represents the most persistent environmental impact.
- **Nutrients:** TN and TP were strongly diluted compared to source levels. At recreational sites, TN ranged 0.049–0.45 mg/L and TP 0.021–0.044 mg/L, reflecting dilution factors >100× relative to pond outlet concentrations.
- **BOD:** Complete data show BOD was measurable only on Days 1–2, then dropped below detection (<0.5 mg/L). This demonstrates rapid breakdown of organic matter, confirming that the harbour ecosystem effectively processed the organic load within 2–3 days.
- **Ammonia:** Consistently low (<0.03 mg/L).
- **DO and pH:** Stable across both events (DO 8.1–9.7 mg/L, pH 7.6–8.1), indicating no oxygen depletion or acidification.

Table 4-2 Physico-chemical results at monitoring sites (Events 1 and 2, Days 1–3)

Event	Site	Day	TSS (mg/L)	BOD (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)	Ammonia (mg/L)	DO (mg/L)	pH
1 (June 12–13)	Clarks Beach	1	62.4	0.56	0.25	0.05	<0.005	8.3	8.0
		2	50.0	<0.5	0.40	0.035	0.022	8.8	7.8
		3	52.0	<0.5	0.45	0.037	0.022	8.2	8.1
	Waiau Beach	1	58.0	0.78	0.26	0.044	0.021	8.1	7.6
		2	45.2	<0.5	0.40	0.035	0.022	8.8	7.8
		3	47.0	<0.5	0.26	0.044	0.021	9.7	8.1
2 (July 30–31)	Clarks Beach	1	46.0	0.72	0.049	0.022	<0.005	8.4	8.0
		2	56.6	0.75	0.22	0.025	0.022	8.7	8.0
		3	48.0	<0.5	0.17	0.021	0.022	8.7	8.0
	Waiau Beach	1	52.2	<0.5	0.14	0.024	0.021	8.4	8.0
		2	60.2	0.57	0.17	0.024	0.023	8.3	8.0
		3	57.8	<0.5	0.17	0.024	0.023	8.6	8.0

4.4 Environmental Impact Interpretation

- **Rapid microbial recovery:** Enterococci remained within safe limits, confirming limited short-term public health risk.
- **Nutrient dilution:** Strong dilution factors (>100×) demonstrate the mixing capacity of the harbour.
- **Suspended solids persistence:** TSS was the only parameter showing multi-day elevation, highlighting it as the main short-lived residual effect.
- **Ecosystem resilience:** DO and pH stability, combined with rapid microbial and BOD recovery, indicate robust buffering capacity of the receiving environment.

Overall, the monitoring results demonstrate that while the bypasses introduced elevated microbial and physical contaminants immediately after discharge, the receiving environment recovered rapidly within days, without evidence of long-term ecological stress.

5. CUMULATIVE ENVIRONMENTAL IMPACT

5.1 Combined Discharge Metrics

- **Total discharge volume:** ~6,700 m³ of partially treated wastewater across two events.
- **Duration:** 16 h 45 min combined bypass operation.
- **Frequency:** Two bypasses within 49 days, highlighting a recurring pattern under storm conditions.

5.2 Ecosystem Stress Assessment

- **Microbiological recovery:** Enterococci levels at both sites (Table 1) remained below the recreational guideline (200 cfu/100 mL) throughout monitoring and returned to background levels within 1–3 days.
- **Physico-chemical stability:** DO and pH (Table 2) remained within normal marine ranges, confirming that the harbour ecosystem maintained oxygenation and buffering capacity during both events.
- **Persistent effects:** TSS remained elevated for several days (Table 2), representing the most consistent short-lived impact.
- **Nutrient dilution:** TN and TP at recreational sites (Table 2) were strongly diluted (>100×) relative to source concentrations, limiting cumulative nutrient stress.

5.3 Cultural and Community Considerations

- **Cultural values:** Repeated discharges into Manukau Harbour have implications for areas of customary importance.
- **Public health:** Safeswim alerts and shellfish gathering advisories were issued for both events, and no recreational exposure incidents were reported.

5.4 Overall Assessment

Environmental monitoring indicates that the receiving environment recovered quickly after each event, with microbial indicators returning to safe levels within 72 hours and stable DO and pH throughout. However, the recurrence of bypasses within a short interval increases the risk of cumulative effects, particularly from repeated inputs of suspended solids and the cultural significance of discharges to Manukau Harbour. The pattern reinforces the need to address WWTP capacity constraints to prevent repeated incidents.

6. ROOT CAUSE ANALYSIS

- **Primary cause:** Treatment plant capacity (1,600 m³/day) inadequate during storm inflows exceeding 2,000 m³/day.

- **Contributing factors:**
    - Increased frequency of intense rainfall events (climate change influence)
    - Limited operational options once ponds reach critical levels
    - Ageing infrastructure not designed for current conditions

The recurrence of bypasses within a short period indicates that capacity limitations will continue until the planned upgrade is completed.

7. CORRECTIVE AND PREVENTIVE ACTIONS

7.1 Immediate Actions (Completed)

- Controlled discharges undertaken to prevent overtopping
- Environmental monitoring completed
- Public health warnings and Safeswim alerts issued
- Notifications to Council and iwi (Event 1 only) completed

7.2 Short-term Measures (Next 12 months)

- Enhanced weather and pond level monitoring with automated alerts
- Revised emergency response protocols
- Staff training for extreme weather scenarios
- Monthly dam safety inspections during storm season

7.3 Long-term Solution

- **New treatment plant upgrade (expected July 2026):**
    - Capacity increased to 5,200 m^3/day
    - Design incorporates storm resilience and climate change projections
    - Aims to eliminate routine bypass events

8. CONCLUSION

- Two emergency bypass discharges occurred in June and July 2025, releasing a combined volume of ~6,700 m³ of partially treated wastewater to the Manukau Harbour.
- Both incidents exceeded several consent parameters, particularly faecal coliforms (Table 1), and highlighted the treatment plant's limited capacity during storm events.
- Environmental monitoring (Tables 6-1 and 6- 2) provides key insight into the effects and recovery of the harbour following these discharges:
    - Enterococci levels remained below the recreational guideline (200 cfu/100 mL) and returned to background within 1–3 days.
    - BOD was measurable only on Day 1–2 and then dropped below detection, showing rapid breakdown of organic material.
    - Nutrients (TN, TP) were strongly diluted (>100×) at recreational sites compared with the source, limiting cumulative nutrient stress.
    - TSS was the most persistent parameter, remaining elevated for several days at both sites.
    - DO and pH remained stable throughout both events, indicating no acute ecological stress.
- The monitoring therefore shows that while the bypasses caused short-term localised increases in microbial and physical contaminants, the receiving environment demonstrated strong resilience and rapid recovery.
- However, the occurrence of two events within 49 days indicates a recurring capacity limitation that increases the risk of cumulative environmental and cultural impacts.

In summary, monitoring confirms that the harbour has a strong capacity to recover from individual bypasses, but repeated events present ongoing risks. The effectiveness of short-term emergency management protected public health, yet the underlying capacity constraint will only be addressed through the planned 2026 treatment plant upgrade.

Appendix E. Receiving environment monitoring programme reports

REPORT

Tonkin+Taylor

Southwest Receiving Environment Monitoring Programme

Year 2 pre discharge - Tokaroa Point Reef Monitoring

Prepared for
Watercare Services Ltd
Prepared by
Tonkin & Taylor Ltd
Date
May 2026
Job Number
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Document control

Title: Southwest Receiving Environment Monitoring Programme – Year 2 pre discharge - Tokaroa Point Reef Monitoring					
Date	**Version**	**Description**	**Prepared by:**	**Reviewed by:**	**Authorised by:**
May 2026	1	Client DRAFT Year 2 reef monitoring	M. Tupe	M. Cameron	R. Van de Munckhof
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Watercare Services Ltd	1 PDF copy
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Table of contents

1 Introduction 1
- 1.1 Background 1
- 1.2 Manukau Harbour Environment 1
- 1.3 Waiuku Estuary 2
- 1.4 Tokaroa Point 2
  - 1.4.1 Significant Ecological Areas (SEAs) 5
  - 1.4.2 Habitat mapping 6

2 Methods 8
- 2.1 Site establishment 8
- 2.2 Site monitoring 9
- 2.3 Statistical analysis 10

3 Results 11
- 3.1 Site descriptions 11
  - 3.1.1 High 11
  - 3.1.2 Middle 1 12
  - 3.1.3 Middle 2 13
  - 3.1.4 Low 15
- 3.2 Statistical analysis 16
  - 3.2.1 Sessile species percent cover and distribution 17
  - 3.2.2 Mobile species abundance and composition 19
  - 3.2.3 Mobile species size distribution 21
  - 3.2.4 Species community composition 23
  - 3.2.5 Sediment distribution 29

4 Discussion 33
- 4.1 Mobile and sessile species distribution and abundance 34
- 4.2 Community composition 34

5 Conclusions and recommendations 36
- 5.1 Recommendations for future monitoring 36

6 Applicability 38

7 References 39

Appendix A Summarised Auckland Council rocky reef monitoring protocols relevant to SW REMP sampling

Appendix B Raw data

Appendix C Quadrat photos

1 Introduction

1.1 Background

Watercare Services Limited (Watercare) holds Resource Consents (CST60082600 and CST60082302) for the Southwest Subregional Wastewater Treatment Plant that includes Condition 27, which mandates the development and implementation of a Southwest Receiving Environment Monitoring Programme (SW REMP). The primary objective of the SW REMP is to monitor and assess spatial and temporal trends in water quality, shellfish quality, marine ecology (benthic and reef) and marine vegetation of the southern Manukau Harbour in relation to the release of treated wastewater from the new Clarks Beach outfall, scheduled to become operational in May 2026.

In accordance with the Resource Consent conditions, environmental monitoring protocols for reef ecology were established by Watercare Services Limited and approved by Auckland Council. Tonkin and Taylor Ltd (T+T) are contracted to implement two components of this monitoring programme which relate to Condition 27 (b)(v) reef monitoring, and Condition 27 (b)(x and xii) monitoring of vegetation presence and blooms.

This report presents the second round of rocky reef monitoring on Tokaroa Point undertaken on 20 October 2025. The survey will contribute to baseline information to determine if any discernible effects occur following the proposed commencement of discharges from the Southwest Subregional Wastewater Treatment Plant in June 2026. The works have been undertaken as per the agreed contract procurement reference number 24-309-ESP.

1.2 Manukau Harbour Environment

To position Tokaroa Point reef within the wider ecological context of the Manukau Harbour, this report outlines key information on the harbour's rocky reefs and the species likely to occur there. The harbour's complex and diverse habitats, along with its rich marine flora and fauna, are recognised as significant at both regional and national levels (Auckland Council, 2021). At low tide, approximately half of the harbour's water drains away, exposing extensive sand and mudflats. These areas support diverse communities of marine invertebrates and provide critical roosting and foraging grounds for numerous endemic and migratory shorebirds, including several species classified as Threatened or At-Risk (Auckland Council, 2021).

The Manukau Harbour encompasses a range of habitats and species assemblages that vary with substrate type, sediment texture, catchment influences, exposure, tidal height, and currents. Predominantly intertidal, the harbour features productive sandflats, mudflats, and scattered rocky reefs along its coastal margins, intersected by deep, meandering channels. This diversity of habitats sustains a wide array of mobile and sessile species, contributing to the ecological richness of the area (Kelly, 2008).

Monitoring of rocky reef habitats throughout the harbour has been limited, with available reports primarily covering the Wāitakere coastline on the northern side of the harbour (Hayward and Morley (2002); Kelly (2008)). The Auckland Council's State of the Environment marine ecology programme is mainly concentrated on intertidal sand and mudflats habitats, and no rocky reef monitoring has been undertaken (Drylie, 2021).

Notable rocky reef locations within the harbour include the sheltered rocky shore along the northern coastline adjacent to the Wāitakere Ranges Heritage Area (Auckland Council, 2023). The substrate in this area consists primarily of volcanic conglomerate (Piha Formation) between Paratutae and Little Huia, and around Puponga Point. Other sections feature softer volcanic grit and sandstone formations, including Cornwallis Grit and Waitemata Sandstone (Kelly, 2008).

Species assemblages on these reefs vary by tidal level. At high tide, common organisms include periwinkles (*Nodilittorina antipoda*), high-arched limpets (*Notoacmea pileopsis*), barnacles (*Chamaesipho brunnea*, *Chamaesipho columna*, *Epopella plicata*), and black mussels (*Xenostrobus pulex*). Tufted red seaweed (*Gigartina laingii*) is also present at this level (Hayward and Morley, 2002). Mid-tide zones support acorn barnacles (*Austrominius modestus*) formerly, *Eliminius modestus*), oyster borers (*Lepsiella albomarginata*), topshells (*Melagraphia aethiops*), limpets (*Cellana radians*), and snakeskin chitons (*Sypharochiton pelliserpentis*), alongside red algae such as *Gelidium caulacantheum* and *Apophlaea sinclairii*. Between mid and low tide, species include shelly tube worms (*Spirobranchus cariniferus*), Pacific oysters (*Crassostrea gigas*), green-lipped mussels (*Perna canaliculus*), and white rock shells (*Dicathais orbita*) (Hayward and Morley, 2002).

Rocky shorelines near Ambury Foreshore and Puketutu Island comprise ancient basaltic lava flows (habitat SA1.7; Singers et al., 2017), supporting diverse marine organisms—gastropods, bivalves, crustaceans, anemones, chitons—and saline vegetation such as coastal needle grass, oioi, knobby clubrush, and glasswort (Kelly, 2003).

1.3 Waiuku Estuary

The Waiuku Estuary is one of the four main branches of the Manukau Harbour running about 11 km from its mouth at Clarks Beach upstream to Waiuku Town Basin. The estuary is considered to have once been a discharge from the Waikato River, which was cut off by lava flows from the South Auckland volcanic field some 3 million years ago (Mills, 2014).

Small areas of rocky intertidal habitats are present on the fringes of the Waiuku Estuary and are dominated by species such as mud snails (*Amphibola crenata*) within areas of mangroves, large numbers of cockles (*Austrovenus stutchburyi*) in the sandy mid-tide habitats, and abundant crabs and shrimps on the lower shoreline. Localised clumps of Pacific oysters (*Crassostrea gigas*) are also notably present along the coastline (Mills, 2014). Broader information on spatial cover of soft sediment benthic ecology and reef ecology habitats and species is minimal for the estuary (Mills, 2014).

The estuary holds important value to the local community for recreational use (fishing, boating, shellfish gathering) and to local iwi who have a highly valued cultural, spiritual, historical and environmental relationship with the estuary (Mills, 2014).

1.4 Tokaroa Point

Tokaroa Point was selected as the representative reef for monitoring as part of the SW REMP project. The location for rocky reef monitoring was provided by Watercare and approved by Auckland Council, to satisfy the Resource Consent conditions for the Southwest Subregional Wastewater Treatment Plant. The reef is located on the western side of Waiuku Estuary in the Manukau Harbour (Figure 1.1). Tokaroa Point is generally characterised by low lying sandstone flats, flat reef, and areas of silt (fine sediment) (Photograph 1.1, Photograph 1.2, Photograph 1.5, Photograph 1.6, Photograph 1.7).



Figure 1.1 Location of Tokaroa Point and the existing Clarks Beach Wastewater Treatment Plant (in the red boxes). The location of the proposed outfall is shown with a red diamond.



Photograph 1.1: Aerial photo of Tokaroa Point reef. Taken November 2025.



Photograph 1.2: Aerial photo of Tokaroa Point reef. Taken November 2025.



Photograph 1.3: Aerial photo of Tokaroa Point reef. Taken May 2025.



Photograph 1.4: Aerial photo of Tokaroa Point reef. Taken May 2025.



Photograph 1.5: Photo looking seaward around mid tide time. Photo taken October 2025.



Photograph 1.6: Photo taken around the mid tide location in October 2025.



Photograph 1.7: Photo looking towards the coastal margin from the low tide mark. Photo taken October 2025.

1.4.1 Significant Ecological Areas (SEAs)

Many Significant Ecological Areas (SEAs) are found throughout the Manukau harbour, protecting areas of ecological importance. Part of Tokaroa Point and to the north is protected by SEA-M2-34a[1] for the protection of intertidal flats for wading birds, saltmarsh, and bird roosts closely adjacent to intertidal banks of an Area of Significant Conservation Value (ASCV) as designated by the Department of Conservation. To the north of Tokaroa Point are areas of the ecosystem SA1.5 Shell barrier beaches, which are protected under SEA-M1-34b[2] (Figure 1.2). This is a high tide roost used by a variety of coastal and wading birds, including a number of threatened species (Table 1.1).

[1] SEA-M2 is an area of regional, national or international significance which do not warrant and SEA-M1 identification as they are generally more robust. SEA-M2-34a is protected for "Waders congregate on the intertidal flats before moving onto the roost. Saltmarsh habitats join the spit with fairly extensive intertidal mangrove areas in Rangiriri Creek. The Department of Conservation has selected the roosts and closely adjacent intertidal banks as an Area of Significant Conservation Value (ASCV).

[2] SEA-M1 is an area which due to their physical forum, scale or inherent values, are considered to be the most vulnerable to any adverse effects of inappropriate subdivision, use and development. SEA-M1-34b is protecting a "Sand bank formed into a spit is a high tide roost used by a variety of coastal birds and thousands of international migratory and New Zealand endemic wading birds including a number of threatened species.

Table 1.1: Marine Significant Ecological Areas (SEAs) overlapping and close by to Tokaroa Point

ID	Location	Values of Significant Ecological Area	SEA-M type
Marine			
34a	Pollock spit – intertidal flats	Waders congregate on the intertidal flats before moving onto the roost. Saltmarsh habitats join the spit with fairly extensive intertidal mangrove areas in Rangiriri Creek. The Department of Conservation has selected the roosts and closely adjacent intertidal banks as an Area of Significant Conservation Value (ASCV).	M2
34b	Pollock spit – Sand bank	Sand bank formed into a spit is a high tide roost used by a variety of coastal birds and thousands of international migratory and New Zealand endemic wading birds including a number of threatened species.	M1

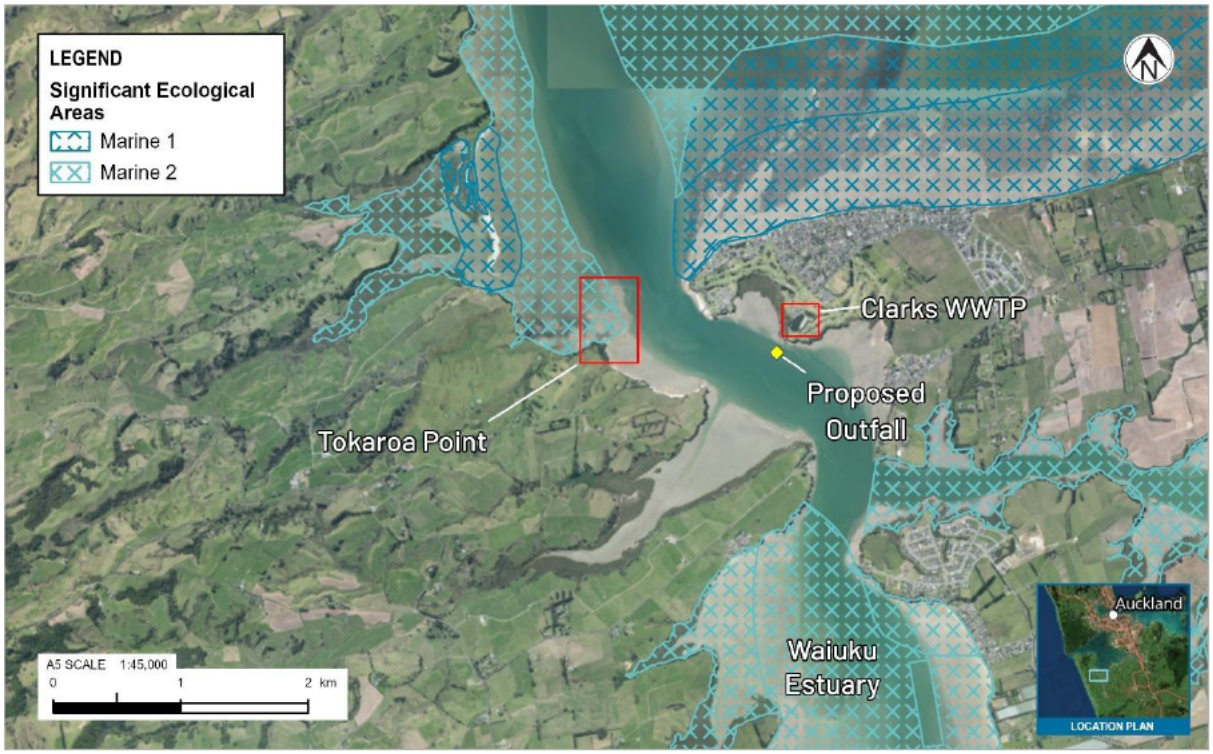


Figure 1.2 Location of Significant Ecological Areas within the vicinity of Tokaroa Point reef.

1.4.2 Habitat mapping

Habitat mapping carried out by Townsend et al. (2016) identified habitat types in and around Waiuku Estuary, including the extent of rocky shore communities at Tokaroa Point (Figure 1.3). Surveys identified rocky reef communities with low density oysters, *Xenostrobus pulex* (little black mussels) and *Austrominius modestus* (barnacles). In patches, silt had accumulated over the rocky reefs and was occupied by crustacean burrows and *Amphibola crenata* (mud snails).

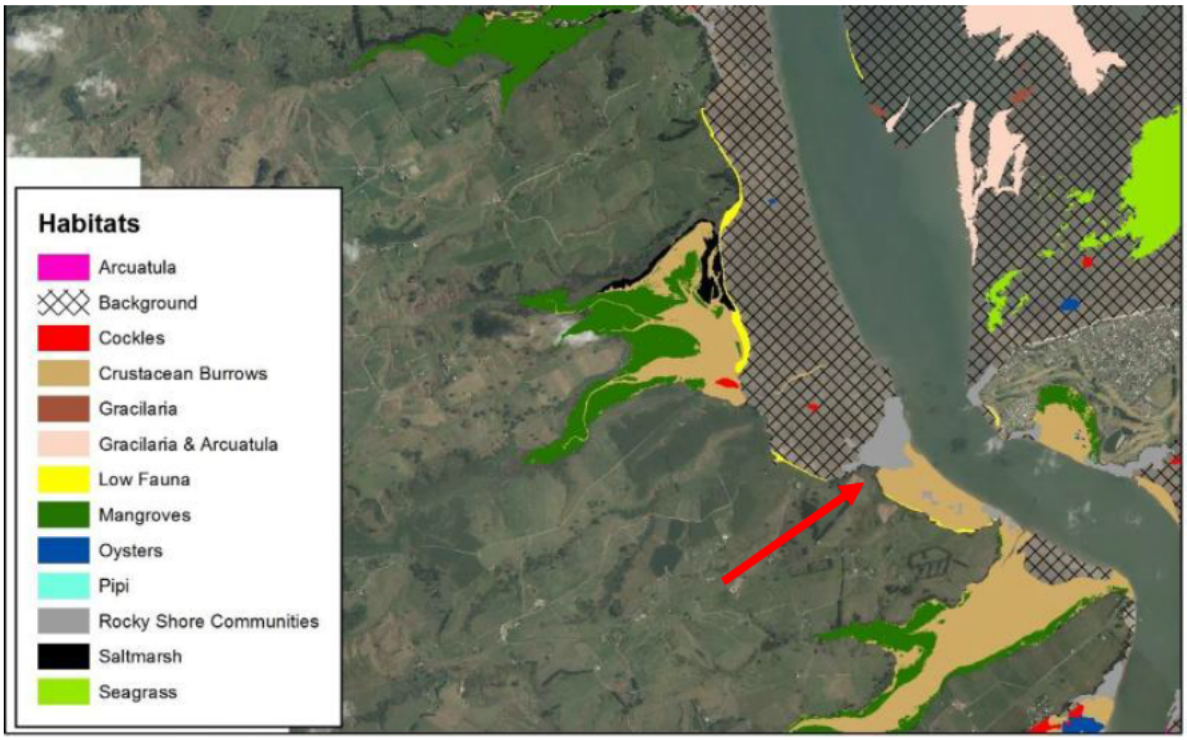


Figure 1.3 Habitat mapping of the Waiuku Estuary and adjacent sandbanks and coastal areas. (the arrow indicates Tokaroa Point, the location of the reef monitoring programme) (Townsend et al., 2016).

2 Methods

Monitoring protocols align with the Auckland Council State of the Environment rocky reef monitoring programme (Auckland Council, 2024).

2.1 Site establishment

Following the Auckland Council reef monitoring protocols (Appendix A), transect locations were chosen by T+T marine ecologists to undertake sampling of four transects at Tokaroa Point that reflect tidal height; these are High, Middle 1, Middle 2 and Low. In the first monitoring year, the location of the sites was predetermined using aerial imagery, with a central line running down the reef and four transect lines branching off on alternate sides. Once on site, the location of the transect lines were confirmed and GPS coordinates recorded at each end of the transect line (Table 2.1 and Figure 2.1 show the location of these). For future monitoring reference, at each site a transect line was marked with a galvanized steel hex bolt. The bolt was fixed into the reef using a fast-setting marine grade epoxy, and GPS coordinates recorded at the start and end of the 20 m transect line.

During the first year of monitoring, it was found that the middle sites were very muddy and weren't ideal representations of rocky reef habitats. Following discussions with Watercare the decision was made to move the Middle 2 site to a more representative rocky reef site for the second year of monitoring. The new Middle 2 site was relocated to the north of the 2024 site. Transect start and finish lines are recorded in Table 2.1 below.

Table 2.1: Transect line NZTM coordinates

Transect location	Start location (NZTM easting, northing)	Finish location (NZTM easting, northing)
High	1743242.9, 5887858.4	1749226.4, 5887866.1
Middle 1	1749282.1, 5888077.1	1749261.3, 5888086.0
Middle 2	1749312.2, 5888223.5	1749294.6, 5888231.5
Low	1749384.9, 58882181.4	1749363.9, 5888291.3



Figure 2.1 Location of transect lines at Tokaroa Point reef.

2.2 Site monitoring

Site monitoring began approximately three hours before low tide. Beginning at the High tide transect and proceeding seaward as the tide ebbed, with the Low tide transect sampled close to low tide. Along each transect line, six quadrats were taken on alternate sides of the transect line. Consistent with the Auckland Council methodology, a 1 m^2 quadrat size was used to reduce the potential effects of small-scale patchiness that can characterise intertidal reefs.

Quadrats were randomly placed 2 - 4 m apart, positioned alongside the transect tape, so the edge of the quadrat ran alongside the tape. Photos were taken of each quadrat prior to any disturbance to the surface from species records being taken.

The following non-biological variables were collected at each quadrat:

- Distance from the water's edge[3].
- Surface water cover as a percentage.
- Maximum depth of surface water.
- Vertical relief.
- Bare space percentage.
- Sediment cover percentage, noting the type of sediment as either sand, silt or gravel.
- Sediment cover maximum depth.

[3] The distance from the low tide transect to the absolute low tide was measured, and then the other distances were calculated using GPS coordinates and measurements from GoogleEarth measurement tools, to avoid additional disturbance to the intertidal area.

Biological variables were recorded within each quadrat. Epiflora and fauna were assessed for percentage cover by visually estimating the area of common algae species (greens, browns, reds), oysters, mussels, tube worms, epiphytes and any other species that required a percentage cover (rather than a numerical count). Species such as anemones, starfish, chitons, limpets, snails/whelks, bivalves were all counted and measured using callipers.

In some quadrats, large numbers of anemones were observed. Due to limited time on site and tidal constraints, photographs were taken where appropriate. Measurements were subsequently completed in the office using PDF XChange Editor.

2.3 Statistical analysis

Multivariate analyses of community composition for both mobile and sessile species data was undertaken using R statistical software (version 4.4.2). Non-metric multidimensional scaling (nMDS) was used to visualise patterns in benthic community composition based on percent cover data for sessile taxa. A Bray–Curtis dissimilarity matrix was calculated from untransformed data, which is appropriate for ecological community datasets characterised by zero-inflated abundance values. Resulting ordinations were examined to identify similarities and differences in community structure within and between sites across baseline monitoring years.

A multivariate PERMANOVA model was run to test for differences between sites (i.e. tidal heights). Similarity Percentages (SIMPER) analysis was preformed, which produces dissimilarity percentages to distinguish the dominant species driving variation between sites (tidal heights).

The results from the 2025 survey were compared against the 2024 results to ascertain any similarities or changes between the two years. As data for each monitoring round is collected, statistical comparisons between sampling events will be conducted. Furthermore, once the new discharge is operational, pre and post discharge comparisons will also be made.

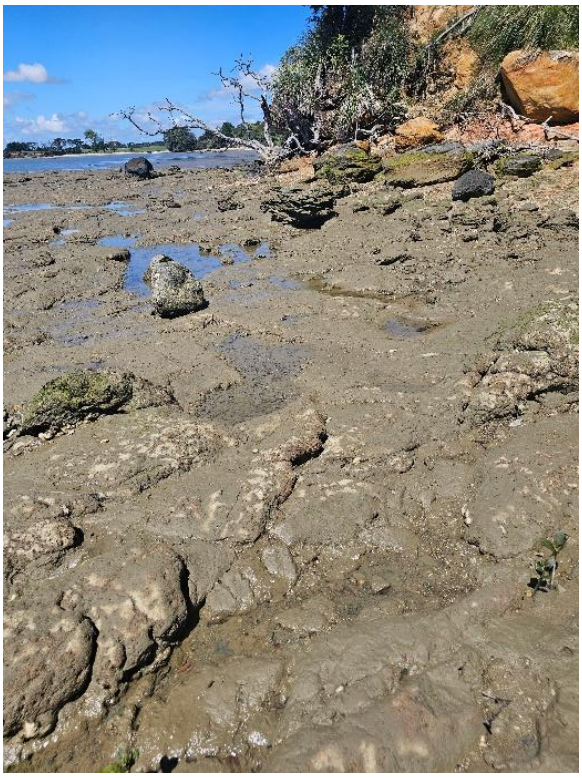
Although the Middle 2 transect was relocated in 2025, it has been retained in the analyses to provide context on spatial variability across the reef. Comparisons involving this site are interpreted cautiously, as observed differences may reflect site-specific habitat conditions rather than temporal change. Temporal comparisons therefore rely primarily on sites that remained fixed between monitoring years.

3 Results

3.1 Site descriptions

3.1.1 High

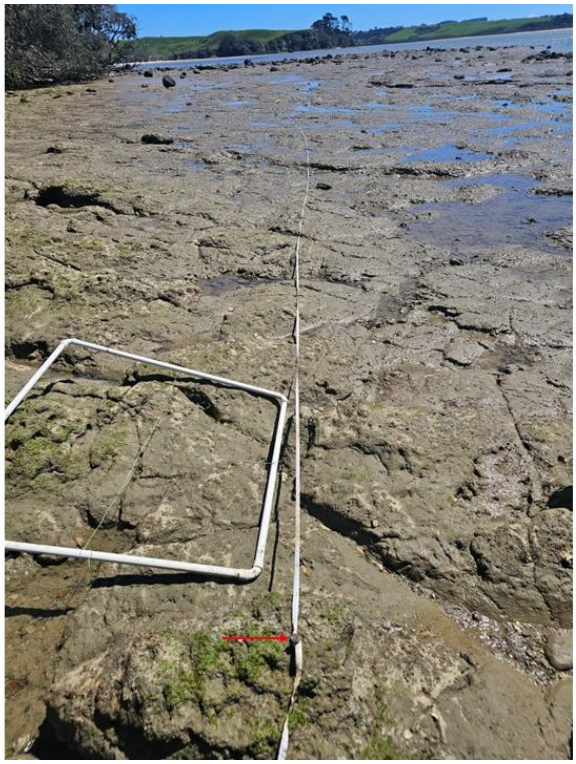
The high tide transects consisted of an undulating flat rocky reef covered in a small amount of silt with rock pools. Medium to large sized boulders were scattered along the coastal edge and through the high tide transect. Some mangrove pneumatophores were present. The coastal cliff was eroding in places and had Pohutukawa (*Metrosideros excelsa*) and scrub vegetation growing above the cliff, and some below, which appeared displaced due to erosion. Many of the boulders were covered in a filamentous green algae. Tidal rock pools were present along the transect line. Most of the sediment present within the quadrats sampled was sand and silt, with depths up to a quadrat average of 13 mm, compared with 17 mm in 2024. There appeared to be a layer of silt present across the site.



Photograph 3.1: Coastal edge and eroding cliff. Photo taken October 2025.



Photograph 3.2: High transect line. Photo taken October, 2025.



Photograph 3.3: High transect line, Transect start marker bolt indicated by the red arrow. Photo taken October 2025.



Photograph 3.4: Transect start marker bolt indicated by the red arrow. Photo taken October, 2025.

3.1.2 Middle 1

This transect location was characterised by deep mud covered in a green filamentous algae in 2024 (Photograph 3.5 and Photograph 3.6), however, in 2025 the site was muddy at the beginning of the transect line and progressed to shellhash/gravel cover towards the end of the transect line (Photograph 3.7 and Photograph 3.8). There were large boulders supporting a variety of mobile and sessile fauna and algal species within the transect area. In comparison with 2024 where all quadrats had 100 percent cover of silt, with the average depth ranging between 46 mm and 190 mm, four quadrats had between 80 percent and 100 per cent cover at the start of the transect line, decreasing to 35 percent at the last quadrat. One quadrat had a sediment average depth of 186 mm all other quadrats had an average depth of 81 mm or below. The random location of the quadrats didn't capture any large boulders that were present within the Middle 1 transect area. Within the general location there was pools of water sitting in deeper channels that run between areas of rocky reef.



Photograph 3.5: Middle 1 transect line in 2024, showing the green filamentous algae covering the deep mud at the site. Photo taken October 2024.



Photograph 3.6: Middle 1 transect location in 2024, showing the green filamentous algae covering the deep mud at the site. Photo taken October 2024.



Photograph 3.7: Middle 1 transect. Photo taken October, 2025.



Photograph 3.8: Middle 1 transect line with scattered large boulders. Photo taken October, 2025.

3.1.3 Middle 2

In 2024 this site was characterised by undulating deep mud with green filamentous algae on the surface (Photograph 3.9 and Photograph 3.10). There were large boulders supporting a variety of mobile and sessile species, and a notable presence of Pacific oysters. All quadrats had 100 percent

cover of silt, with the average depth ranging between an average of 18 mm and 60 mm, although some areas that were not within the quadrats were deeper mud.

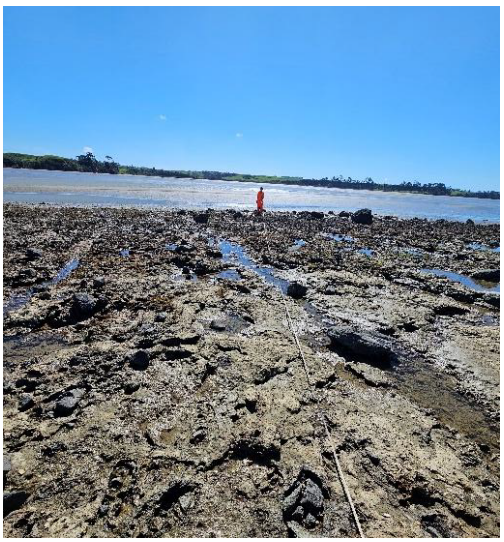


Photograph 3.9: Large boulder along the transect. Photo taken October, 2024.



Photograph 3.10: Crab holes in mud. Photo taken October, 2024.

Following discussions with Watercare Services Ltd and then confirmed with Auckland Council, the decision was made to shift this site to a location to the north which was more characteristic of a rocky reef site. The new location is a north of the existing site, and slightly raised (Photograph 3.11 and Photograph 3.12). The new location consisted of rock pools, boulders and low amounts of sediment, with half the quadrats containing no silt. Average sediment depths were up to 19 mm.



Photograph 3.11: Middle 2 transect line. Photo taken October 2025.



Photograph 3.12: Looking from the seaward side of the site to the coastal edge. Photo taken October 2025.

Sediment plumes were also observed in the water column to the north of the middle and low reef sites. Aerial imagery captured during vegetation mapping surveys for the SW REMP indicates that these plumes originate from the adjacent catchment and are depositing sediment onto the Tokaroa Point reef (Photograph 3.13; Photograph 3.14; Photograph 3.15).



Photograph 3.13: Aerial imagery showing sediment plume from the catchment, north of Tokaroa Point. Photo taken November 2025.



Photograph 3.14: Sediment plume north of Tokaroa Point. Photo taken October 2025.



Photograph 3.15: Channel between the middle 1 and 2 sites. Photo taken October 2025.

3.1.4 Low

The location of the Low transect was on visible rocky undulating reef, covered in shell hash and oysters. In 2024 areas of deep mud and green filamentous algae was present and this was not seen

to the same extent in 2025. The sediment present within the quadrats at this site was predominantly gravel and silt (Photograph 3.16; Photograph 3.17; Photograph 3.18; Photograph 3.19). The gravel was a fine scattered layer across the reef, and the silt had average depths of up to 19 mm. There is a channel marker buoy present close to the start of the transect line.



Photograph 3.16: Rocky reef, covered in shell hash and oysters. Photo taken October, 2024.



Photograph 3.17: Marker buoy close to the start of the transect line. Photo taken October, 2024.



Photograph 3.18: Low tide transect line. Photo taken October 2025.



Photograph 3.19: Looking seaward from the low tide transect. Photo taken October 2025.

3.2 Statistical analysis

All species present within each of the six quadrats, along the four transects were identified and either percentage cover estimated, or the size of an individual measured (consistent with the

Auckland Council methodology approach). A total of 19 species were identified during the 2025 monitoring survey, with seven of these considered to be sessile species, and 12 mobile species (Table 3.2; Table 3.3). These results compare against 24 species identified in 2024, consisting of 11 sessile species and 13 mobile species.

When species diversity is compared within each tidal height, some variation is evident between 2024 and 2025, with a small overall increase in mobile species richness and a decline in sessile species richness at the Low transect (Table 3.1). The Low transect site had the highest overall number of species in 2024, however the Low transect had seven less species identified in 2025 (six of these sessile species). The new Middle 2 site overall had the highest species diversity with 13 species in 2025 (eight mobile and five sessile species) (Table 3.1).

The High tide transect site saw a decline of two sessile species between 2024 and 2025 while mobile species numbers stayed consistent. The Middle 1 site showed a small increase in diversity for sessile species, and for mobile species from zero to four, this may be consistent with lower sediment depths across the site. The movement of the Middle 2 site saw an overall increase in diversity for both sessile and mobile species. The Low transect had both increasing and decreasing shifts for mobile and sessile species, highlighting fluidity of the lower ecological zone on the shore (Table 3.2).

Table 3.1: Species diversity per transect line (tidal height)

Transect	2024		2025		Difference between 2024 and 2025	
	Sessile	Mobile	Sessile	Mobile	Sessile	Mobile
High	6	5	4	5	**-2**	**0**
Middle 1	2	0	3	4	**1**	**4**
Middle 2**	4	5	5	8	**1**	**3**
Low	10	9	4	11	**-6**	**2**

**Noting that this site was moved in 2025 from a muddy site to a rockier site.

3.2.1 Sessile species percent cover and distribution

Figure 3.1 shows a shift in the species group dominance between 2024 and 2025 across the four transect sites at Tokaroa Point. In 2024, green filamentous algae dominated both the Middle sites, however in 2025 there was an absence of green filamentous algae with none at the Middle 1 site. The shift of the Middle 2 site to a rockier reef site, shows a move from the green filamentous algae sitting on the surface of the mud in 2024 to a dominance of bivalve species at the site indicating that this is more representative of a reef site (Figure 3.1).

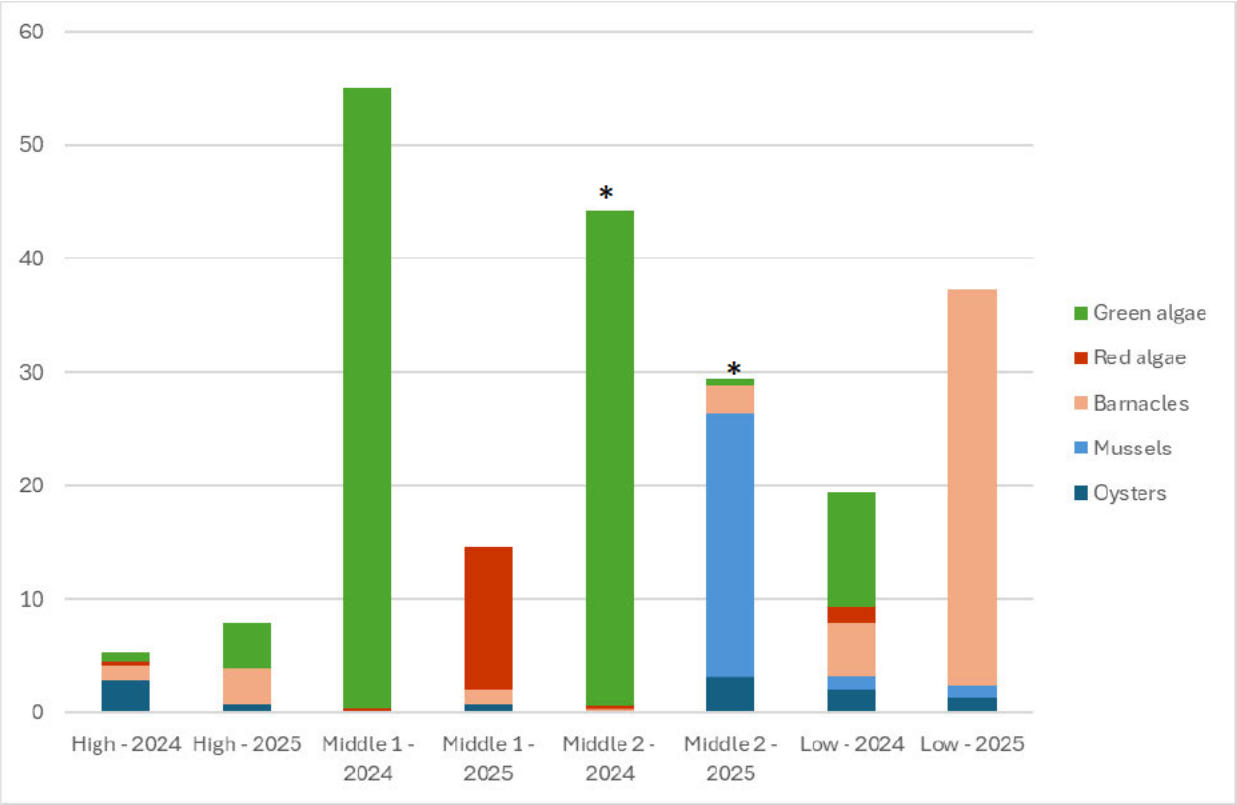


*Figure 3.1 Average percentage of sessile species groups for 2024 and 2025 (*Middle 2 site was moved from a muddy site in 2024 to a rockier reef site in 2025, noting the shift from green algae dominated to bivalve dominated)*

Overall species richness declined in 2025 compared to 2024, with 19 species recorded versus 24 in the previous year (Table 3.2). In 2024, green filamentous algae exhibited the highest percentage cover across quadrats, whereas in 2025, the barnacle *Austrominius modestus* dominated. Additionally, in 2025, coralline turf showed substantial coverage—between 30% and 35%—in the second and third quadrats at the Middle 1 site. This contributed to an overall increase in red algae representation at that location.

The percentage of the average bare space overall shows a decline from the high tide transect site to the low tide transect (Table 3.2).

Table 3.2: Average percent cover of sessile species from 6 quadrats at each transect location (High, Middle 1, Middle 2, Low), for 2024 and 2025). Comparisons between years for the Middle 2 site have been left in to record the shift of species composition following the shift in transect and habitat type (mud to rocky reef).

Group	Species	High		Middle 1		Middle 2		Low	
		2024	2025	2024	2025	2024	2025	2024	2025
Oysters	*Crassostrea gigas*	0	0.83	0	0.83	0	3.17	0	1.33
	Ostreidae sp.	2.8	0	0	0	0	0	2	0
Mussels	*Arcuatula senhousia*	0	0	0	0	0	0	0.08	0.17
	Xenostrobus sp.	0	0	0	0	0	23.17	1.17	0.83
Barnacles	*Chamaesipho columna*	0.02	0	0	0	0	0	4	0

Group	Species	High		Middle 1		Middle 2		Low	
		2024	2025	2024	2025	2024	2025	2024	2025
	Austrominius modestus	1.33	3.08	0	1.17	0.33	2.5	0.58	35
Red algae	Coralline turf	0	0	0	12.67	0	0	0	0
	Gracilaria chilensis	0.33	0	0.42	0	0.33	0	0.58	0
	Polysiphonia sp.	0	0	0	0	0	0	0.33	0
	Unidentified red filamentous algae	0	0	0	0	0	0	0.58	0
Green algae	*Prasiola sp.*	0.67	0	0	0	0	0	0	0
	Ulva sp.	0.17	3.33	0	0	0.17	0.02	0.58	0
	Unidentified green filamentous algae	0	0.67	54.67	0	43.33	0.6	9.5	0
TOTAL COUNT OF SPECIES PRESENT		**6**	**4**	**2**	**3**	**4**	**5**	**10**	**4**
Bare space		69.17	73.33	45	76.67	40	35.83	40.83	47.5

3.2.2 Mobile species abundance and composition

The most abundant species group in 2024 was anemones and in 2025 snails/whelks. In both years, the highest abundances were found at the Middle 2 site (noting that this site was shifted in 2025) reflecting a shift from a muddier environment to a rocky reef environment (Figure 3.2).

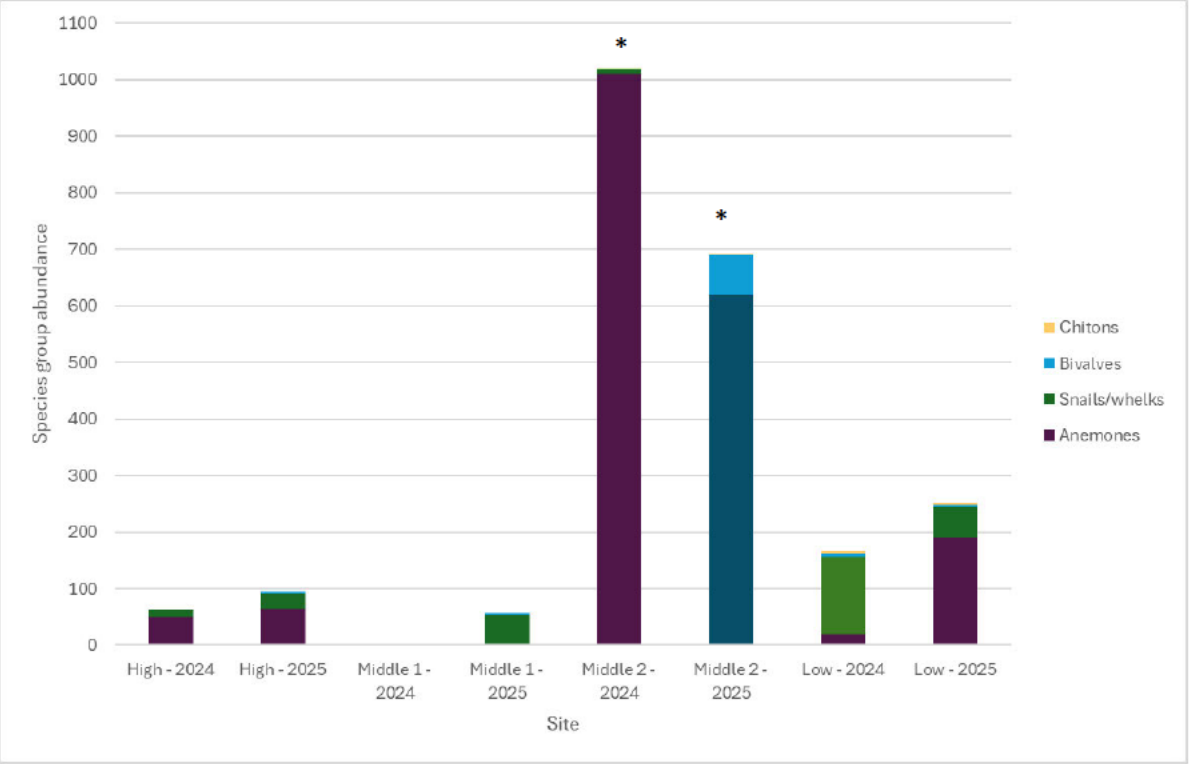


*Figure 3.2 Total abundance by species group compared across sites and years (2024 and 2025). (*Middle 2 site was moved from a muddy site in 2024 to a rockier reef site in 2025, noting the shift from anemones dominating the site to bivalve dominated).*

The anemone *Isactinia olivacea* was the most abundant species (1079 individuals across the Middle 2 site) in 2024 and the mud snail *Zeacumantus* sp. in 2025 (541 individuals across the Middle 2 site) (Table 3.3; Figure 3.3).

Table 3.3: Mobile species total abundance across the four transect tidal heights in 2025

Group	Species	High		Middle- 1		Middle – 2		Low	
		2024	2025	2024	2025	2024	2025	2024	2025
Anemones	*Anthopleura sp.*	0	9	0	0	0	3	0	1
	Anthopleura aureoradiata	0	55	0	0	0	0	0	189
	Isactinia olivacea	49	0	0	0	1011	0	19	0
	Unidentified anemone	0	0	0	0	0	0	0	1
Chitons	*Chiton glaucus*	0	0	0	0	0	1	0	1
	Sypharochiton pelliserpentis	0	0	0	0	0	0	4	3
Snails/whelks	*Bucciniulum linea*	0	0	0	0	1	0	0	0
	Cominella adspersa	0	0	0	0	0	0	1	0
	Cominella glandiformis	3	0	0	42	0	1	0	0
	Cominella virgata	0	26	0	9	0	53	40	5
	Diloma aethiops	0	1	0	3	0	16	0	1
	Haustrum scobina	0	0	0	0	0	0	77	26
	Lunella smaragdus	0	0	0	0	0	9	2	17
	Nerita melanotragus	1	0	0	0	0	0	0	0
	Onchidella nigricanus	7	0	0	0	0	0	6	0
	Unidentified gastropoda (whelk)	0	0	0	0	1	0	0	0
	Zeacumantus sp.	2	0	0	0	5	537	11	4
Bivalves	*Austrovenus stutchburyi*	0	3	0	3	1	71	6	4
TOTAL COUNT OF SPECIES PRESENT		**5**	**5**	**0**	**4**	**5**	**8**	**9**	**11**

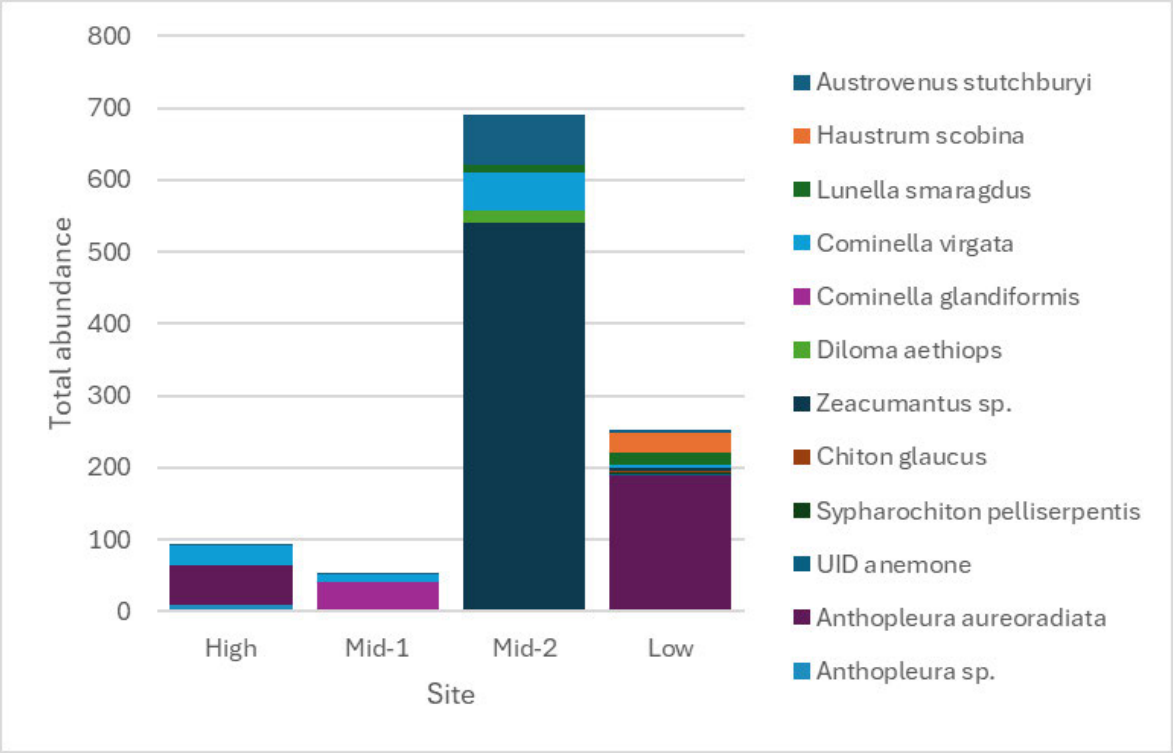


Figure 3.3 Total abundance of species at each transect site at Tokaroa Point in 2025

The four most abundant mobile species in 2025 were the snail/whelks *Zeacumantus* sp. and *Cominella virgata*, the anemone *Anthopleura aureoradiata* and the bivalve *Austrovenus stutchburyi* (cockle). In 2024 the most abundant species included two of the same species- the snail/whelk *Zeacumantus* sp. and *Cominella virgata* - and two different species, the anemone, *Isactinia olivacea* and the whelk *Haustrum scobina*.

3.2.3 Mobile species size distribution

The size distribution graphs (Figure 3.4, Figure 3.5, Figure 3.6 and Figure 3.7) shows differences in size structure of each species across the sites. The majority of *Zeacumantus* sp. were found in the smaller size classes, with most between 2 – 14 mm in 2025 which was consistent with the sizes in 2024, between the majority of individuals between 4 – 16 mm. Most individuals were found in the newly relocated Middle 2 site.

Cominella virgata displayed a broader size range, with most individuals in larger size classes in 2025 between 18 - 26 mm, which was larger than those found in 2024, which were generally between 10-18 mm. There is some variation in size class distributions among the sites, with higher abundance at the new Middle 2 site.

Anthopleura aureoradiata was most abundant in the smaller size classes (2 – 8 mm), particularly at the Low site. *Austrovenus stutchburyi* showed a clear dominance of larger individuals (16 – 24 mm), especially at the Middle 2 site. These patterns suggest spatial variation in population structure, potentially reflecting differences in recruitment, growth, or habitat suitability among sites.

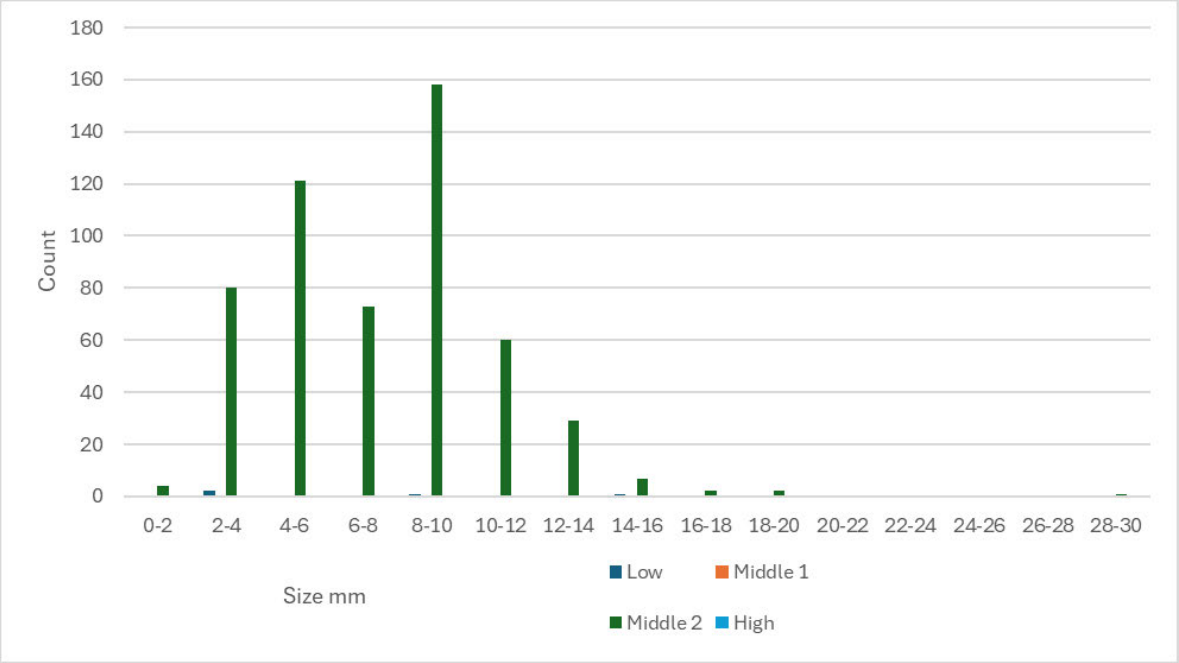


Figure 3.4 Size distribution classes for Zeacumantus sp.

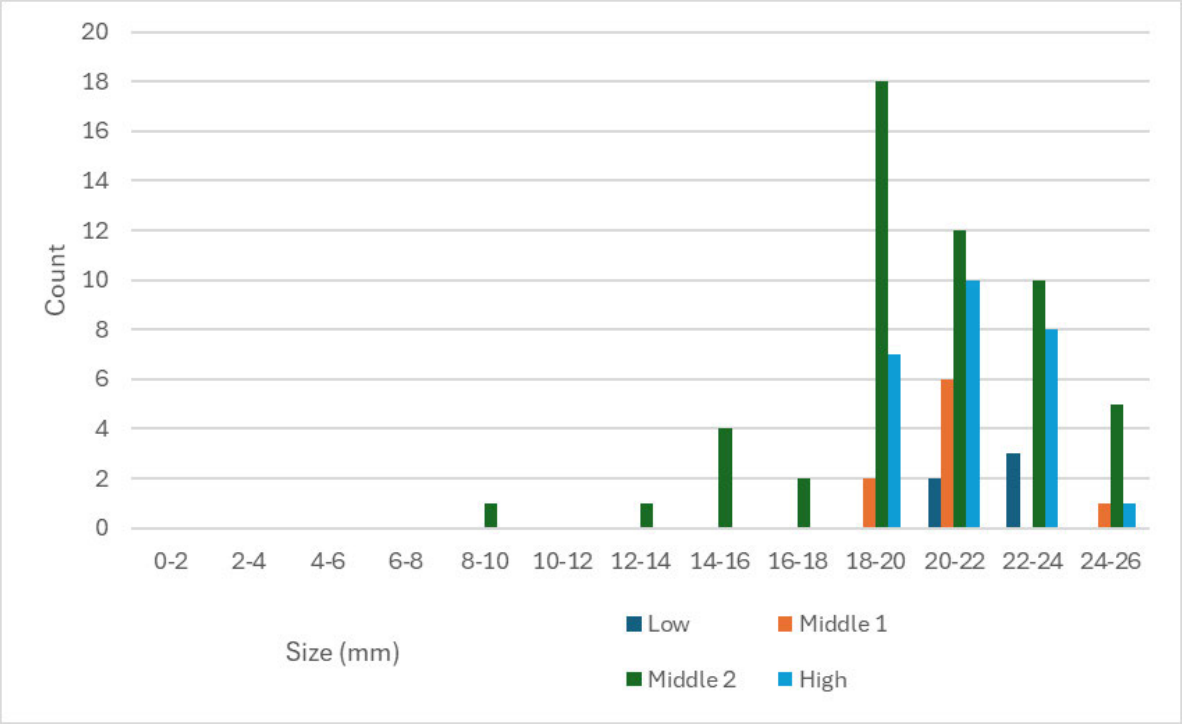


Figure 3.5 Size distribution classes for Cominella virgata.

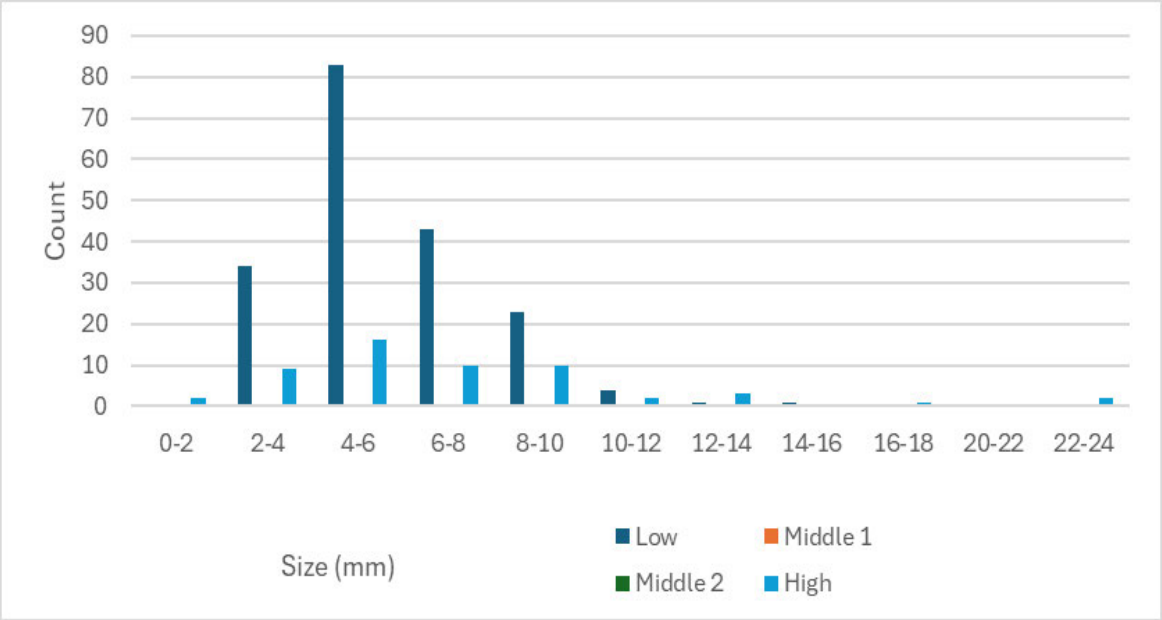


Figure 3.6 Size distribution classes for Anthopleura aureoradiata.

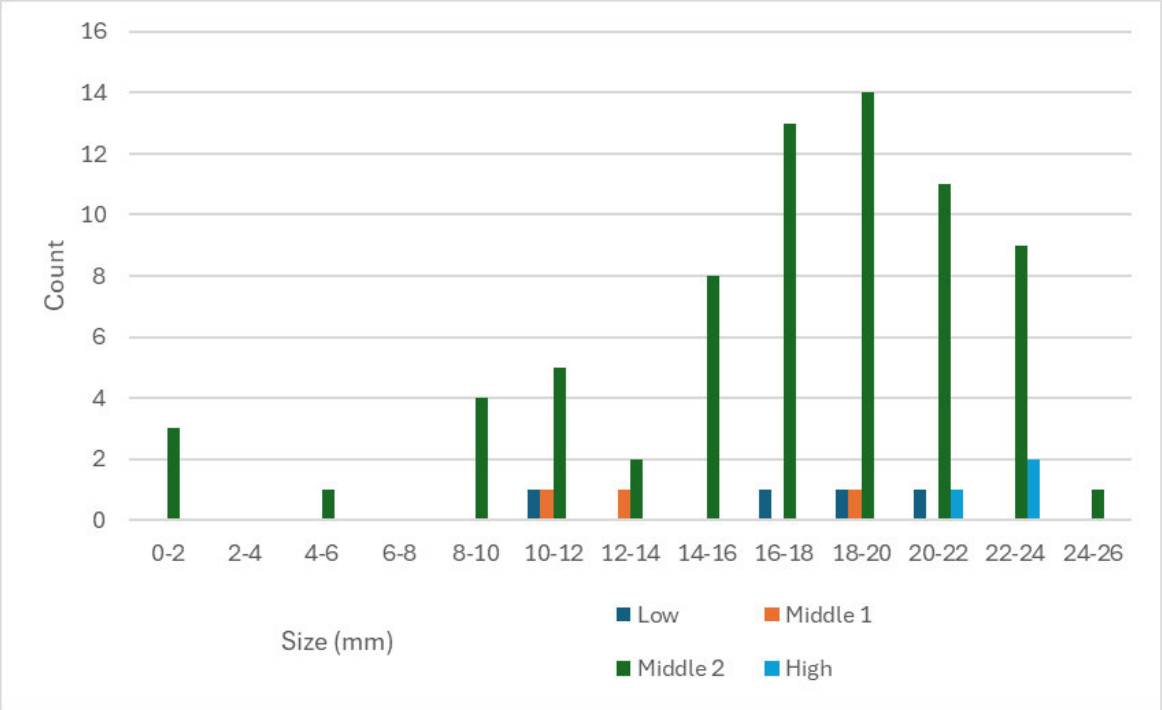


Figure 3.7 Size distribution classes for Austrovenus stutchburyi.

3.2.4 Species community composition

Species composition has varied across the two monitoring years, with only five sessile species present in both 2024 and 2025 at the same transect site, and six mobile species. These species are:

- Sessile species:
  - *Arcuatula senhousia* (Low transect).
  - *Xenostrobus* sp. (Low transect).
  - *Austrominius modestus* (High, Middle 2[4] and Low transects).

  - *Ulva* sp. (High, Middle 2[4] transect).
  - Unidentified green filamentous algae (Middle 2[4] transect).
- Mobile species:
  - Chiton *(Sypharochiton pelliserpentis)* (Low transect).
  - *Cominella virgata* (Low transect).
  - *Haustrum scobina* (Low transect).
  - *Lunella smaragdus* (Low transect).
  - *Zeacumantus sp.* (Middle 2, Low transects).
  - Bivalves *(Austrovenus stutchburyi*).

3.2.4.1 Non-metric multidimensional scaling (nMDS)

Non-metric multidimensional scaling (nMDS) analyses were undertaken to examine patterns in reef benthic community composition across sites during two years of baseline monitoring. Ordinations were based on Bray–Curtis dissimilarities calculated from percent cover data for sessile taxa. As Bray-Curtis can be influenced by dominant taxa, ordination patterns primarly reflect differences in the most abundant groups.

Across both monitoring years, nMDS ordinations showed clear separation in benthic community composition between sites, with samples generally clustering by site and tidal elevation rather than by monitoring year (Figure 3.8 to Figure 3.11). This indicates a strong spatial structuring of reef communities, consistent with local habitat gradients, and suggests that site-specific assemblages were already well established prior to the commencement of any wastewater discharge activities.

For the first year of monitoring, benthic assemblages exhibited distinct grouping among sites, with limited overlap between clusters, indicating differences in the relative dominance of key sessile taxa. Ellipse groupings showed moderate within-site variability, reflecting natural small-scale heterogeneity in reef cover, while maintaining clear separation from other sites.

Results from the second year of monitoring showed a similar spatial pattern, with site-level clustering broadly consistent with that observed in the first year. Although some variation in the dispersion of samples was evident between years, there was no systematic shift in ordination space indicating a directional or temporal change in reef community composition. Overall, the configuration of sites in ordination space remained comparable between years.

Stress values for the nMDS ordinations were very low, indicating that the two-dimensional solutions provided an excellent representation of the underlying multivariate relationships in the dataset. This reflects the relatively simple community structure and strong zonation patterns characteristic of the monitored reef environment.

Taken together, these results indicate that reef benthic communities were spatially stable over the two-year baseline period, with differences in community composition primarily attributable to site-specific factors rather than interannual change. These ordinations therefore provide a robust baseline against which any future changes associated with wastewater discharge operations can be assessed.

[4] Noting that this transect was moved in 2025 so comparisons with 2024 are not directly the same location

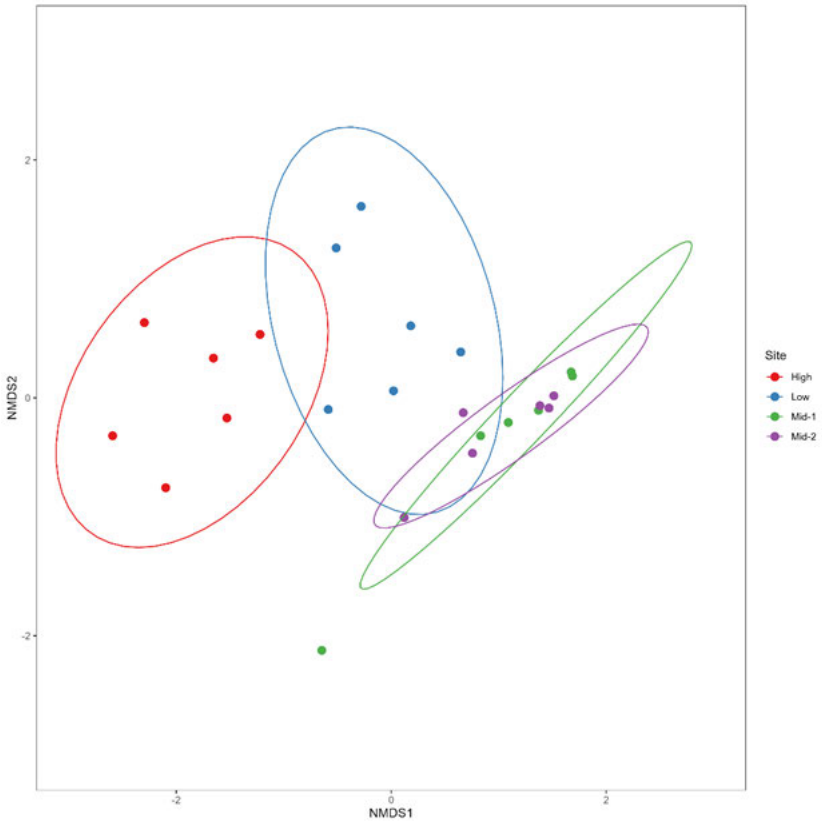


Figure 3.8 Non-metric multidimensional scaling (nMDS) plot of benthic communities, of sessile species during the first round of reef monitoring (October 2024).

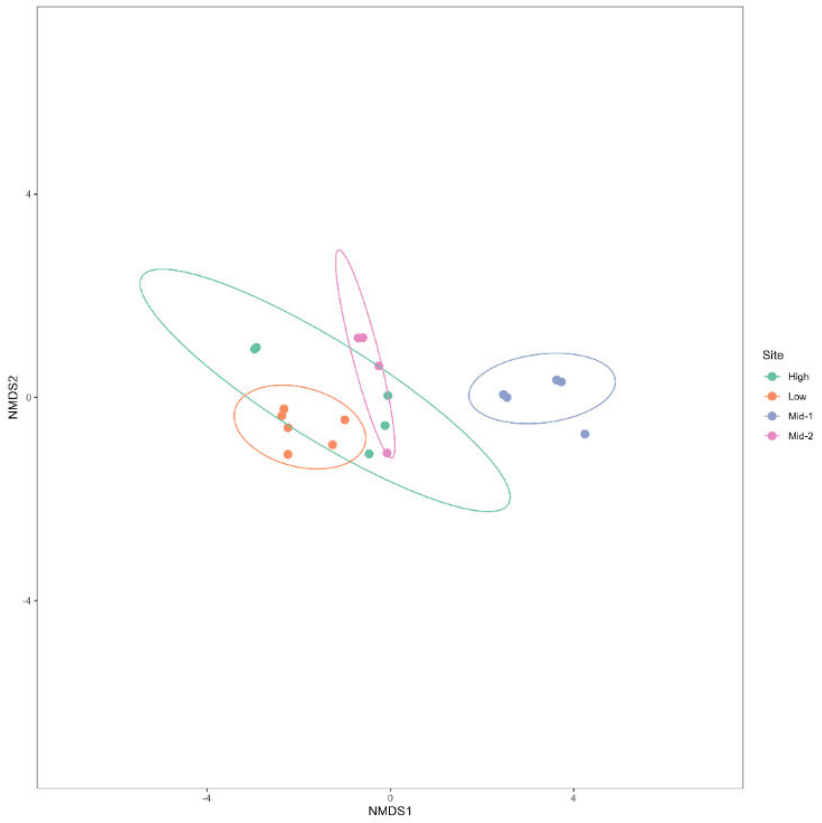


Figure 3.9 Non-metric multidimensional scaling (nMDS) plot of benthic communities of mobile species during the first round of reef monitoring (October 2024).

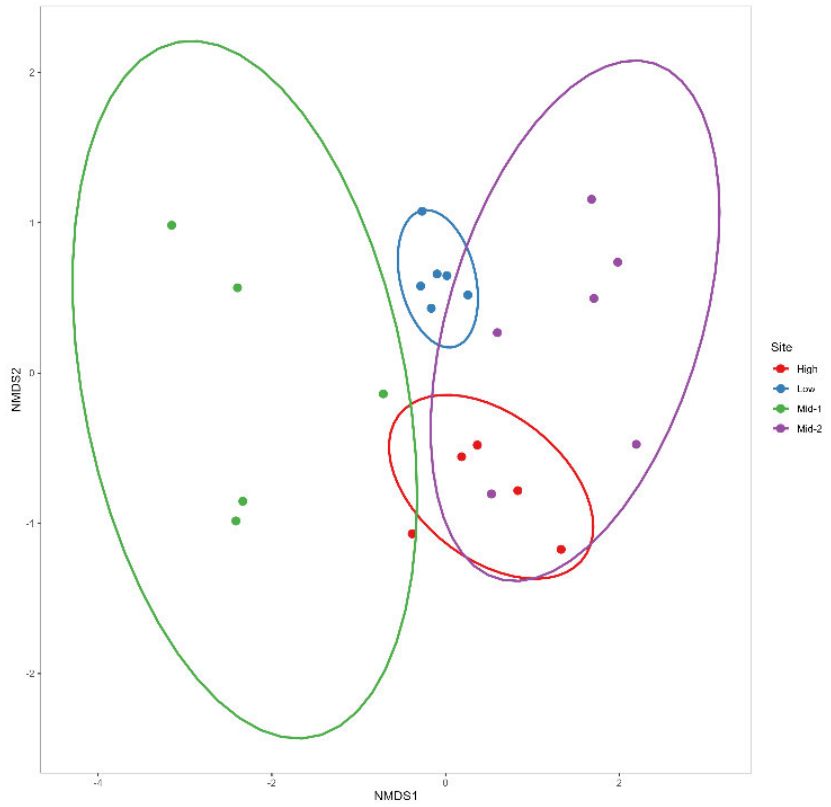


Figure 3.10 Non-metric multidimensional scaling (nMDS) plot of benthic communities of sessile species during the second round of reef monitoring (October 2025).

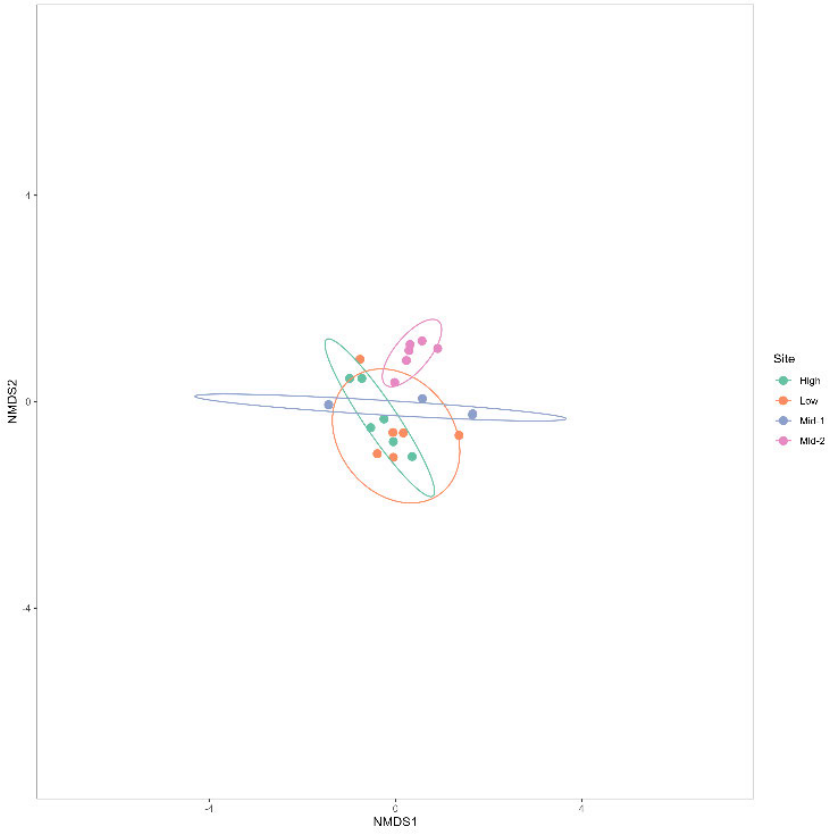


Figure 3.11 Non-metric multidimensional scaling (nMDS) plot of benthic communities of mobile species during the second round of reef monitoring (October 2025).

3.2.4.2 Permutational Multivariate Analysis of Variance (PERMANOVA)

A Permutational Multivariate Analysis of Variance (PERMANOVA) was used in this study to assess the differences in community composition across the transect tidal heights. A PERMANOVA helps to determine if the variation between the transects exceeds the variation within the transects. This analysis aims to determine if there were statistically significant differences in the community composition between different transects and tidal heights.

Permutational multivariate analysis of variance (PERMANOVA) indicated significant differences in benthic community composition among sites for both sessile and mobile species assemblages. For sessile species, site explained approximately 48% of the observed variation in community structure (Pseudo-F = 6.15, p = 0.001), indicating strong spatial differentiation in sessile assemblages. Mobile species assemblages also differed significantly among sites, with site accounting for approximately 43% of the variation in community composition (Pseudo-F = 4.96, p = 0.001). In both cases, the remaining variation was attributable to within-site variability. These results confirm that spatial location was a primary driver of reef benthic community structure during the baseline period and support the interpretation of strong site-specific assemblages across the study area (Table 3.4).

The significant differences in community composition associated with site and tidal height, indicates strong spatial and tidal structuring of both sessile and mobile species assemblages.

Table 3.4: PERMANOVA results to determine differences in community composition across the transect tidal heights for sessile and mobile species for 2025[5].

Source	df	SumOfSqs	R2	Pseudo-F	Pr(>F)	Perms
Sessile species						
Model	3	4.1238	0.4797	6.1465	0.001	999
Residual	20	4.4728	0.5203			
Total	23	8.5965	1.0000			
Mobile species						
Model	3	3.8778	0.42664	4.9607	0.001	999
Residual	20	5.2114	0.57336			
Total	23	9.0893	1.00000			

3.2.4.3 Similarity Percentages (SIMPER)

A Similarity Percentages (SIMPER) analysis helps to identify the species that contribute the most to the average dissimilarity between transect sites. The cumulative contribution refers to the total percentage contribution to group dissimilarity of one or more species. Table 3.5 presents the cumulative proportion of dissimilarity of each species when comparing transect sites.

The SIMPER analysis shows differences in sessile community composition between sites were primarily driven by a few key taxa. The barnacle, *Austrominius modestus* was the most influential species, contributing to dissimilarity across most site pairs, particularly between High and Low and Middle 1 and Low. *Xenostrobus* sp. and Coralline turf also played important roles in distinguishing certain site pairs, especially between Middle 2 and Low and High and Middle 1. These findings highlight that spatial variation in community structure is largely attributable to shifts in the abundance of these dominant taxa across the intertidal gradient.

[5] Results should be interpreted with caution because differences may partly reflect dispersion, and dispersion diagnostics were not assessed.

The SIMPER analysis shows that a small number of taxa are primarily responsible for differences in community composition between sites, with *Cominella virgata, Anthopleura aureoradiata,* and *Zeacumantus* sp. being the most influential across Tokaroa Point reef.

In 2024 the SIMPER analysis indicates that differences in mobile species composition between transect sites were primarily driven by a few key taxa. *Isactinia olivacea* was the most influential species, contributing strongly to dissimilarities across nearly all site comparisons, particularly between Middle 2 and Low (82%) and Middle 1 and Middle 2 (81%). *Cominella virgata* also played a significant role, especially in comparisons involving Low and Middle 1 sites (up to 68%), while *Haustrum scobina* contributed notably between High and Middle 1 (52%) and Middle 1 and Low (39%). Overall, these results highlight that spatial variation in community structure is largely driven by shifts in the abundance of these dominant species across the intertidal gradient.

Compared to 2024, the 2025 SIMPER results show a shift in the dominant species driving dissimilarities between transect sites. In 2024, mobile species differences were largely influenced by *Isactinia olivacea*, with additional contributions from *Cominella virgata* and *Haustrum scobina*. By contrast, in 2025, mobile species variation was more evenly distributed among *Anthopleura aureoradiata*, *Cominella glandiformis*, *Cominella virgata*, and *Zeacumantus sp.*, indicating a broader range of influential taxa. This could be as a result of discontinuity across the transect line and where the quadrat lands, rather than differences between years. Across the reef there are areas where organisms are clustering together, rather than uniformly spread across the reef, something which is typical of marine organisms in this type of environment.

For sessile species, 2024 results emphasized green filamentous algae, whereas 2025 was dominated by *Austrominius modestus*, with *Xenostrobus sp.* and coralline turf also contributing significantly. These changes suggest temporal shifts in community structure, with barnacles and red algae becoming more prominent in 2025.

Table 3.5: Main taxa contributing to dissimilarity between site pairs in 2025 (SIMPER analysis)

Site pair	Species	Cumulative proportion of dissimilarity
Sessile species		
High vs Middle 1	Coralline turf	0.43
	Austrominius modestus	0.75
High vs Middle 2	*Xenostrobus* sp.	0.59
	Austrominius modestus	0.75
High vs Low	*Austrominius modestus*	0.84
Middle 1 vs Middle 2	*Xenostrobus* sp.	0.45
	Coralline turf	0.74
Middle 1 vs Low	*Austrominius modestus*	0.73
Middle 2 vs Low	*Austrominius modestus*	0.62
	Xenostrobus sp.	0.93
Mobile species		
High vs Middle 1	*Anthopleura aureoradiata*	0.42
	Cominella glandiformis	0.65
	Cominella virgata	0.87
High vs Middle 2	*Zeacumantus* sp.	0.66
	Austrovenus stutchburyi	0.76
High vs Low	*Anthopleura aureoradiata*	0.55
	Cominella virgata	0.68
	Haustrum scobina	0.81
Middle 1 vs Middle 2	*Zeacumantus* sp.	0.68
	Austrovenus stutchburyi	0.79
Middle 1 vs Low	*Anthopleura aureoradiata*	0.5
	Cominella glandiformis	0.66
	Haustrum scobina	0.79
Middle 2 vs Low	*Zeacumantus* sp.	0.56
	Anthopleura aureoradiata	0.75

Note: These numbers are cumulative contributions and not individual species contributions.

3.2.5 Sediment distribution

To understand the differences in sediment type, cover and depth across Tokaroa reef, following AC protocols, the type (sand, silt, gravel/shell) of sediment was recorded as both a percent cover of each quadrat along the transect and as an averaged depth. To collect the average depth for each sediment type, three measurements of sediment depth were taken in each quadrat and these were averaged to provide a result for each quadrat. Sediment cover of each quadrat was recorded as sand, silt or gravel/shell hash. Noting that this could be a layer of sediment on top of bare rock, or the sediment may have epifauna on top. These parameters are recorded separately and presented as primary and secondary covers (refer to Section 3.2.1 for epifauna cover).

The percent cover estimates taken for the 2025 round of monitoring show a strong presence of silt persisting for most of the transect line at the Middle 1 site (Figure 3.13). Both the High and Low

transect sites show presence of silt across all quadrats (Figure 3.14; *Figure* 3.15), with the Low site having some quadrats almost entirely covered by silt. Middle 2 had the lowest proportions of silt and as outlined in Section 3.2.1 it also had a higher cover of epifauna than the other sites, although the Low site also had moderate cover of epifauna across some quadrats (Figure 3.14). Sites High and Middle 1 had minimal epifauna cover.

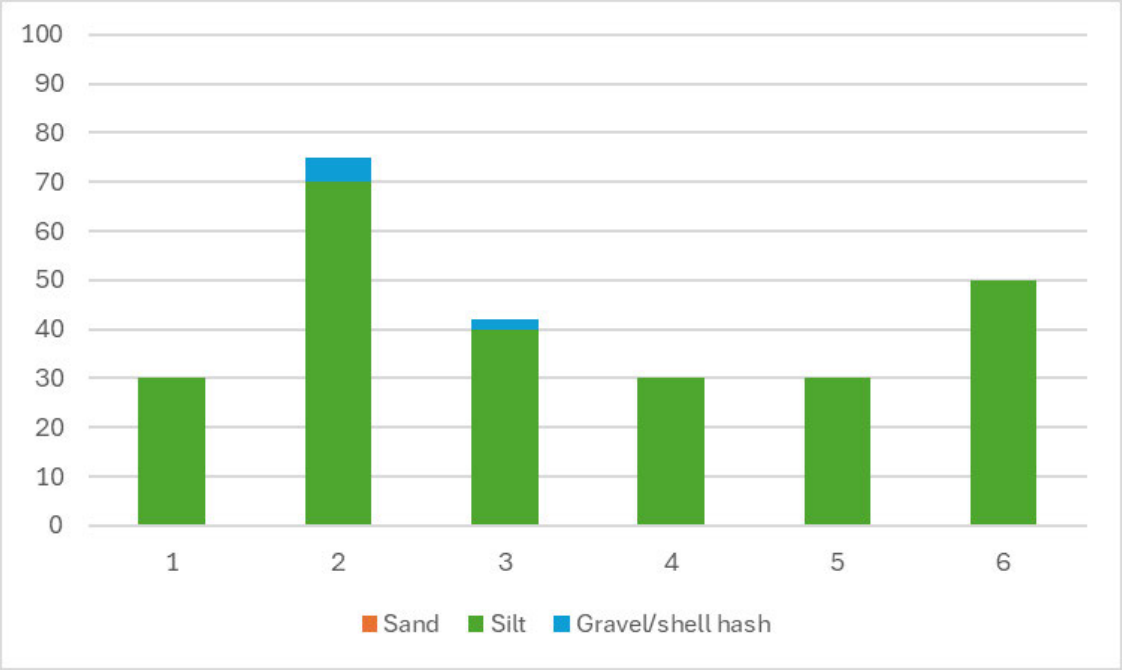


Figure 3.12 Percent cover type across each quadrat at the High transect line in 2025.

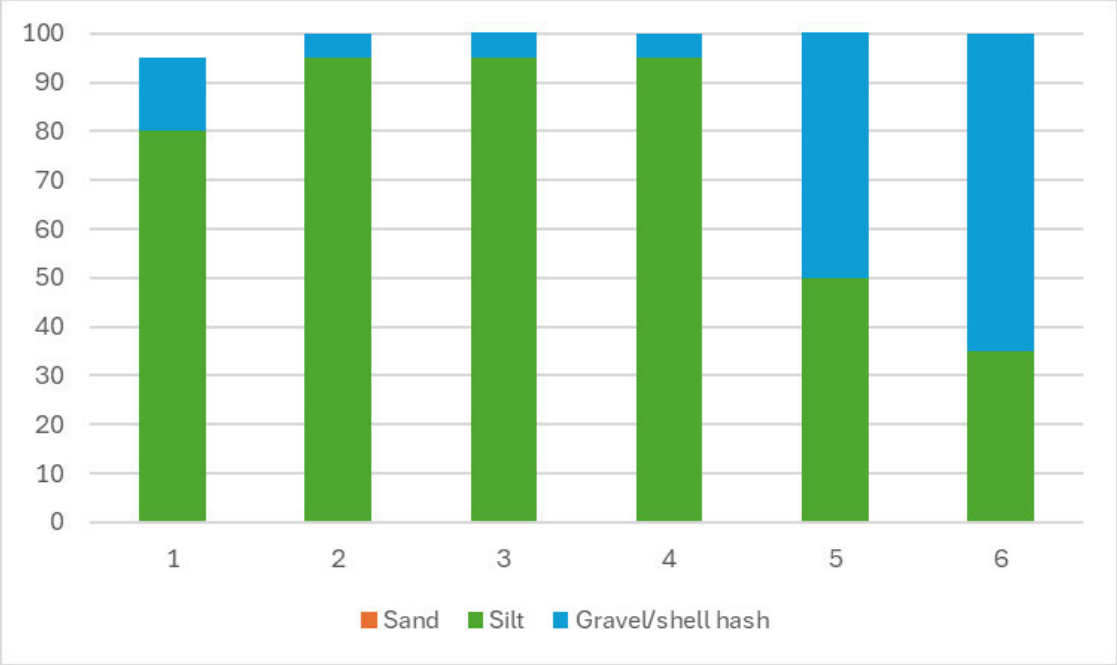


Figure 3.13. Percent cover type across each quadrat at the Middle 1 transect line in 2025.

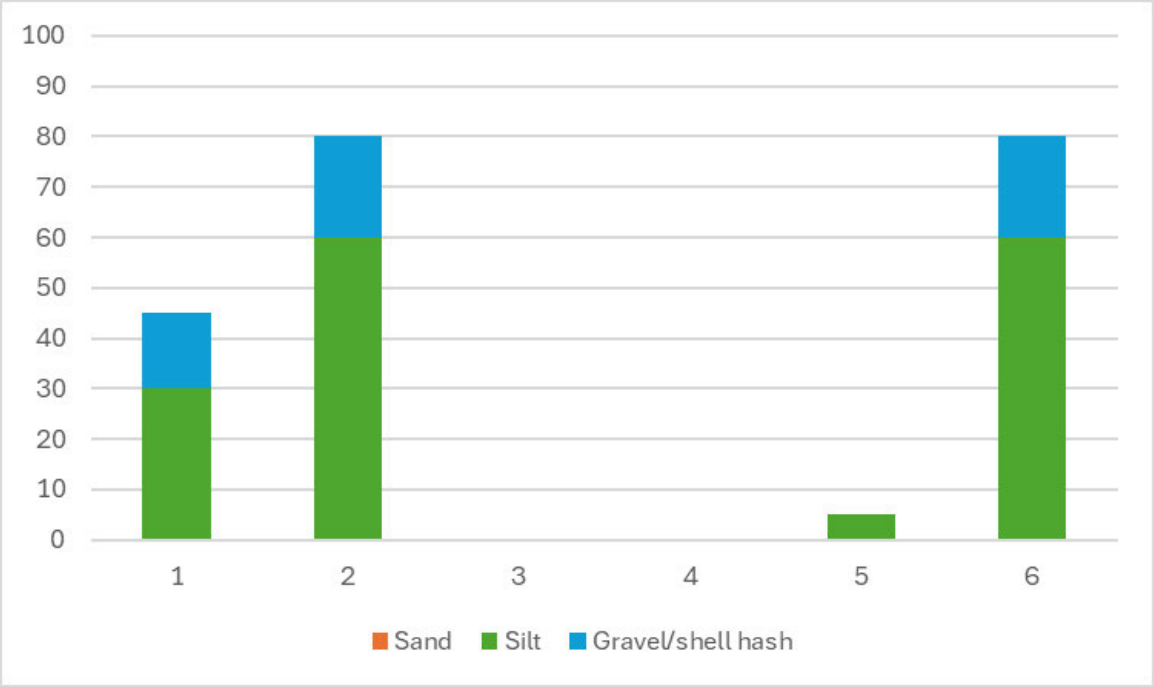


Figure 3.14. Percent cover type across each quadrat at the Middle 2 transect line in 2025.

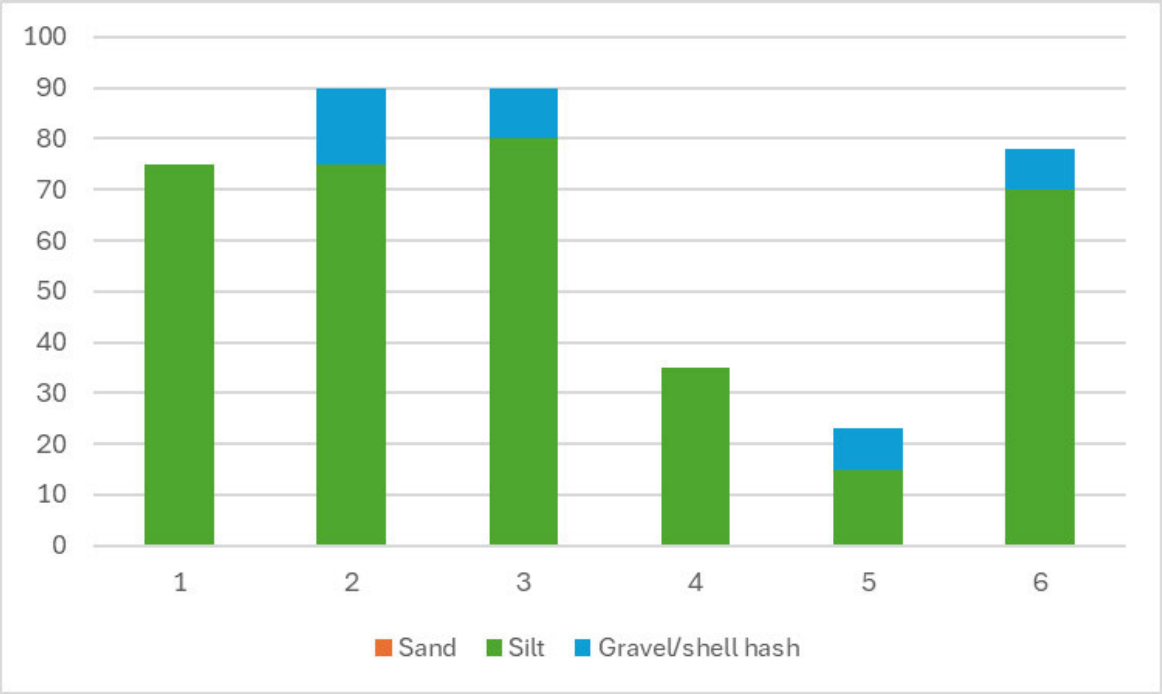


Figure 3.15. Percent cover type across each quadrat at the Low transect line in 2025.

The average silt depth for each quadrat across the reef was between 0 and 190 mm for both 2024 and 2025. The deepest sediment was recorded at the Middle 1 transect, with a depth of 190 mm in 2024 and 186 mm in 2025, with the deepest mud at the beginning of the transect line in both years, and a progressively shallower depth of silt out towards the edge of the reef. Results for the Low transect showed a consistently higher amount of silt across all quadrats in 2025 compared with

2024. Data for Middle 2 transect in 2024 was not included because the site was moved in 2025. 2025 data had an average silt depth per quadrat between 5 and 19 (Figure 3.16).

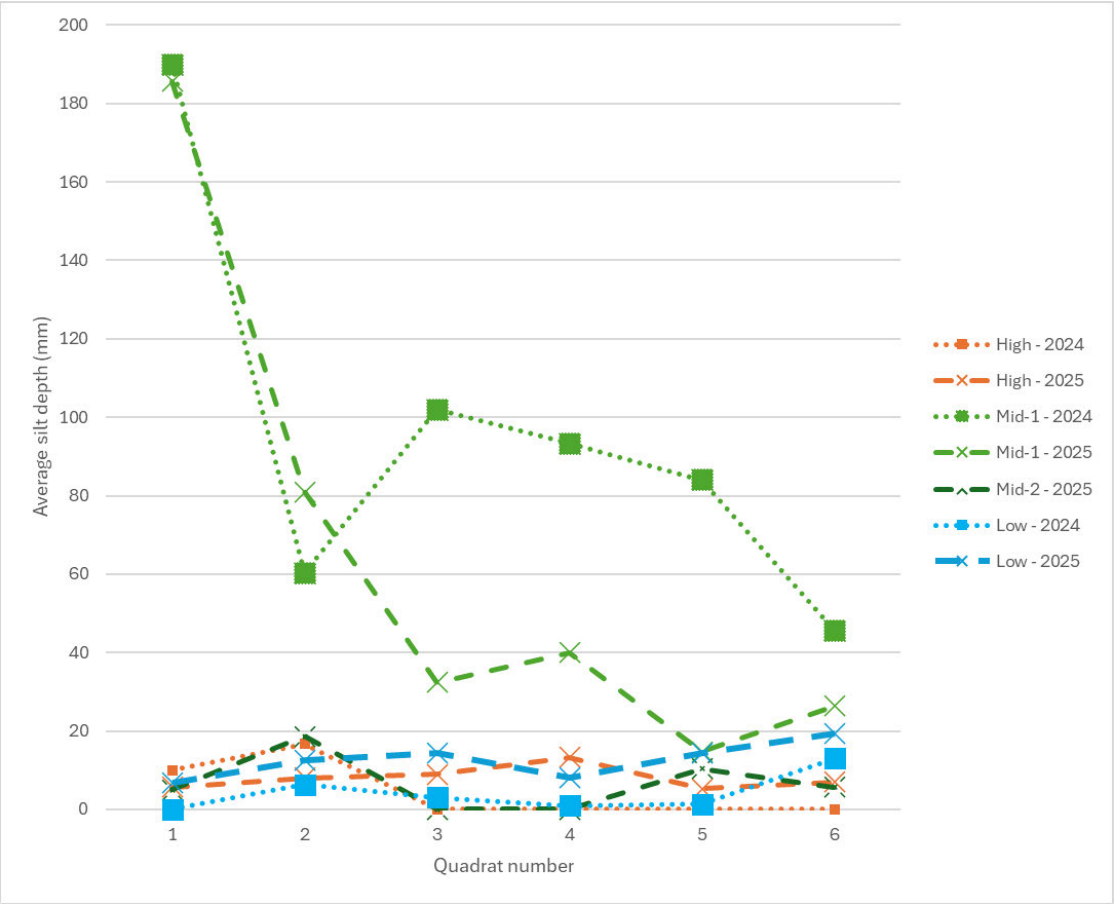


Figure 3.16 Silt depth for each quadrat across the High, Middle 1 and Low transect sites for 2024 and 2025.

4 Discussion

This report presents data for the second annual pre-discharge monitoring survey of the rocky reef site at Tokaroa Point carried out in October 2024 and 2025. Following Auckland Council rocky reef sampling methodology, four transect lines were established, and six quadrats placed randomly along the transect lines on alternating sides at approximately 2 – 3 m intervals. The transects were placed as follows: one at high tide, two at mid tide and one at low tide along Tokaroa Point reef. Monitoring within the quadrats included identifying, measuring and estimating percent cover for all marine species encountered. Overall, the two baseline sampling years showed both similarities and differences which are discussed further in sections 4.1 and 4.2 below.

Sediment monitoring indicated that silt is a persistent feature of the Tokaroa Point reef, with a significant increase in silt cover and depth recorded at the Low intertidal transect in 2025. As observed in 2024, sediment remained widespread across the reef in 2025, reflecting the sediment-influenced nature of the receiving environment. Aerial imagery collected during the 2025 SW REMP vegetation mapping surveys identified sediment plumes originating from the adjacent Awhitu catchment to the north of Tokaroa Point, where land use is predominantly zoned as mixed rural and rural coastal (Photograph 3.13; Photograph 3.14; Photograph 3.15 above and Photograph 4.1 below). These plumes appear to be transported via local hydrodynamic processes through a tidal channel north of the reef, with one channel arm directing sediment deposition directly onto the reef platform and another arm discharging into the main Waiuku channel, which also indirectly affects the reef. Collectively, these findings indicate that sediment dynamics are a key ecological driver influencing reef community structure at Tokaroa Point and are likely to contribute to the underlying spatial and temporal variability observed in benthic assemblages during baseline monitoring.

The 2024 and 2025 baseline surveys provide pre-wastewater treatment plant discharge observations of the ecological state of the Tokaroa Point reef.



Photograph 4.1: Tokaroa reef and associated sediment plume (Photo taken May 2025). The channel arm closest to the land discharges directly onto Tokoroa Point reef whilst another arm discharges into the main Waiuku channel which also indirectly affects the reef.

4.1 Mobile and sessile species distribution and abundance

The 2025 monitoring survey recorded a total of 19 species (seven sessile and 12 mobile), representing a reduction from 24 species (11 sessile and 13 mobile) recorded in 2024. This decline was driven primarily by reduced sessile species richness, particularly at the High and Low tidal height transects, while mobile species richness showed a slight overall increase. The Low transect continued to support the highest diversity of mobile species, reinforcing its importance as a biologically diverse zone within the intertidal gradient.

Changes in species richness between years were site-specific and differed between mobile and sessile assemblages. Mobile species richness remained stable at the High transect, declined slightly at the Low transect, and increased modestly at the Middle 1 and Middle 2 transects. The increase in mobile species at the Middle transects, particularly at Middle 1 where no mobile species were recorded in 2024, may reflect locally reduced sediment cover in 2025, and because of the Middle 2 site shift to a rockier location, increasing the availability of hard substrate and microhabitats suitable for mobile taxa.

In contrast, sessile species richness declined markedly at the Low transect (from 10 to four species) and more moderately at the High transect (from six to four species), while small increases were recorded at both Middle transects. These patterns suggest that sessile assemblages are more sensitive to changes in local habitat conditions, particularly sediment cover and depth, and may also reflect interannual variability in recruitment.

Community composition also shifted between years. In 2024, green filamentous algae dominated the muddy Middle 1 and Middle 2 transects, whereas in 2025 these algae were largely absent. The relocation of the Middle 2 transect to a rockier habitat in 2025 resulted in a shift from an algae-dominated assemblage to one characterised by bivalves and gastropods, consistent with a more reef-like environment. Across the reef, the barnacle *Austrominius modestus* became the most widespread sessile species in 2025, reflecting its tolerance of a wide range of intertidal conditions and its role as a key structuring species within sheltered harbour reefs (Hawkins, 2010).

Among mobile species, *Zeacumantus* sp. was the most abundant taxon in 2025, particularly at the Middle 2 transect, with size distributions consistent with those observed in 2024. These species play an essential role in intertidal communities, contributing to nutrient cycling and energy flow (Kamiya and Poulin, 2012). In 2024, the olive anemone (*Isactinia olivacea*) was highly abundant at the muddy Middle 2 site, reflecting its tolerance of sediment-influenced habitats. The shift in dominance from anemones in 2024 to gastropods and bivalves in 2025 likely reflects changes in local habitat conditions rather than a directional ecological trend.

Overall, the observed year-to-year changes in species richness, abundance, and dominance highlight the dynamic and patchy nature of intertidal reef communities at Tokaroa Point. Some of this variability is likely driven by natural fluctuations in sediment dynamics, habitat structure, and recruitment, while some may reflect small-scale spatial heterogeneity captured through random quadrat placement. These factors reinforce the need to consider natural variability when interpreting baseline patterns and support the recommendation for fixed quadrat locations in future monitoring to better resolve temporal trends.

4.2 Community composition

Marked shifts in community composition were observed between years. Sessile assemblages transitioned from being dominated by green filamentous algae in 2024 to bivalves and turfing algae in 2025. This shift represents a more reef-associated community structure and could be attributed to fluctuations in sediment and/or nutrients across the reef, alternating between sediment and rocky reef driven habitats and community structures. Mobile species assemblages also changed with a

shift to gastropod and bivalve species replacing anemones as the most abundant groups in 2025. Size structure analysis indicated spatial variation in population structures, which likely reflects differences in recruitment, growth and habitat suitability across tidal heights.

Non-metric multidimensional scaling (nMDS) was used to visualize benthic community patterns at Tokaroa Point reef across the two monitoring rounds (October 2024 and 2025). In 2024, sessile species showed similarities among sites, particularly between Middle transects, while mobile species displayed distinctness at Middle 1 compared to High, Middle 2, and Low sites.

The combined results of the two years of baseline reef monitoring indicate that benthic reef communities within the study area are spatially structured and broadly temporally stable so far. Multivariate analyses showed some site-specific patterns in community composition across monitoring years and some variation across locations, however, there was no obvious progressive degradation of the reef during the baseline period. Observed differences in assemblage structure are considered primarily attributable to natural spatial variability associated with site location and tidal elevation, and associated sediment pressure, rather than interannual variation.

PERMANOVA confirmed differences in community composition by transect and tidal height for both years. For sessile species, pseudo-F values were 6.26 (2024) and 6.16 (2025), and for mobile species, 6.15 (2024) and 4.96 (2025), all with $p = 0.001$, this statistical analysis supports spatial and tidal structuring of species on Tokaroa reef. The differences among tidal heights are consistent with rocky reef zonation, which is influenced by desiccation, immersion and wave exposure while the transect effects reflect the microhabitat heterogeneity. The residual variation implies patchiness within the tidal heights.

Compared to 2024, the 2025 SIMPER results show a shift in the dominant species driving dissimilarities between transect sites. In 2024, mobile species differences were largely influenced by *Isactinia olivacea*, with additional contributions from *Cominella virgata* and *Haustrum scobina*. In contrast, in 2025, mobile species variation was more evenly distributed among *Anthopleura aureoradiata*, *Cominella glandiformis*, *Cominella virgata*, and *Zeacumantus sp.*, indicating a broader range of influential taxa. For sessile species, 2024 results emphasized green filamentous algae, whereas 2025 was dominated by *Austrominius modestus*, with *Xenostrobus sp.* and coralline turf also contributing significantly.

5 Conclusions and recommendations

Two years of pre-discharge monitoring have provided useful information on the current state of Tokaroa Point Reef and its intertidal reef communities within the receiving environment of the Southwest Subregional Wastewater Treatment Plant discharge. Across both monitoring years, benthic community composition was consistently structured by tidal height and transect location, reflecting expected patterns of rocky reef zonation within a sediment-influenced harbour environment. Multivariate analyses (nMDS and PERMANOVA) confirmed statistically significant spatial differences among transects for both sessile and mobile species assemblages, indicating that the chosen transect locations appropriately capture the range of habitat conditions present across the intertidal gradient at Tokaroa Point.

Temporal comparisons between 2024 and 2025 indicate that reef communities exhibited notable interannual variability in species richness, abundance, and dominant taxa, particularly for sessile assemblages. Changes observed between years included the absence of green filamentous algae at the Middle transects in 2025, shifts in dominance towards barnacles, bivalves and turfing algae, and changes in mobile species assemblages from anemone-dominated to gastropod- and bivalve-dominated communities. At the High tidal transect, differences between years included reduced sessile species richness and increased dominance of barnacles in 2025, while mobile species richness remained relatively consistent. These temporal differences appear to reflect a combination of natural variability, sediment dynamics, and habitat patchiness rather than evidence of any clear directional trend or ecological degradation prior to commencement of wastewater discharges.

Interpretation of temporal variability is influenced by the patchy distribution of organisms across the reef platform and the random placement of quadrats along transect lines. As such, some of the observed year-to-year differences are likely attributable to small-scale spatial heterogeneity and microhabitat differences captured by quadrat placement, rather than true interannual change in community condition. This is further supported by high within-site variability identified in the statistical analyses.

The relocation of the Middle 2 transect in 2025 resulted in a site that is more representative of rocky reef habitat, with lower sediment cover and higher mobile species diversity. Accordingly, 2025 data for the Middle 2 transect should be utilised to establish a revised baseline for that site, with 2024 data retained for contextual purposes only.

Overall, information and data collected for Tokaroa Point Reef from monitoring over two years in 2024 and 2025, has shown some variability both across the reef and between years. This provides a starting point for future monitoring to compare against, and data to inform proposed refinement of the monitoring programme for future years to better account for spatial and temporal variability.

5.1 Recommendations for future monitoring

To strengthen the ability of the monitoring programme to detect post-discharge ecological change, the following recommendations are made:

- **Adopt fixed quadrat locations** along each transect for all future monitoring years. Fixed quadrats will reduce the influence of small-scale patchiness and improve confidence that observed changes reflect temporal trends rather than artefacts of quadrat placement.
- **Pool the 2024 and 2025 pre-discharge datasets** (excluding the relocated Middle 2 transect) to establish a more robust baseline envelope of natural variability against which post-discharge data can be assessed.
- **Use 2025 data only to define the baseline for the Middle 2 transect**, given its relocation to a more representative rocky reef habitat. 2024 data can still be used for broader context.

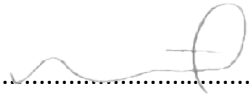
- **Maintain the existing transect layout across tidal heights**, as results indicate that transect placement is appropriate for capturing spatial variation across the reef and for distinguishing intertidal habitat-driven community differences.
- **Interpret future changes primarily on a temporal basis within each transect** and based on all four transects combined (rather than comparing between tidal heights), recognising that the key objective of the monitoring programme is to detect change over time associated with wastewater discharge operations.
- **Continue to record sediment cover and depth as key contextual variables**, as sedimentation is likely to be a major ecological driver influencing reef community structure at Tokaroa Point and will assist in distinguishing WWTP discharge-related effects from broader catchment-derived influences.

6 Applicability

This report has been prepared for the exclusive use of our client Watercare Services Ltd, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of an application for resource consent and that Auckland Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

Report prepared by:	Authorised for Tonkin & Taylor Ltd by:
	
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Melanie Tupe	Rob Van de Munckhof
Marine Ecologist	Project Director

This document has been Technically Reviewed by Marcus Cameron, Technical Director – Marine Ecology and Water Science

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Appendix A Summarised Auckland Council rocky reef monitoring protocols relevant to SW REMP sampling

Auckland Council Intertidal Rocky Reef Monitoring Methods – summarised for applicability to the SW REMP sampling.

Transect and quadrat placement

The reef platform is stratified into three zones, determined according to the tidal height on the shore (high, mid and low). One 20 m transect tape is run parallel to the shore through the centre of each zone and each transect permanently marked at both ends with a galvanized steel hex bolt embedded in the reef with epoxy. To better facilitate finding the sites again for resurvey, GPS coordinates are recorded for every bolt/transect start and end position and photographs taken with landscape features captured in the background. Photos of the entire transect and each individual quadrat sampled are taken at every site to provide a permanent visual record.

A 0.25 m^2 quadrat is used and quadrats are sampled on each side of the tape (shoreward and seaward) so that the edge of the quadrat runs along the tape. The 0.25 m^2 was considered adequate for all zones, however a backup 1 m^2 quadrate should be used to reduce the potential effects of small-scale patchiness on some intertidal reefs. 0.25 m^2 are adequate when there is greater homogeneity and low species diversity. If the location of a quadrat happens to encompass a rockpool, a new random location is selected because the species assemblages within rockpools differ from the surrounding reef.

Biological variables

Each 0.25 m^2 quadrat is divided into twenty-five 10 x 10 cm squares. The squares are used to visually estimate percentage cover of sessile and permanently attached organisms (such as algae, sponges, barnacles, mussels, oysters and ascidians). Counts of mobile invertebrates (mainly gastropods) are made for the whole quadrat. Without overturning rocks or removing sessile species, all visible mobile species > 5 mm are counted in the quadrat - except for small crustaceans, such as amphipods and isopods. Rock oysters are not identified to the species level due to difficulties separating the native oyster *Saccostrea glomerata* from the Pacific oyster *Crassostrea gigas* in the field.

Non-biological variables

Vertical relief is estimated for each quadrat by measuring the distance from the plane of the quadrat as it lies on the reef to the lowest point below the quadrat. The slope of the plot, or the vertical distance between the highest and lowest point in the quadrat, is measured by lifting the lowest edge of the quadrat to that it is approximately horizontal and then the distance between the quadrat and the reef at the point farthest from the reef is measured. Percentage cover of bare rock, silt (fine sediment), mud, sand, shell hash and gravel are estimated in the same manner as sessile organisms. The depth of silt, sand and mud is estimated by taking the average of three depth measurements made throughout the quadrat. Percentage surface water is estimated in the same manner as for sessile organisms and the maximum water depth found in the quadrat is also measured.

Appendix B Raw data

- **Raw data can be found in the supplemental spreadsheet.**

Table Appendix B.1: Physical variables for Tokaroa Point reef transect locations.

	Start location		End location												Sediment (% cover)			Sediment (avg depth mm)		
Site	Lat	Long	Lat	Long	Date	Recorder	Counter	Quadrat #	Distance along transect (m)	Quadrat size (m^2)	Distance from ocean (m)	Surface water cover (%)	Surface water max depth (cm)	Vertical relief (cm)	Bare space %	Sand	Fine silt	Gravel/shell hash	Sand	Fine silt	Gravel
Tokaroa Point High	37.143756	174.680441	37.143689	174.680253	20/10/2025	METU	SHLA, TYEA	1	0	1	452.4	15	7.4	43.8	65	0	30	0	0	5.67	0
Tokaroa Point High	37.143756	174.680441	37.143689	174.680253	20/10/2025	METU	SHLA, TYEA	2	3.5	1	452.4	20	4	17.1	70	0	70	0	0	8	0
Tokaroa Point High	37.143756	174.680441	37.143689	174.680253	20/10/2025	METU	SHLA, TYEA	3	6.5	1	452.4	2	0.3	12.4	90	0	40	0	0	9	0
Tokaroa Point High	37.143756	174.680441	37.143689	174.680253	20/10/2025	METU	SHLA, TYEA	4	9.5	1	452.4	5	0.26	9.3	85	0	30	0	0	13	0
Tokaroa Point High	37.143756	174.680441	37.143689	174.680253	20/10/2025	METU	SHLA, TYEA	5	12.5	1	452.4	10	1.6	9	85	0	30	0	0	5	0
Tokaroa Point High	37.143756	174.680441	37.143689	174.680253	20/10/2025	METU	SHLA, TYEA	6	16	1	452.4	50	3.4	12	45	0	50	0	0	7	0
Tokaroa Point Mid-1	37.141779	174.680838	37.141779	174.680838	20/10/2025	METU	SHLA, TYEA	1	0	1	225.4	0	0	29	80	0	80	Under fine silt	0	186	0
Tokaroa Point Mid-1	37.141779	174.680838	37.141779	174.680838	20/10/2025	METU	SHLA, TYEA	2	3.5	1	225.4	0	0	12	95	0	100	0	0	81	0
Tokaroa Point Mid-1	37.141779	174.680838	37.141779	174.680838	20/10/2025	METU	SHLA, TYEA	3	6.5	1	225.4	10	3	11	85	0	95	shell hash present	0	32	0
Tokaroa Point Mid-1	37.141779	174.680838	37.141779	174.680838	20/10/2025	METU	SHLA, TYEA	4	9.5	1	225.4	0	0	13	95	0	95	shell hash present	0	40	0
Tokaroa Point Mid-1	37.141779	174.680838	37.141779	174.680838	20/10/2025	METU	SHLA, TYEA	5	12.5	1	225.4	40	2.7	7	95	0	50	50	0	15	0
Tokaroa Point Mid-1	37.141779	174.680838	37.141779	174.680838	20/10/2025	METU	SHLA, TYEA	6	16	1	225.4	75	2.1	90	10	0	35	65	0	26	0
Tokaroa Point Mid-2	37.140455	174.681148	37.141264	174.681667	20/10/2025	METU	SHLA, TYEA	1	0	1	90.71	5	1.5	0	50	0	30	15	0	5	0
Tokaroa Point Mid-2	37.140455	174.681148	37.141264	174.681667	20/10/2025	METU	SHLA, TYEA	2	4	1	90.71	23	5.5	34	40	0	60	20 - shell hash as well	0	19	0
Tokaroa Point Mid-2	37.140455	174.681148	37.141264	174.681667	20/10/2025	METU	SHLA, TYEA	3	8	1	90.71	1	1.9	17.5	25	0	0	0	0	0	0
Tokaroa Point Mid-2	37.140455	174.681148	37.141264	174.681667	20/10/2025	METU	SHLA, TYEA	4	11.5	1	90.71	0	0	7	75	0	0	0	0	0	0
Tokaroa Point Mid-2	37.140455	174.681148	37.141264	174.681667	20/10/2025	METU	SHLA, TYEA	5	15.5	1	90.71	1	4.6	20	10	0	5	0	0	10	0
Tokaroa Point Mid-2	37.140455	174.681148	37.141264	174.681667	20/10/2025	METU	SHLA, TYEA	6	19.5	1	90.71	0	0	0	15	0	60	20-shell hash as well	0	6	0
Tokaroa Point Low	37.139922	174.681954	37.139836	174.681739	20/10/2025	METU	SHLA, TYEA	1	0	1	11.4	3	1.7	24	80	0	75	0	0	7	0
Tokaroa Point Low	37.139922	174.681954	37.139836	174.681739	20/10/2025	METU	SHLA, TYEA	2	3	1	11.4	0	0	25	40	0	75	15	0	13	0
Tokaroa Point Low	37.139922	174.681954	37.139836	174.681739	20/10/2025	METU	SHLA, TYEA	3	6	1	11.4	0	0	15	40	0	80	10	0	14	0
Tokaroa Point Low	37.139922	174.681954	37.139836	174.681739	20/10/2025	METU	SHLA, TYEA	4	11	1	11.4	4	3	9	40	0	35	0	0	8	0
Tokaroa Point Low	37.139922	174.681954	37.139836	174.681739	20/10/2025	METU	SHLA, TYEA	5	15	1	11.4	4	1	9	15	0	30	8	0	14	0
Tokaroa Point Low	37.139922	174.681954	37.139836	174.681739	20/10/2025	METU	SHLA, TYEA	6	18	1	11.4	0	0	16	70	0	65	8	0	19	0

Appendix C Quadrat photos

C1 Tokaroa Point Reef - High transect quadrat photos.



Photograph Appendix C.1: Quadrat 1.



Photograph Appendix C.2: Quadrat 2



Photograph Appendix C.3: Quadrat 3



*Photograph Appendix C.4:*Quadrat *4*



Photograph Appendix C.5: Quadrat 5



Photograph Appendix C.6:Quadrat 6

C2 Tokaroa Point Reef - Middle 1 transect quadrat photos.



Photograph Appendix C.7: Quadrat 1



Photograph Appendix C.8: Quadrat 2



Photograph Appendix C.9: Quadrat 3



Photograph Appendix C.10: Quadrat 4



Photograph Appendix C.11: Quadrat 5



Photograph Appendix C.12: Quadrat 6

C3 Tokaroa Point Reef - Middle 2 transect quadrat photos



Photograph Appendix C.13: Quadrat 1



Photograph Appendix C.14: Quadrat 2



Photograph Appendix C.15: Quadrat 3



Photograph Appendix C.16: Quadrat 4



Photograph Appendix C.17: Quadrat 5



Photograph Appendix C.18: Quadrat 6

C4 Tokaroa Point Reef - Low transect quadrat photos



Photograph Appendix C.19: Quadrat 1



Photograph Appendix C.20: Quadrat 2



Photograph Appendix C.21: Quadrat 3



Photograph Appendix C.22: Quadrat 4



Photograph Appendix C.23: Quadrat 5

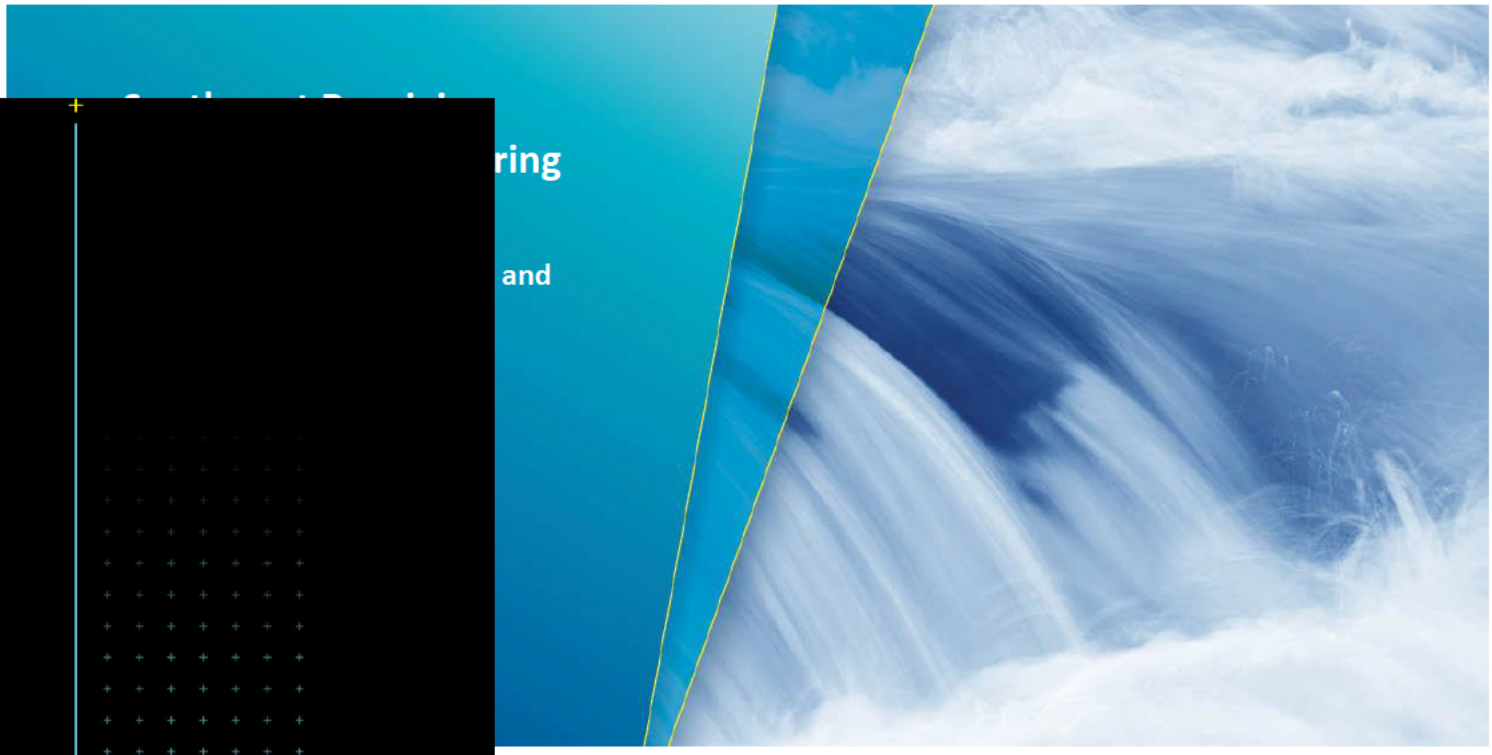


Photograph Appendix C.24: Quadrat 6

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REPORT

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Table of contents

Glossary of terms **ii**

Executive summary **i**

1 Introduction **3**
- 1.1 Background and purpose 3
- 1.2 Manukau Harbour vegetation 5
  - 1.2.1 *Gracilaria* spp. 5
  - 1.2.2 *Ulva* spp. 6
  - 1.2.3 Seagrass 7

2 Methodology **9**
- 2.1 Image acquisition 9
  - 2.1.1 Weather 10
  - 2.1.2 Tides 10
  - 2.1.3 Flight decision tree 12
  - 2.1.4 Camera specifications 12
  - 2.1.5 Flight specifications 14
  - 2.1.6 Orthomosaic creation 15
- 2.2 Ground truthing 15
  - 2.2.1 UAV imagery acquisition 16
  - 2.2.2 Ground truthing from the land 16
  - 2.2.3 Ground truthing from the ocean 17
  - 2.2.4 Manual image classification for *Ulva* spp. and *Gracilaria* spp. 18
- 2.3 Vegetation classification 18
  - 2.3.1 Automated image classification 18
  - 2.3.2 *Ulva* spp. and *Gracilaria* spp. image classification 20

3 Results **20**
- 3.1 Imagery processing 20
- 3.2 Ground truthing surveys 21
  - 3.2.1 Ground truthing from land 21
  - 3.2.2 Ground truthing from the ocean 26
  - 3.2.3 Additional observations 28
- 3.3 Vegetation classification 29
  - 3.3.1 Habitat coverage extents 30
  - 3.3.2 *Ulva* spp. and *Gracilaria* spp. detection 32
  - 3.3.3 Marine vegetation imagery classification limitations 35

4 Nutrient budget contribution and modelling **36**

5 Project summary **38**
- 5.1 Future recommendations 38

6 Applicability **40**

7 References **41**

Appendix A **Orthomosaics**

Appendix B **Marine vegetation and habitat classification**

Appendix C **Locations of Ulva spp. and Gracilaria spp. detected during ground truthing surveys**

Appendix D **Imagery collected during ground truthing surveys**

Glossary of terms

Area of interest: the area for aerial survey as identified by Townsend et al (2016) in the SW REMP

CD: Chart datum

GCP: Ground control point

Focused survey area: reduced aerial survey area as agreed with Auckland Council

GSD: Ground sampling distance

MHWS: Mean high water spring

MSL: Mean sea level

MSL: Mean sea level zero

Orthomosaic: A detailed map which stiches numerous overlapping photographs that have been corrected for topographical relief, lens distortion and camera tilt.

RGB: Red, green, blue

SW REMP: Southwest Receiving Environment Monitoring Programme

UAV: Unmanned Automated Vehicle

WWTP: Wastewater treatment plant

Executive summary

Intertidal vegetation monitoring was undertaken between December 2024 and April 2026 in accordance with the Southwest Receiving Environment Monitoring Programme (SW REMP) required by Resource Consent conditions. The monitoring incorporated seasonal aerial imagery acquisition, image classification, and ground-truthing surveys to establish a baseline against which future ecological changes can be assessed following commencement of the new Clarks Beach Wastewater Treatment Plant (WWTP) outfall, scheduled to become operational in May 2026.

Several methodological refinements were implemented during the programme with the agreement of Watercare Services Ltd (Watercare) and Auckland Council, including adjustments to aerial survey optimum flying conditions, refinement of the survey area to improve image resolution, and modifications to flight specifications to improve orthomosaic generation and marine vegetation detection. These changes were made to optimise data quality while maintaining alignment with the intent of the approved SW REMP methodology.

A total of eight seasonal aerial surveys were originally anticipated over the two-year baseline period (July 2024 – June 2026). Of these, two surveys (Winter and Spring 2024) were not flown because suitable combinations of low tide, daylight hours and weather conditions could not be achieved. Aerial imagery collected in one round could not be used for habitat classification because orthomosaic quality was compromised by insufficient image overlap and lighting conditions. Consequently, five surveys (December 2024, May 2025, July 2025, March 2026 and April 2026) were available for vegetation classification and quantitative habitat assessment.

Aerial imagery collection successfully captured images that were used to create an orthomosaic and map seagrass throughout the focus survey area. Aerial imagery was not suitable for mapping the extent and presence of nuisance macroalgae *Ulva* spp. and *Gracilaria* spp., which was instead achieved using imagery collected in ground truthing surveys using an UAV.

The monitoring demonstrated that the southern Manukau Harbour baseline is characterised by an extensive and well-established seagrass meadow centred on Clarks Beach, relatively stable mangrove habitat, and variable but generally low levels of nuisance macroalgae. To ensure habitat coverage could be compared consistently between years, all vegetation analyses were undertaken within a focused survey area representing the area common to all processed surveys. This approach removed anomalies associated with differences in aerial survey coverage and enabled direct comparison of habitat extent through time.

Within the focused survey area, mangrove extent remained consistent throughout the monitoring period, varying between 204 and 229 ha (11–12% cover) over the 2-year monitoring period. Seagrass extent displayed greater temporal variability, ranging from 153 to 303 ha (8–16% cover) with the majority of this found within the seagrass bed at Clarks beach. The highest extent coverage was recorded in May 2025 and lowest extent coverage observed during March 2026. While this variation may reflect seasonal and interannual influences, no consistent trend of increasing or decreasing seagrass extent was evident over the baseline monitoring period.

Aerial imagery and classification processing did not identify extensive blooms of *Ulva* spp. or *Gracilaria* spp. Ground-truthing surveys, however, confirmed the presence of both species at several locations throughout the monitoring area. These occurrences were generally limited to small patches or individual plants below the detection threshold of the aerial imagery and were occasionally seen interspersed within seagrass beds, such as at Clarks beach. *Ulva* spp. were identified during each ground truthing survey at Glenbrook beach and showed some seasonal variation, with the highest extent coverage in July 2025 (57.6 ha), and the smallest in March 2026 (0.7 ha).

The results indicate that, prior to commencement of the new WWTP discharge, intertidal vegetation communities within the survey area were dominated by stable mangrove habitat and an extensive seagrass bed, with nuisance macroalgae occurring at low abundance and of limited spatial extent.

Future intertidal vegetation surveys should be assessed against this baseline and interpreted alongside information from other SW REMP monitoring components, including water quality, sediment quality and nutrient monitoring. Consistent with the SW REMP requirements, future changes in seagrass, and nuisance macroalgal extent will be evaluated in relation to the catchment nutrient budget and the relative contribution of nutrients from the WWTP discharge. This multiple-lines-of-evidence approach will support interpretation of observed ecological changes and help distinguish natural variability from potential wastewater-related effects over time.

This report identifies a number of potential opportunities to refine the vegetation mapping process in the future, including:

- Continue the aerial imagery collection as it was effective for mapping seagrass distribution, however it was unable to detect and classify *Ulva* spp. and *Graciliara* spp. due to methodological limitation.
- More frequent UAV surveys, combined with field verification, could be more effective for identifying presence and extent or nuisance macroalgae.
- A reduced aerial imagery programme may be sufficient for tracking broad-scale changes in seagrass extent.
- Collection of more regular imagery to increase the chance of blooms being identified

1 Introduction

1.1 Background and purpose

Watercare Services Limited (Watercare) holds Resource Consents (CST60082600 and CST60082302) for the Southwest Subregional Wastewater Treatment Plant which mandates the development and implementation of a Southwest Receiving Environment Monitoring Programme (SW REMP) (Condition 27).

Under Condition 27 Watercare is required to implement a Receiving Environment Monitoring Programme (REMP). The REMP is designed to detect and evaluate long-term trends in water quality, sediment quality, shellfish health, marine vegetation and marine benthic ecology within the southern Manukau Harbour, specifically in relation to the discharge of treated wastewater from the newly consented Clarks Beach outfall. It outlines the monitoring protocols and management actions necessary to meet the consent conditions for the discharge into the Waiuku Estuary, with operations expected to commence in May 2026.

In accordance with the Resource Consent conditions, environmental monitoring protocols were established by Watercare Services Limited and approved by Auckland Council. Tonkin & Taylor Ltd (T+T) was engaged to complete two components of this monitoring programme which relate to Condition 27 (b)(v) reef monitoring (reported separately in the Southwest Receiving Environment Monitoring Programme – Reef Monitoring report 2026) and Condition 27 (b)(xii) monitoring of spatial and temporal extent of algal blooms (this report).

> "*Vegetation mapping, utilising aerial imagery, will focus primarily on identifying nuisance red algae (Gracilaria* spp.*), nuisance sea lettuce (Ulva lactuca), and seagrass (Zostera muelleri) using manual or automated techniques in ARC-GIS. Changes in time, such as increases in Gracilaria* spp. *coverage and decreases in seagrass, will be assessed in relation to the nutrient budget of the catchment and the potential increasing contribution from the WWTP"*

The area of interest identified in the SW REMP has been derived from a previous report completed by Townsend et al. (2016) (Figure 1.1) was put forward as the area of focus for the monitoring programme. The area covers a large expanse of approximately 150 km^2 stretching from Waiuku township in the south to Big Bay in the north and from Clarks Beach in the west to Kingseat in the east. The area of interest encompasses estuaries, sandy intertidal flats, and shallow subtidal flats (Townsend et al., 2016).

The monitoring methodology within the SW REMP includes collection of aerial imagery using a fixed wing plane, and ground truthing utilising an UAV and boat to confirm the presence of marine vegetation. Mapped vegetation is then verified using automated and manual techniques in Arc GIS to identify and report changes in marine vegetation coverage over the course of the 2-year monitoring period.

This report presents these results to create a baseline from which to determine if any discernible effects to marine vegetation coverage occurs following the commencement of discharges from the new Southwest Subregional Wastewater Treatment Plant outfall in May 2026.

The works have been undertaken as per contract 24-309-ESP between Watercare and T+T dated 22 July 2024.



Figure 1.1 Area of interest within the potential receiving environment of the Southwest Subregional Wastewater Treatment Plant discharge (red polygon) (Townsend et al., 2016). The location of the existing Clarks Beach Wastewater Treatment Plant (yellow box), and the proposed outfall location is shown with a yellow diamond.

1.2 Manukau Harbour vegetation

The SW REMP identifies key species in determining potential effects associated with the area of interest as the area that could have potential effect from the discharge. These species, seagrass (*Zostera* muelleri) and the nuisance red algae *Gracilaria spp*. and the green algae *Ulva* spp. (Greenfield et al., 2016) are commonly found in the Manukau Harbour and blooms can occur largely in response to human-induced environmental changes (eutrophication in particular), although they can also be linked to natural seasonal variation (Greenfield, et al., 2016).

The section below describes each of the three species of focus for the SW REMP consent monitoring, noting that mangroves are also present throughout the harbour and were included in vegetation mapping to provide additional context, but are not described in detail here.

1.2.1 *Gracilaria* spp.

Three species of the genus *Gracilaria* are found within the Manukau Harbour. *Gracilaria chilensis* is considered native to New Zealand (Guillemin et al., 2014) and is a key component of macroalgal blooms in the harbour. Two other red algae which are morphologically similar to *G. chilensis* have been identified.

The source of one of these species is yet to be identified and a species name assigned, however, a *Gracilaria* sp. was found in samples through restriction enzyme digest patterns of PCR amplification products of the nuclear ribosomal cistron (Candia et al., 1999). *Gracilaria* sp. is considered to be an introduced species to New Zealand based on its limited distribution, solely in the Manukau Harbour, Orakei Basin in the Waitematā harbour and the Kaipara harbour (Nelson, et al. 2015). Reproduction of all *Gracilaria* spp. is thought to occur via spores and algal fragments (Nelson, et al., 2015).

A third red algae species, *Solieria* sp. is also found within the Manukau harbour and generally cannot be distinguished from *Gracilaria* spp. morphologically, but living specimens can be by the live colour which is a reddish pink colour for *Solieria* sp. compared to *Gracilaria* spp. which is a dark brownish red to black (Nelson et al., 2015).

Blooms of *Gracilaria chilensis* in Manukau Harbour can be extensive, with large accumulations forming in sheltered, depositional areas. These blooms are considered widespread and have been documented across multiple regions in New Zealand. While exact measurements vary seasonally and spatially, blooms can cover hundreds of hectares, particularly during periods of elevated nutrient input and calm conditions (Nelson et al., 2015). *Gracilaria* spp. blooms in Manukau Harbour can last for weeks to months, especially during summer when nutrients and warmth peak. In sheltered areas with limited water movement, blooms can accumulate and persist longer, sometimes becoming semi-permanent features during favourable conditions (Nelson, et al., 2015).

The overgrowth of *Gracilaria* spp. can smother seagrass, deplete oxygen, and reduce biodiversity. While it has bioremediation potential, excessive blooms, like those seen in the Manukau Harbour, generally indicate ecological imbalance and degraded water quality (Robertson and Stevens, 2012).



Photograph 1.1: Gracilaria/ Solieria (Kelly et al., 2021).



Photograph 1.2: Gracilaria spp. (Kelly, et al., 2021).



Photograph 1.3: Gracilaria spp. (Photo M. Wilcox in Nelson et al., 2015).

1.2.2 *Ulva* spp.

Ulva spp. are known for its ability to grow rapidly and form blooms to nuisance quantities considered to be indicative of nutrient enrichment (Stevens and Roberston, 2013). *Ulva* spp. are physiologically resilient to stress from wide ranging light and salinity conditions (Raffaelli et al., 1998; Schramm 1999), and growth on an area of shore is often limited only by availability of suitable substrate (Raffaelli et al., 1998).

Ulva lactuca plays a vital ecological role as a primary producer, supporting marine food webs and oxygenating coastal waters. However, its rapid growth under nutrient-rich conditions can lead to dense blooms that reduce biodiversity, smother habitats, and disrupt local ecosystems. These blooms may persist for weeks to months, depending on environmental factors (Peter, et al. 2024).

High levels of nutrient enrichment can result in increased primary production and nuisance levels of opportunistic algae such as *Ulva* spp. (Townsend, et al., 2016). Nineteen species of *Ulva* have been identified to the species level based on morphological and genetic data. Commonly *Ulva lactuca* is referred to as the dominant species, but Nelson et al., 2015 noted that this has been a general misapplication and there are often more than one *Ulva* species involved in blooms. *Ulva* spp. reproduce by prolific spore and gamete production as well as through fragmentation (Nelson et al., 2015).



Photograph 1.4: Ulva (bright green strip) at Karaka Point identified during Auckland Council marine ecology monitoring in October 2017 (Greenfield et al., 2019).



Photograph 1.5: Tokaroa point Ulva bloom (image supplied from Shane Kelly, January 17 2025).



Photograph 1.6: Subtidal Ulva accumulations, Otago Harbour (photo R D'Archino) (Nelson et al., 2015).

1.2.3 Seagrass

Seagrass in New Zealand is distributed extensively from Parengarenga Harbour in the north to Stewart Island in the south, predominantly occupying intertidal zones within estuaries and shallow bays. The sole species present, *Zostera muelleri*, is indigenous to New Zealand and southern parts of Australia. Seagrass forms both intertidal and subtidal meadows, with subtidal assemblages supporting greater macrofaunal density, biomass, and productivity compared to intertidal beds (Morrison et al., 2014).

Seagrass meadows are ecologically significant biogenic habitats, contributing to primary production, structural complexity, and nutrient cycling (Hailes, 2006). Their productivity is enhanced by interactions with epiphytes, sediment dynamics, and diverse invertebrate communities, which in turn support a wide range of benthic organisms and provides habitats and nurseries for mobile species such as crabs, shrimps, juvenile fish, and squid (Hailes, 2006; Morrison et al., 2014).

The spatial extent of seagrass varies considerably, ranging from small patches of a few metres to expansive meadows covering several kilometres with primarily clonal reproduction. Historically, seagrass meadows in Manukau Harbour were extensive, with beds exceeding one mile in width during the late 1960s (Morton and Miller, 1973). However, significant declines occurred in subsequent decades, potentially linked to fungal infection by *Labyrinthula* (Henriques, 1977 in Kelly, 2008). By the mid-1970s, seagrass coverage in the harbour had reduced to 171 hectares, representing 1.2% of the intertidal area of the harbour. Native seagrass *Zostera muelleri* which has known beds within the Project area (Greenfield et al., 2016; Hart et al., 2025)

Seagrass at Clarks Beach has previously been classified as the largest seagrass meadow within the Manukau Harbour, accounting for 72% of the total seagrass area in the harbour (Kelly, 2008). Seagrass loss is a key indicator of eutrophication, while expansion suggests improving environmental conditions (Kelly, 2021). Declines are attributed to multiple anthropogenic stressors, including nutrient, contaminant and sediment inputs from septic systems, land use change, stormwater and stream discharges, hydrodynamic transport of pollutants, and marine vessel effluent (Matheson et al., 2010). Additional pressures include disease, intense grazing (Anderson et al., 2019), and climate change-related impacts such as coastal squeeze, elevated temperatures, and increased turbidity (Kettles and Bell, 2016).



Photograph 1.7: Seagrass meadows at Mill Bay northeast Manukau Harbour (Photo credit: M. Tupe, April 2023).



Photograph 1.8:Seagrass meadow at Clarks Beach (Photo taken, February 2025).



Photograph 1.9: Seagrass meadows at Clarks Beach (Photo collected using a UAV, March 2026).



Photograph 1.10: Density of seagrass meadows at Clarks Beach (Photo collected using a UAV, March 2026).

2 Methodology

Over a two-year period prior to the WWTP discharge commencing, the vegetation surveys aim to collect seasonal imagery to map seasonal variation in vegetation coverage to identify if there are specific time periods with lower or higher coverage. To collect this information aerial imagery was captured seasonally during optimum conditions (Figure 2.2).

Imagery collection was undertaken via aerial survey with a fixed-wing aircraft equipped with RGB and multispectral cameras. Methods are outlined in Section 2.1 below, with subsequent ground truthing surveys undertaken with a UAV to validate the aerial imagery (Section 2.2). The imagery is processed to create an orthomosaic image which is used for vegetation classification (Section 2.1.6 and 2.3.1).

2.1 Image acquisition

The collection of aerial imagery for mapping vegetation expanse within the southern Manukau harbour was carried out using a lightweight single-engine plane, equipped with a RGB camera (Canon EOS R5) and a multispectral camera (MicaSense Red Edge-M), to collect imagery within specified optimum conditions. Meeting optimum conditions was challenging due to limited low tides under 0.8 m chart datum (CD) during daylight hours that coincided with good weather days and minimal cloud cover. As such, only two of the four planned surveys were completed in the July 2024 – June 2025 year (Table 2.1).

Discussion regarding the specified optimum conditions was undertaken with Watercare and Auckland Council over April/May 2025 to determine conditions that are more feasible, whilst still providing a suitable quality and extent of imagery collection. In the July 2025 – June 2026 year, the four planned surveys were conducted. For these surveys, upon agreement from Watercare and Auckland Council[1] the coverage area was reduced so that higher resolution orthomosaics could be created with the aim to identify *Ulva* spp. and *Gracilaria* spp. (refer to Figure 2.3 for the area of interest as outlined in SW REMP and smaller focused survey area).

The dates and times of the surveys conducted are included in Table 2.1.

Table 2.1: Survey dates and times and weather at the time of survey

Season	Date	Time	Weather
Winter 2024	No survey conducted due to challenges identifying a good weather window that also met the low tide condition of <0.8 m CD.		
Spring 2024			
Summer 2024/2025	18 December 2024	7:00 am – 10:30 am	10 knot southerlies. No cloud cover. No rain.
Autumn 2025	24 May 2025	11:30 am – 3:30 pm	5 knot easterlies. Light scattered low cloud cover (<10%). No rain.
Winter 2025	23 July 2025	1:00 pm – 5:00 pm	2 knot southerlies. No cloud cover. No rain.
Spring 2025	4 November 2025	3:00 pm – 6:30 pm	4 knot southwesterlies. No cloud cover. No rain.

[1] Meeting (26 February 2025) REMP Veg Mapping attended by Leon Blackburn, Tarn Drylie, Laurent Daghdevirenian, Peter Quilter

Season	Date	Time	Weather
Summer 2025/2026	7 March 2026	8:00 am – 11:30 am	4 knot southwesterlies. No cloud cover. No rain.
Autumn 2026	30 April 2026	1:00 pm – 4:30 pm	5 knot southeasterlies. Light scattered high cloud cover (<10%). No rain.

2.1.1 Weather

The SW REMP identifies the following weather conditions as being optimum for aerial surveys:

> *'Consistent lighting conditions are required for the duration of the aerial flight to ensure minimal change in image exposure. Image capture will be required to take place during daylight hours where the sun angle is minimally changing during the aerial flight. Times of consistent lighting conditions would also require or include minimal cloud cover, minimal wind (due to wind wave reflection in subtidal habitats), or alternatively full cloud cover. An assessment of these conditions closer to the suitable image capture days will be required to determine whether the image capture flight is undertaken, or an alternative day is chosen.'*

Section 2.1.3 describes how the above weather conditions fit into the overall decision process for proceeding with a flight. The weather during the surveys is summarised in Table 2.1.

2.1.2 Tides

The SW REMP identifies the following preferred tidal range as being suitable for aerial surveys:

> *"Images will be collected at the time of low water (ideally spring low water) when the sand and mudflats are exposed. To ensure as much intertidal habitat is exposed during the imagery capture flight, a spring low tide will be targeted, and if not possible a low tide less than 0.8 m (Townsend, et al., 2016)"*

Potential low tides were identified if the low tide was less than 0.8 m CD (-1.6 m MSL0[2]).

To provide further opportunities for intertidal surveys, the average water depth over the survey window was also considered, enabling selection of days that maximised intertidal exposure and overall survey quality. This approach provided for more days with low tides coinciding with sufficient daylight hours, particularly in winter where many low tides occur during darkness. Additional survey days could be considered where the average water level over the four-hour survey window was less than 1.3 m CD (approximately -1.1 m MSL), provided that the timing of low tide occurred at least one hour after sunrise or one hour before sunset.

This approach was agreed following conversations with Watercare and Auckland Council on 26 February 2025[1].

This provision allowed additional survey days to be considered where the average water level over the four-hour survey window was less than 1.3 m CD (approximately -1.1 m MSL), provided that the timing of low tide occurred at least one hour after sunrise or one hour before sunset. This ensured sufficient daylight was available to undertake surveys on both the ebb and flood tide, maximising

[2] Mean Sea Level Zero (MSL0) is a specific tidal datum that is often used as a reference point for nautical charts and tidal predictions. It's derived from Mean Sea Level (MSL) but may have a slight offset to align with other tidal datums like LAT (Lowest Astronomical Tide).

intertidal exposure during the survey period. The tide cycles during the flights are shown in Figure 2.1.

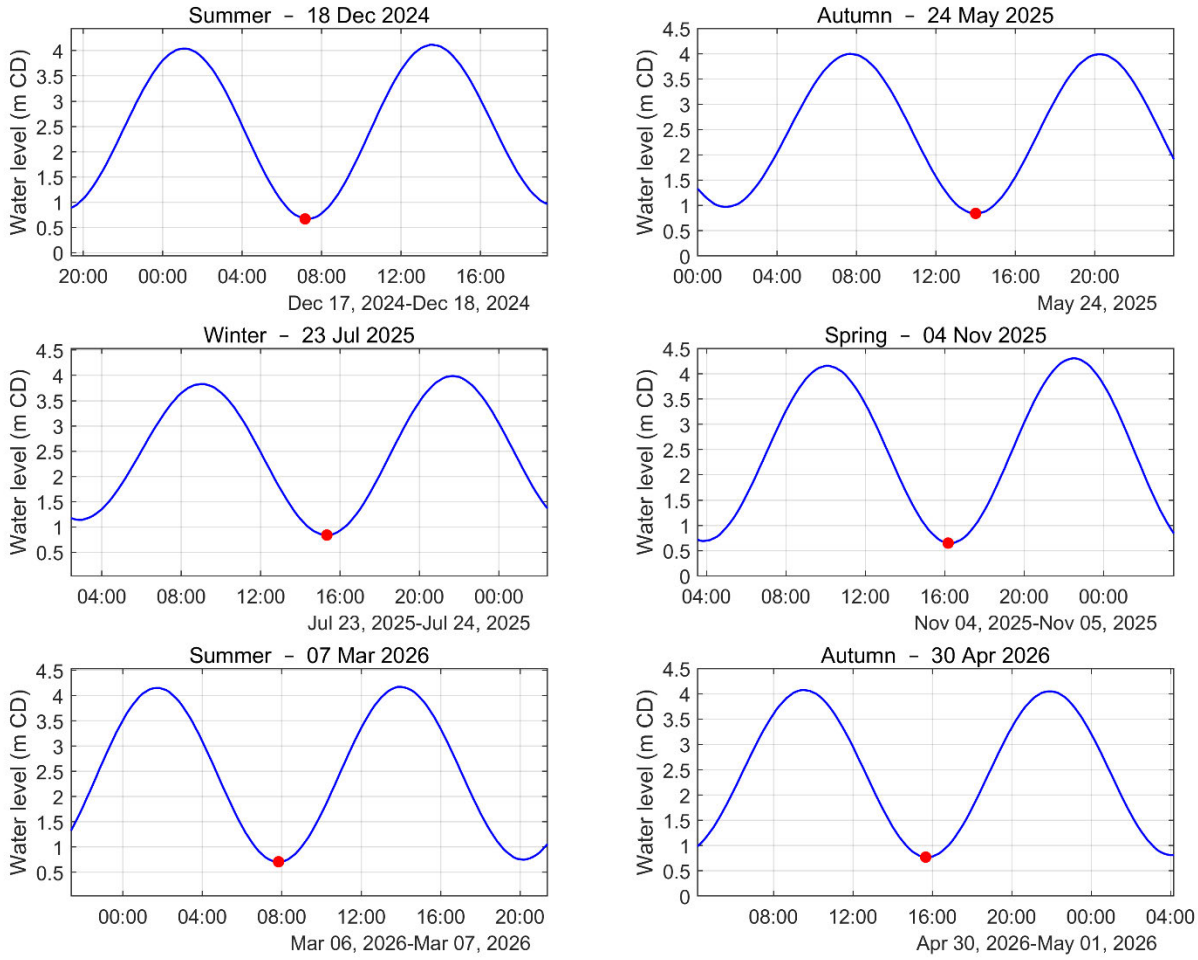


Figure 2.1: Tide cycles at latitude = -37.145, longitude = 174.698, source: NIWA tides.

2.1.3 Flight decision tree

A decision tree for conducting a flight is shown in Figure 2.2, based on the optimum flight conditions defined in the SW REMP and following approved modifications to optimum conditions as mentioned above. To optimise survey coverage and quality, the joint occurrence of the following variables needs to be considered:

1 Consistent lighting conditions are required for the duration of the aerial flight to ensure minimal change in image exposure. This requires minimal (<10%) cloud cover.

2 Image capture during daylight hours where the sun angle is minimally changing during the aerial flight, defined by sun angles are less than 15 degrees from the horizon.

3 During spring low tides, when low water levels are less than 0.8 m CD (-1.6 m MSL)

4 Avoiding windy conditions that reduce visibility in shallow submerged areas.

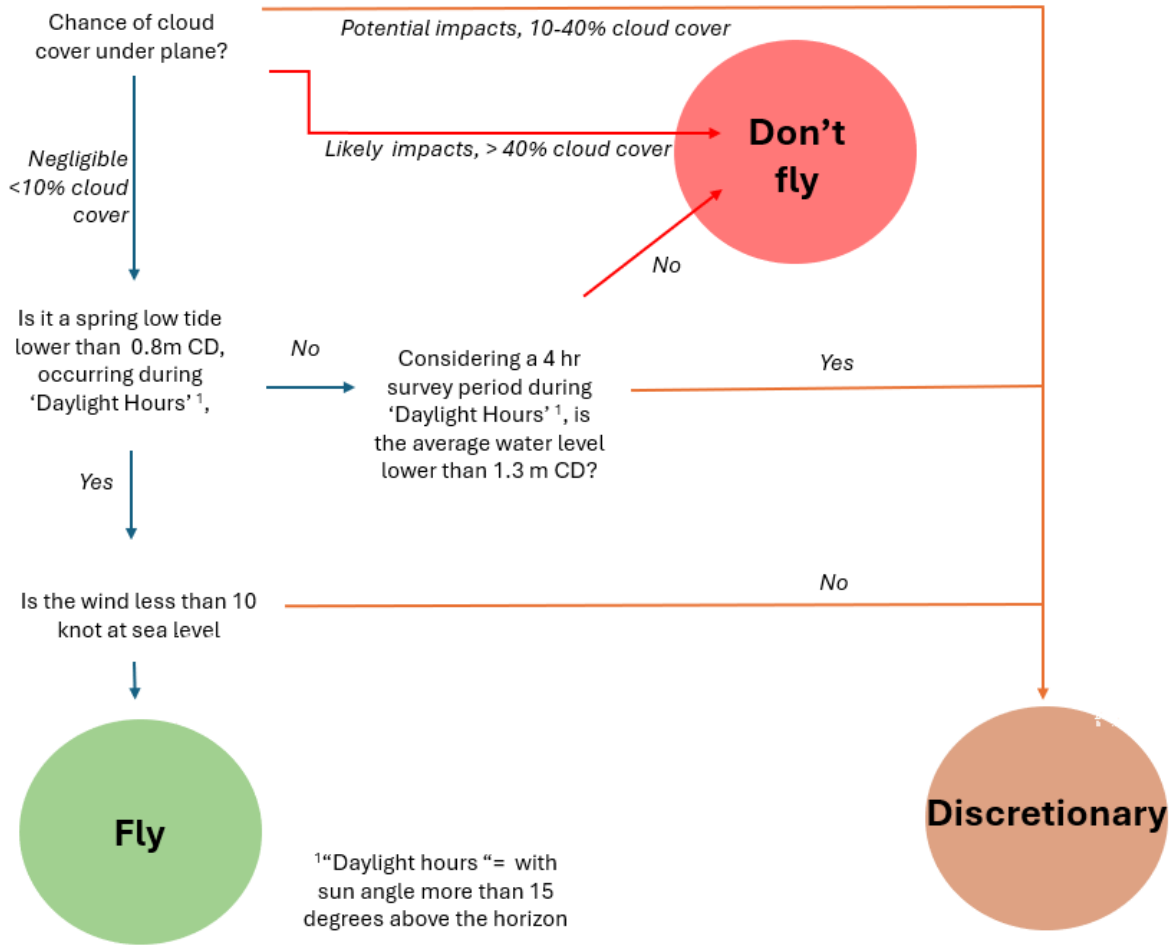


Figure 2.2: Decision tree for whether to fly or not.

2.1.4 Camera specifications

The Canon camera details are summarised in Table 2.2 below. The Canon (RGB) camera provides high resolution imagery.

Lower resolution multispectral imagery (1280 x 960 pixels) was collected in the first two surveys to enable alternative and complementary image processing tools. The multispectral lenses capture data

across multiple wavelengths (e.g., visible, near-infrared, shortwave infrared), allowing for differentiation between materials or features that may appear similar in standard imagery. In this setting these differences can infer changes in sediment type, levels of saturation, chlorophyl (i.e., plants/marine vegetation). Given the lower resolution of the multispectral camera, it did not improve the ability to map *Gracilaria* spp., *Ulva* spp. and seagrass compared to the high Canon resolution. As a result, multispectral imagery was not captured in subsequent surveys.

Table 2.2: Camera specifications

Camera	Image resolution	Approximate GSD (m.pixel) @3000 m	Shutter type	Exposure type	Bit depth	Spectral wavelength
MicaSense Red Edge-M	1280 x 960 pixel (per band)	~2 m	Global shutter	Mulitspectral, synchronised, across bands	12-bit RAW per band	Blue (475 nm), Green (560 nm), Red 668 nm), Red Edge (717 nm), NIR (840 nm)
Canon EOS R5 with 50 mm lens	8192 x 5464 pixel	~0.3 m	Mechanical or Electronic (rolling)	RGB, single exposure	14-bit RAW (stills)	Overall sensitivity range: ~400 nm to ~700 nm

2.1.5 Flight specifications

The flight specifications were progressively refined during the monitoring programme to balance survey coverage area and image resolution (Table 2.3). The first two surveys covered the full SW REMP area of interest and provided imagery suitable for seagrass mapping. Subsequent surveys covered a smaller focused area (Figure 2.3) surrounding the predicted discharge plume to improve image resolution for detecting smaller macroalgal species (*Ulva* spp. and *Gracilaria* spp), following approval from Watercare[3] in March 2026. The focused survey area northern extent was bound by the Auckland Airport south-west sector airspace (Figure 2.3). Following the 4 November 2025 survey with insufficient image overlap for orthomosaic generation, the camera lens was widened to increase image side lap, with minimal change to ground sampling distance.

Table 2.3: Summary of flight specifications used during each survey flight[4]

Surveys	Coverage area	Flight elevation	Camera focal length	Side lap	Inferred ground sampling distance (GSD)	Updates to aerial capture methodology
18th December 2024 (Summer) 24th May 2025 (Autumn) 23rd July 2025 (Winter)	Area of interest (350 km^2)	3000 m	50 mm	70%	27 cm/pixel	NA
4th November 2025 (Spring)	Focused area (50 km^2)	450 m	50 mm	38%	4 cm/pixel	Flew at low elevation to decrease GSD to try detecting *Ulva* spp. and *Gracilaria* spp. Not enough side lap for orthomosaic creation.
7th March 2026 (Summer) 30th April 2026 (Autumn)	Focused area (50 km^2)	450 m	24 mm	70%	7 cm/pixel	Side lap increased by using 24 mm lens.

[3] Email correspondence with Michiel Jonker 6 March 2026

[4] The winter and spring 2024 flights were not achieved due to the original constraints around tide and weather conditions which were then relaxed for the following surveys.

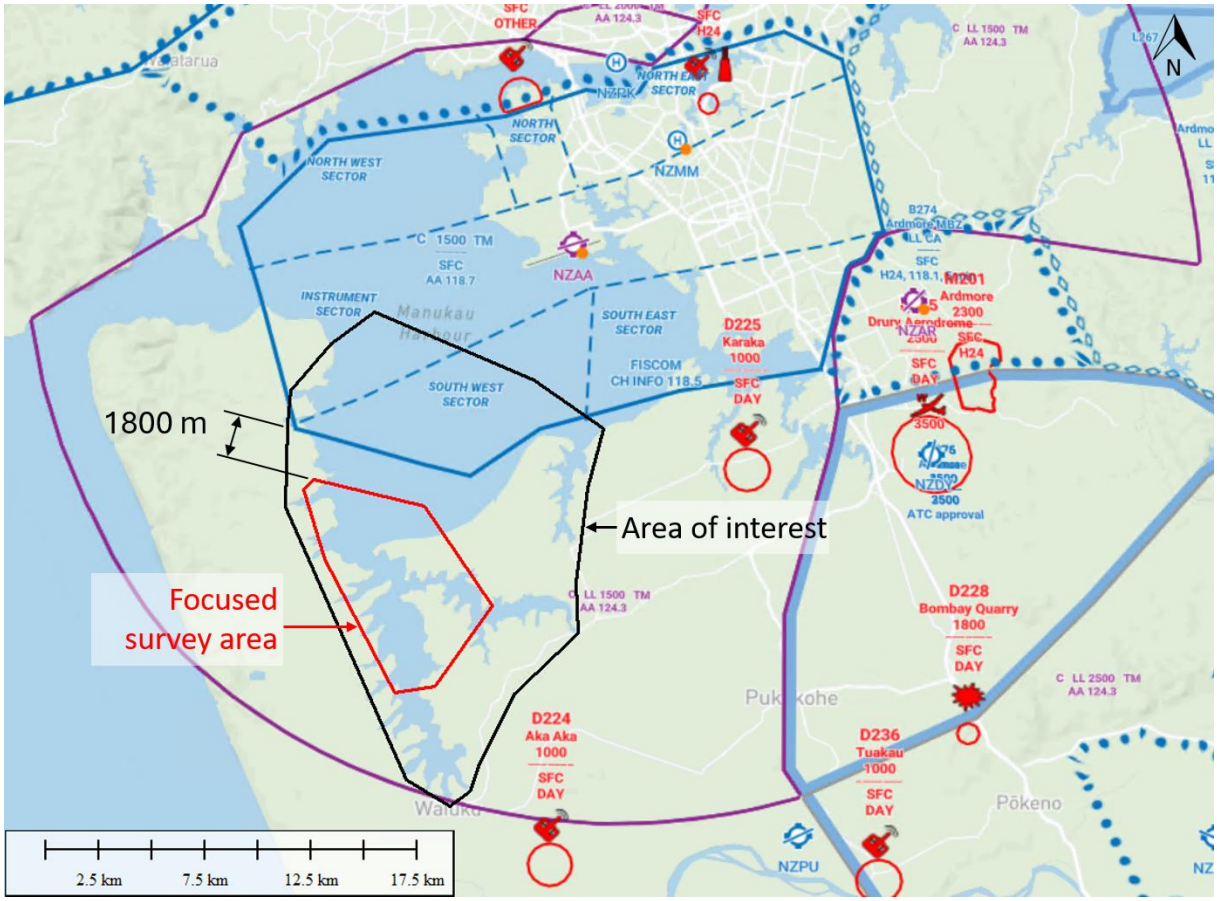


Figure 2.3: Map showing the two SW REMP survey areas (area of interest was outlined in the SW REMP) overlaid on the controlled airspace map (PreFlight, 2026). The blue region is controlled airspace upwards from the surface (ground level). The magenta region is controlled airspace from 1500 ft (457 m) upwards. The focused survey area is offset from the southwest sector by 1800 m based on the plane turning radius.

2.1.6 Orthomosaic creation

Image processing was undertaken using the software Pix4D mapper to create a georectified orthomosaic. The software analyses hundreds of overlapping images, identifying common features (tie points) across images to reconstruct the three-dimensional geometry of the survey area, which is used to stitch the images into a single composite orthomosaic. The orthomosaic is then georectified by aligning it to Ground Control Points (GCPs) of known geographic position, anchoring the orthomosaic to a real-world coordinate system and ensuring it is spatially accurate. GCPs were based on common features in the Auckland Council South Auckland 2016 LiDAR and collected aerial imagery. A minimum of 15 GCPs and 5 Quality Control Points (QCPs) were used in processing. The root-mean-squared error in the horizontal plane for QCP points was less than 10 m for all flights.

The resolution of the orthomosaics were reduced to 1.0 m/pixel to suit the seagrass image classification described further in Section 3.3.

2.2 Ground truthing

Ground truthing surveys were undertaken to support the classification of marine vegetation growth observed in the aerial survey imagery. Each survey was undertaken by a UAV operator and a marine ecologist. The primary objectives for ground truthing were as follows:

- Confirmation of species-level identification of marine vegetation growth where uncertainty remains within the classified imagery.

- Investigate and record on-the-ground observations of marine vegetation distribution that can be referenced during aerial flight imagery classification.
- Identify and record the presence of marine vegetation not able to be identified by the aerial imagery due to limited resolution or other distortions present in the processed aerial imagery.

For an overview of each UAV survey please refer to Table 2.4.

Table 2.4: Ground truthing surveys (all survey imagery was collected using an UAV)

Date survey completed	Drone model	Survey Approach	Low tide depth	Low tide time
10 February 2025	Mavic 3E	Land based	1.1 m	16:41
27 May 2025	Mavic 3E	Marine (6 m Punt Vessel)	0.5 m	17:10
24 July 2025	Mavic 3E	Marine (6 m Punt Vessel)	0.8 m	16:41
6 November 2025	Mavic 3E	Marine (6 m hardtop Vessel)	0.4 m	18:30
18 March 2026	Phantom 4 Pro	Marine (6 m Punt Vessel)	0.7 m	17:51
12 May 2026	Phantom 4 Pro	Marine (6 m Punt Vessel)	1.3 m	13:00

Two methodologies were trialled to determine the most effective approach for collecting ground truthing data:

1. Land based UAV deployment, involving visits to locations where access to the coastal marine area (CMA) was possible and the presence of marine vegetation was considered likely.
2. Marine-based UAV deployment, covering the majority of the focused area captured during the aerial imagery survey.

2.2.1 UAV imagery acquisition

Drone surveys were undertaken either using a DJI Mavic 3E or a Phantom 4 Pro. These platforms were selected due to their compact size, stability, and suitability for deployment from both terrestrial and marine platforms. The camera specifications were:

- DJI Mavic 3E: 5280 × 3956 (20MP)
- Phantom 4 Pro: 5472 × 3648 (20MP)

Prior to each flight, weather and wind conditions were assessed, survey routes confirmed, and Compass and IMU calibrations were completed as required. All operations were conducted in accordance with Civil Aviation Authority (CAA) Part 101 regulations.

Imagery acquisition combined wide-angle photographs to document vegetation distribution and extent with close-range photographs to support species identification and assessment of fine-scale spatial variability in vegetation cover.

2.2.2 Ground truthing from the land

Land based ground truthing was undertaken on 10th February 2025 at survey locations selected based on a preliminary review of the aerial imagery (Figure 2.4). Each location was accessed on foot via public land, with surveys undertaken within the intertidal zone, and assessed through direct visual observation or using a UAV to investigate and document marine vegetation distribution and condition.

Land-based flights were launched from discrete locations away from wildlife and members of the public.

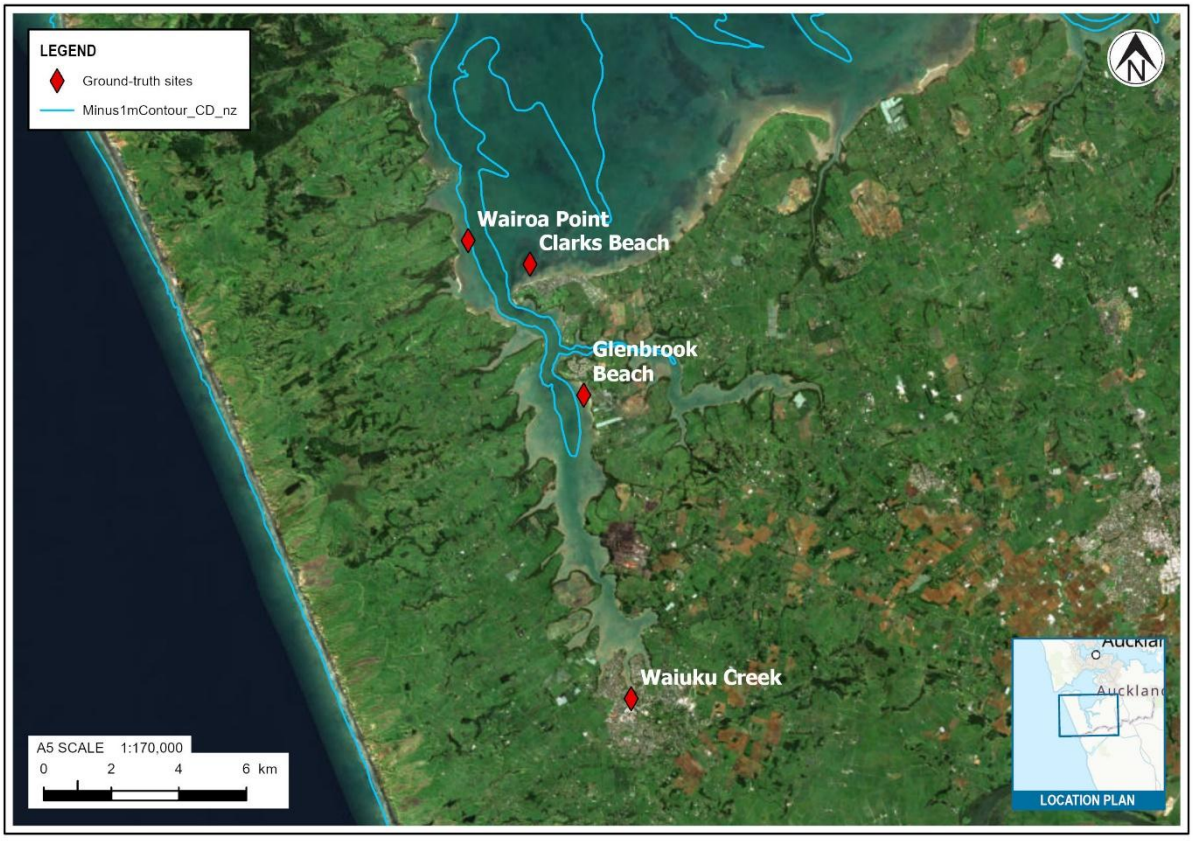


Figure 2.4: Sites selected for ground truthing on 10 February 2025 accessed via land.

2.2.3 Ground truthing from the ocean

Marine based ground truthing was undertaken using a vessel launched from the Waiau Pa boat ramp, with skipper services provided by New Zealand Dive and Salvage. Safe UAV operations from the vessel were achieved through clear crew communication, dynamic hazard monitoring, use of a moving home point, proficient manual flight control, and conservative battery management to ensure safe launch and recovery.

UAV operations were performed from a boat by a competent and trained operator. Five of these marine based operations were carried out between May 2025 and May 2026 targeting a two-hour time window either side of low tide. This approach enabled access to areas across the entire area of imagery collected by the plane. Figure 2.5 shows an example of the locations where UAV imagery and video collected during the survey.

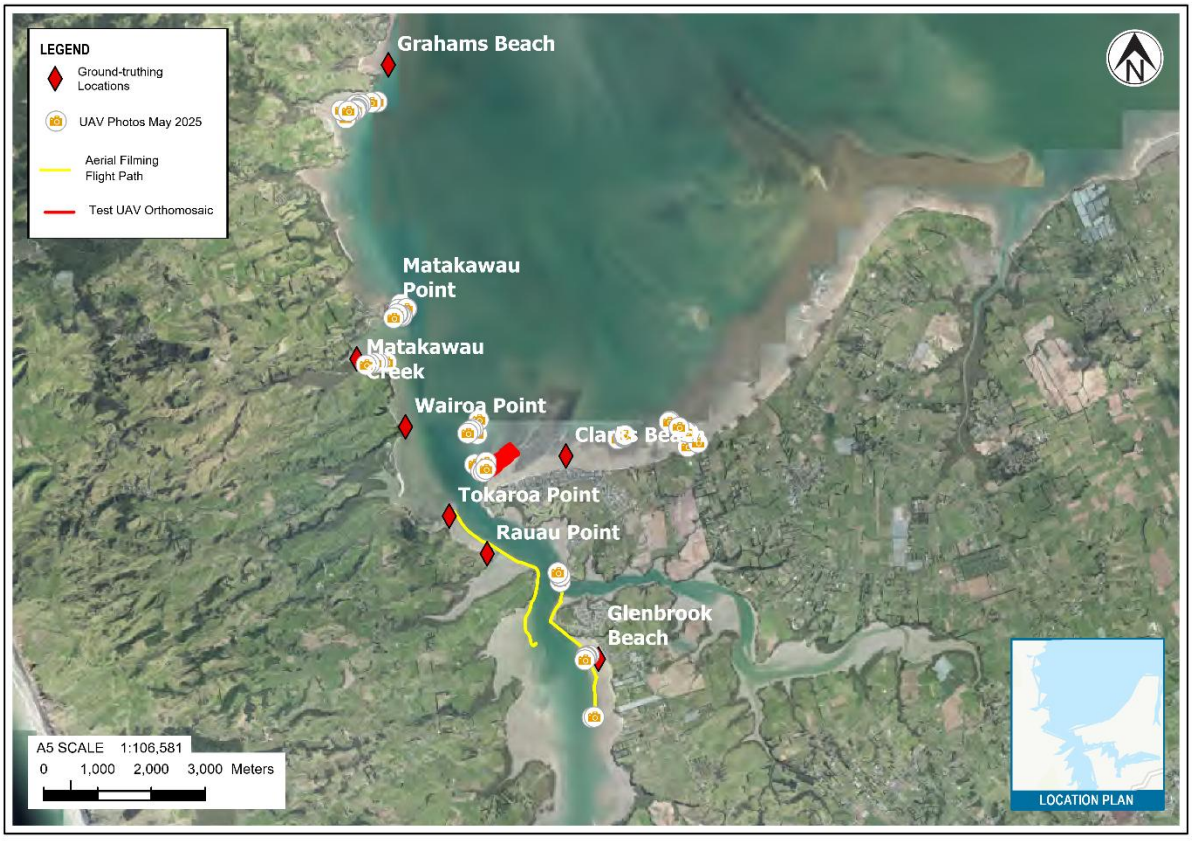


Figure 2.5: Boat launched drone ground truthing on 27th May 2025, an example of where imagery and video collected.

2.2.4 Manual image classification for *Ulva* spp. and *Gracilaria* spp.

An outcome of the ground truthing surveys was imagery that showed the presence of *Ulva* spp. and *Gracilaria* spp. in locations where the aerial imagery had not detected these. As a result, a manual approach to mapping *Ulva* spp. and *Gracilaria* spp. was taken, where all instances recorded were mapped to show the spatial coverage.

The imagery captured during the ground truth surveys were taken at various heights from the ground and at oblique and orthographic angles. The images were not captured with a scale reference and therefore objects in the images were not measurable.

The ground truth images were reviewed by an ecologist and photographs with *Ulva* spp. and *Gracilaria* spp. identified were selected for each survey. Location points were mapped from the location information recorded for the selected photos. Convex polygons were generated from these points, and the extent boundaries were then manually adjusted to match what was photographed during the ground truth surveys based off a visual assessment.

2.3 Vegetation classification

2.3.1 Automated image classification

To ascertain marine vegetation extent (seagrass, *Ulva* spp. and *Gracilaria* spp.) within the intertidal area of the survey area, imagery was clipped between a -1 m Chart Datum Bathymetric Contour which was derived from a composite bathymetric surface created by T+T, and Mean High Water Springs (MHWS), described as an 'Indicative Coastline boundary' (Geomaps, 2025). These extents are visible in Figure 2.6. Image processing was then used to identify the extents and coverage areas of

marine vegetation, as well as mangroves and sand, as the other dominant habitats within the survey focus area and were automatically classified during the image processing.

Supervised image classification was undertaken using ArcGIS Pro 3.1 Software. For computational efficiency, images were subsampled to a 1-metre GSD. This process involves the segmentation of the imagery into regions based on the spectral and spatial properties of the pixels. Neighbouring pixels with similar spectral properties are grouped together to identify where there are objects in an image. These clusters of pixels are first turned into segments, which then get classified into a habitat class, i.e. sand, seagrass, mangroves.

To account for the edge effect and difference in seagrass density across the bed, detailed extent polygons were generalised using ArcGIS tools to create 'coverage polygons' which captured areas of sparse seagrass, which may not otherwise get detected through the classification process[5]. This classification methodology was used to estimate seagrass coverage for each aerial survey.

For the first survey that was flown in December 2024, training samples were manually selected to inform the supervised machine learning model to assign habitat classes to the different segmented regions. Key challenges in this process are related to natural variations in the appearance of sandy/muddy and rock substrates, lighting conditions, and differing depths of submersion. Care was taken to ensure sampling represented the diversity of conditions and was of relatively even spatial distribution.

The initial December 2024 training data set was applied to the May 2025 imagery for classification, augmented with additional training data from the May survey. This process was repeated for each following survey, building a larger training sample database to inform the classification model.

For each survey habitat analysis, the ground truth imagery was used to confirm the species that was identified within the aerial classification as that present.

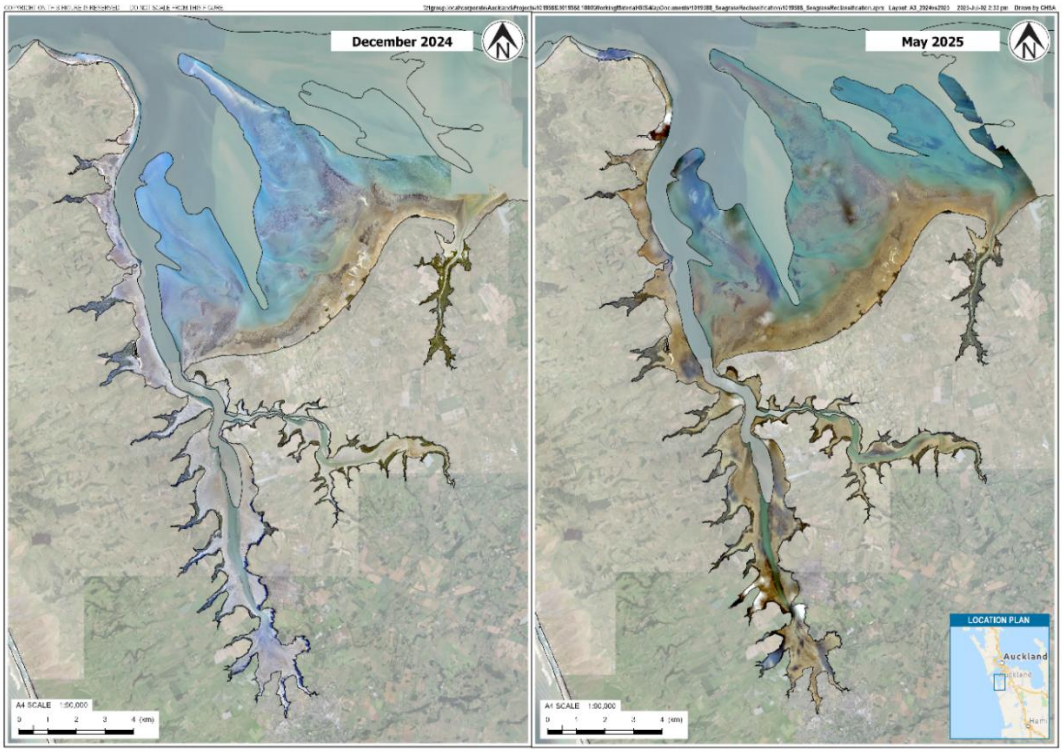


Figure 2.6: December 2024 and May 2025 orthomosaic clipped to the tidal area of interest for supervised classification image processing.

[5] 'Generalisation Polygon' tool in ArcGIS simplifies line and polygon features while preserving their essential shape.

2.3.2 *Ulva* spp. and *Gracilaria* spp. image classification

Ulva spp. and *Gracilaria* spp. were detected at a few locations during the ground truthing surveys, however, due to the sparse, unconnected nature of the distribution of the plants they did not exhibit a sufficiently distinct spectral signature for reliable identification through aerial image classification. Instead, during the classification process, radiance values were averaged with the surrounding sandy substrate, which prevented automated classification of the macroalgae species.

To address this limitation of the aerial imagery and classification process, georeferenced ground-truth photographs collected during each survey were used to map *Ulva* spp. occurrence and delineate indicative coverage extents. Extent boundaries were manually interpreted and adjusted based on field observations and photographic evidence. Coverage extents for *Gracilaria* spp. were not generated, as only isolated individual plants were recorded during the ground-truth surveys, instead these were identified and recorded with their presence and location.

3 Results

3.1 Imagery processing

Orthomosaics were created for each survey flight and are presented in Appendix A. Key challenges identified during orthomosaic creation was the construction over water and clouds.

Cloud cover has the potential to reduce image quality in aerial surveys in two ways:

1 Cloud above the plane can cast shadows onto the ground, resulting in dark areas in the orthomosaic, for example the north-west extent in Figure Appendix A.6. Cloud above the plane is more likely for the latest surveys which were conducted at 450 m elevation compared to the previous surveys at 3000 m elevation.

2 Low-lying cloud beneath the plane (i.e. below the camera) can obscure detail on the ground. In Figure Appendix A.2 affected areas appear as white cloud. When cloud cover becomes sufficiently dense, orthomosaic reconstruction is no longer possible and ‘holes’ in the orthomosaic occur. One such example is visible in Figure Appendix A.2 south of Grahams Beach towards the northern end of the Awhitu Peninsula. Low-lying cloud is unlikely for surveys at 450 m and none was observed for surveys conducted at that altitude.

The water surface is near uniform in colour, affected by reflection and has wind texture moving the water surface. Images that only include water and no land reduced the number of matching points (key points) between overlapping images. Examples of where the orthomosaic could not be constructed over water are shown by the white squares north of the Clarks beach intertidal area (Figure Appendix A.1 and Figure Appendix A.5) and along the centre of the Waiuku river (Figure Appendix A.6). Since the objective it to survey and map marine vegetation in the intertidal areas, this does not have an impact on the results.

All survey data were suitable for processing except for the flight undertaken on 4 November 2026. Imagery from this survey (Figure Appendix A.4) was not usable due to poor lighting conditions associated with the mid-afternoon survey window in conjunction with less overlap between photos to optimise coverage.

Following review of the November survey results, it was agreed to increase the side-lap and further reduce the focused survey area for subsequent flights to ensure that a complete orthomosaic could be successfully processed regardless of sun angle.

For the March 2026 orthomosaic, some streakiness was observed in line with the flight path due to uneven lighting. The colour also fluctuated over water as sun reflection was in some frames and not others. The streaks appear to be minimised by flying from southwest to northeast in the April 2026

afternoon survey. Flying at a lower elevation means that lighting between individual frames over smaller footprints vary more, compared to the high elevation flights that look down over larger areas.

3.2 Ground truthing surveys

Ground truthing surveys were conducted over the same focus area that the aerial imagery was collected for using a UAV. The purpose of these was to survey the area and collect imagery of marine vegetation to confirm the species present and the spectral signatures to help with the automated imagery classification process. The UAV imagery also provided the opportunity to identify any *Ulva* spp. or *Gracilaria* spp. that may have been missed in the aerial imagery.

3.2.1 Ground truthing from land

3.2.1.1 Clarks beach

Seagrass distribution across the western extent of the inter-tidal marine area of Clarks beach was investigated on-foot on 7 February 2025 with observations recorded using phone-based GIS. The extent of visible seagrass on the western edge of Clarks Beach was walked following as close as possible to the low tide boundary. Figure 3.1 below shows the extent of the intertidal marine area walked and surveyed, with corresponding observations geospatially referenced. Approximately 4.8 ha of intertidal seabed was surveyed.



Figure 3.1 Clarks beach ground truthing extent, including observation points corresponding to those discussed in Table 3.1.

Table 3.1: Observations in the Clarks Beach ground truth area corresponding to the points shown in Figure 3.1 above

Observation point	Observation description	Photograph reference
1	Throughout the seagrass beds across the ground truth area were localised fragments of the biosecurity species Spaghetti bryozoan (*Amathia verticillatua*).	Photograph 3.1
2	The oyster reef found at Clarks beach did not contain any noticeable distributions of the nuisance marine vegetation species. Some fragments/blades of seagrass were observable throughout oyster reef, however these are very unlikely to be visible in the aerial imagery capture. This oyster bed was not captured as seagrass in the imagery capture.	Photograph 3.2
3	Seagrass across the Clarks beach area showed notable variation in colour expression. Some patches of seagrass were a uniform green or black colour, and others had non-uniform mixes of red, black, dark green, and green colourations, which has caused some challenges with the aerial imagery processing.	Photograph 3.3



Photograph 3.1: Spaghetti bryozoan (Amathia verticillate) (shown at the ends of the red arrows) identified within the seagrass beds of Clarks beach (Photo taken, February 2025)



Photograph 3.2: Oyster reef identified off Clarks beach (Photo taken, February 2025)



Photograph 3.3: Colour variation observed in seagrass bed at Clarks Beach (Photo taken February 2025)

3.2.1.2 Wairoa Point

Wairoa Point and the intertidal marine area towards the south was accessed via the beach and investigated using a UAV, which was flown to identify locations of marine vegetation growth. The UAV was flown at 20 m elevation across the ground truth survey area (shown in Photograph 3.2) in order to identify discrete points of interest where photographs were taken.

The observation point shown in the figure below represents a location where isolated patches of sea lettuce (*Ulva* spp.), had been observed in January 2025 surveys undertaken by Coast and Catchment (email communication 21 January 2025). The UAV was subsequently flown at a lower elevation and close-up photographs captured of this area to confirm species classification (see Photograph 3.4 and Photograph 3.5 below).



Figure 3.2: Wairoa Point ground truth survey area.

The patches of *Ulva* spp. detected at the observation point shown in Figure 3.2 are too small to be detected from the aerial survey and subsequently cannot be identified during the image analysis process. No patches larger than those shown in Photograph 3.4 were observed, and these are estimated to be around 2 m – 5 m in width (refer to Section 3.2.3 for photo capture during marine vegetation surveys by Coast and Catchment in January 2025).



Photograph 3.4: Drone imagery showing approximate extent and pattern distribution of Ulva spp. identified at Wairoa Point (Photo taken, February 2025)



Photograph 3.5: Close up drone imagery showing Ulva spp. (Photo taken, February 2025).

3.2.1.3 Glenbrook Beach

The extent of Glenbrook Beach was investigated primarily using a drone, with an approximate 100 m by 100 m reach walked on-foot in February 2025 (Figure 3.3). Initial observations of the intertidal area around the high tide mark showed small, sparsely distributed growths of *Ulva* spp. which when observed from a distance, were not discernible from the surrounding intertidal substrate. The extent of the beach was then flown with a drone at an elevation of approximately 10 m to visualise the full extent of these isolated *Ulva* spp. growths.

Following the investigation via drone, it was determined that these individual growths extended across the intertidal marine area from the low-tide to the high-tide mark, across the extent of Glenbrook Beach, as shown in Photograph 3.6 and Photograph 3.7. Each *Ulva* spp. plant was approximately 10 cm – 30 cm in length, scattered across the beach.



Figure 3.3 Glenbrook beach ground truth survey area



Photograph 3.6: Distribution of small growths of Ulva spp. across Glenbrook Beach (Photo taken, February 2025).



Photograph 3.7: Photograph taken from drone at approximately 2 meters elevation showing small growths of Ulva spp. at Glenbrook Beach (Photo taken, February 2025).

3.2.2 Ground truthing from the ocean

UAV imagery collected from a boat allowed a survey area from around Matakawau Point in the Manukau Harbour, Clarks beach, along the coastal edges of Waiuku Estuary up to Gordons Landing. The UAV was flown and the UAV operator and marine ecologist monitored the imagery as the UAV moved to look for any areas of seagrass, *Ulva* spp. and *Gracilaria* spp. When plants were detected imagery was collected, and their distribution investigated. During each survey the seagrass expanse at Clarks beach was monitored, and imagery collected to determine if there was any presence of *Ulva* spp. or *Gracilaria* spp. amongst the seagrass.

Table 3.2 presents a record of locations where *Ulva* spp. and *Gracilaria* spp. were detected during UAV ground truthing surveys, and Appendix C shows the spatial distribution of detection, and Appendix D shows examples of imagery collected.

Table 3.2: Locations and survey periods when *Ulva* spp. or *Gracilaria* spp. were detected

Survey period	Species detected	Location	Qualitative expanse description
February 2025	***Ulva***	Glenbrook Beach	Across the entire beach / small plants (< 30 cm)
May 2025	***Ulva***	Glenbrook Beach	Across the entire beach / small plants (< 30 cm)
July 2025	***Ulva***	Glenbrook Beach	Across the entire beach / small plants (< 30 cm)
November 2025	***Ulva***	Glenbrook Beach	Northern section of beach / small plants (< 30 cm)
March 2026	***Ulva***	Glenbrook Beach	Northern section of beach / small plants (< 30 cm)
March 2026	***Gracilaria***	Clarks beach and Kaikaka Point to Gordons Landing	Small patch

Survey period	Species detected	Location	Qualitative expanse description
April 2026	***Ulva***	Clarks beach and Glenbrook Beach	Across most of Glenbrook beach and smaller patches at the western edge of Clarks beach
April 2026	***Gracilaria***	Clarks beach	Small patches within seagrass

3.2.2.1 Clarks beach

The ground truthing imagery capture confirmed the presence of a large expanse of seagrass within the intertidal area. This seagrass bed has persisted for a number of years and has been captured in previous literature (Nelson et al., 2015; Townsend et al., 2016), Auckland Council GeoMaps and from personal observations[6]. The UAV capture assisted the training for image classification due to the large variation of colours seen within the seagrass bed (Photograph 3.8 and Photograph 3.9). The survey also detected small patches and plants of *Ulva* spp. and *Gracilaria* spp. (Photograph 3.10 and Photograph 3.11).



Photograph 3.8: UAV aerial capture of seagrass beds at Clarks beach. Photo taken May 2025.



Photograph 3.9: UAV aerial capture of seagrass beds at Clarks beach. Photo taken May 2025.

[6] M. Tupe during recreational fishing surveys between 2007 and 2009 undertaken for NIWA.



Photograph 3.10: UAV aerial capture of Gracilaria spp. and Ulva spp. at Clarks beach. Photo taken May 2026.



Photograph 3.11: UAV aerial capture of Gracilaria spp. within seagrass beds at Clarks beach. Photo taken May 2026.

3.2.3 Additional observations

In January 2025, benthic ecology and marine vegetation surveys conducted by Coast and Catchment identified extensive growths of *Ulva* spp. and scattered *Gracilaria* spp. at the Tokaroa North site, located east of Rangiriri Creek. These nuisance algae species were observed to blanket the bay, extending beyond the line of sight, indicating their capacity to proliferate rapidly and unpredictably (Photograph 3.12 and Photograph 3.13) (Kelly and Sim-Smith, 2025). Notably, this algal coverage was absent during both the December 2024 aerial imagery capture and the February 2025 ground-truthing survey—despite the area being a focal point of the latter. This highlights the transient nature of macroalgal blooms and underscores the importance of multi-temporal monitoring to accurately assess ecological conditions.



Photograph 3.12: Imagery capture of Ulva spp. at Tokaroa North site during marine vegetation surveys undertaken in January 2025 (Photo credit: Coast and Catchment).



Photograph 3.13: Imagery capture of Gracilaria spp. at Tokaroa North site during marine vegetation surveys undertaken in January 2025 (Photo credit: Coast and Catchment).

3.3 Vegetation classification

Figure Appendix B.1 to Figure Appendix B.6 present the classification of habitats and marine vegetation present within the intertidal area based on the orthomosaic image for all aerial surveys captured between December 2024 and April 2026, with the exception of November 2025 as the orthomosaic was unable to be constructed during the photogrammetry process.

The spatial extent of marine vegetation including seagrass and mangroves, and unvegetated substrate classified as 'sand' (noting that this category may include mud, as the imagery classification does not distinguish between sediment grain sizes) was derived from the image classifications of each survey.

The conditions of the image capture for each survey (described in Section 2.3) added variation to the spectral properties of the identified habitat classes. The presence of the clouds, cast shadows, sun reflection in the aerial imagery introduces spectral complexity and added noise to the machine learning model resulting in some misclassifications which were corrected during the manual quality check.

The variability in seagrass density creates spectral complexity during the image classification process. To detect seagrass within the classification the plants must be growing at a density with a minimum size of 1 m^2 of solid growth to result in a distinctive spectral signature that does not take an averaged radiance value from the surrounding substrates in the imagery. The minimum segment size for the image classification was 20 pixels, which required seagrass clumps to be a minimum size of 20 m^2 to be identified as 'seagrass' habitat.

The image classification results can differentiate between high and low-density clusters of the vegetation types and is dependent on the condition of the imagery capture. To make the quantification of habitat extents comparable between surveys, coverage extent polygons were generated by creating a singular extent polygon around clusters of the same vegetation class that are within 20 m of each other. This allowed for the quantification of both high and low density seagrass, and to map the outer extent of the seagrass patch / bed.

This process removes the discrepancies in the density mapping between the individual surveys and creates comparable coverage extent polygons. A limitation of this is that the initial resolution of the mapped extent is lost. This process generalises the data, removing the detail of individual clusters to instead show coverage, with a +/- 20 m error margin by assuming areas surrounding seagrass clusters are also seagrass. Figure Appendix B.1 to Figure Appendix B.6 show the high-resolution seagrass classification in the dark blue polygons and the generalised polygon to measure extent around this in the lighter blue.

A process of manual classification was included to help train the image classification tool to identify habitats correctly. However, even with extensive processing and manual classifications, there is still potential error due to the image quality. Properties such as shadow, sun glare and clouds all impact the imagery and can create noise and introduce variation to the spectral signature of the seagrass in particular. It should be noted that these challengers are consistent across the surveys, meaning that the classification methodology errors were consistent across all surveys.

The aerial imagery did not identify any extensive cover (or blooms) of the target nuisance macroalage species (*Ulva* spp. and *Gracilaria* spp.), however, ground-truthing surveys recorded their presence across most surveys, typically as isolated individuals or interspersed within seagrass beds (refer to Section 3.2 for further detail). These instances of nuisance algae were missed in the aerial survey imagery due to their small size (<30 cm per plant), which falls below the detection threshold of the aerial imagery collected.

3.3.1 Habitat coverage extents

For each survey the extent of area (ha) for each habitat type (sand, mangroves, seagrass) was calculated and is presented in Table 3.3. As can be seen in the maps in Appendix B the seagrass presence is predominantly at Clarks beach.

Note that this table represents the full extent of aerial imagery capture and the corresponding processed marine vegetation and habitat extents. Variation in the area available for processing (as outlined above) means the values are not directly comparable between surveys and should be interpreted as representing each individual survey's imagery classification only.

Table 3.3: Indicative quantification of habitat extents from the full generalised extents of processed aerial imagery

Survey	Sand Habitat Class (indicative area (hectares)	Sand %	Mangrove Habitat Class (indicative area (hectares)	Mangrove %	Seagrass Habitat Class (indicative area (hectares)	Seagrass %	Total extent of processed imagery
December 2024	6,724	76%	999	11%	1,166	13%	**8,888**
May 2025	6,584	68%	1012	10%	2,112	22%	**9,709**
November 2025	Orthomosaic could not be used due to imagery quality						
July 2025	7,311	75%	946	10%	1,518	16%	**9,775**
March 2026	2,076	79%	398	15%	166	6%	**2,640**
April 2026	2,013	76%	419	16%	227	9%	**2,659**

Note:

1) The extent quantified for all surveys are different due to aerial imagery capture extents.
2) Conditions of the imagery capture should be considered when viewing habitat quantifications (effect of conditions are outlined in the classification methodology).

For consistency in the quantification of the marine vegetation extents across surveys, a focused survey extent was generated from areas within the 'tidal area of interest' where aerial imagery was available for all surveys (shown in Figure 2.1).

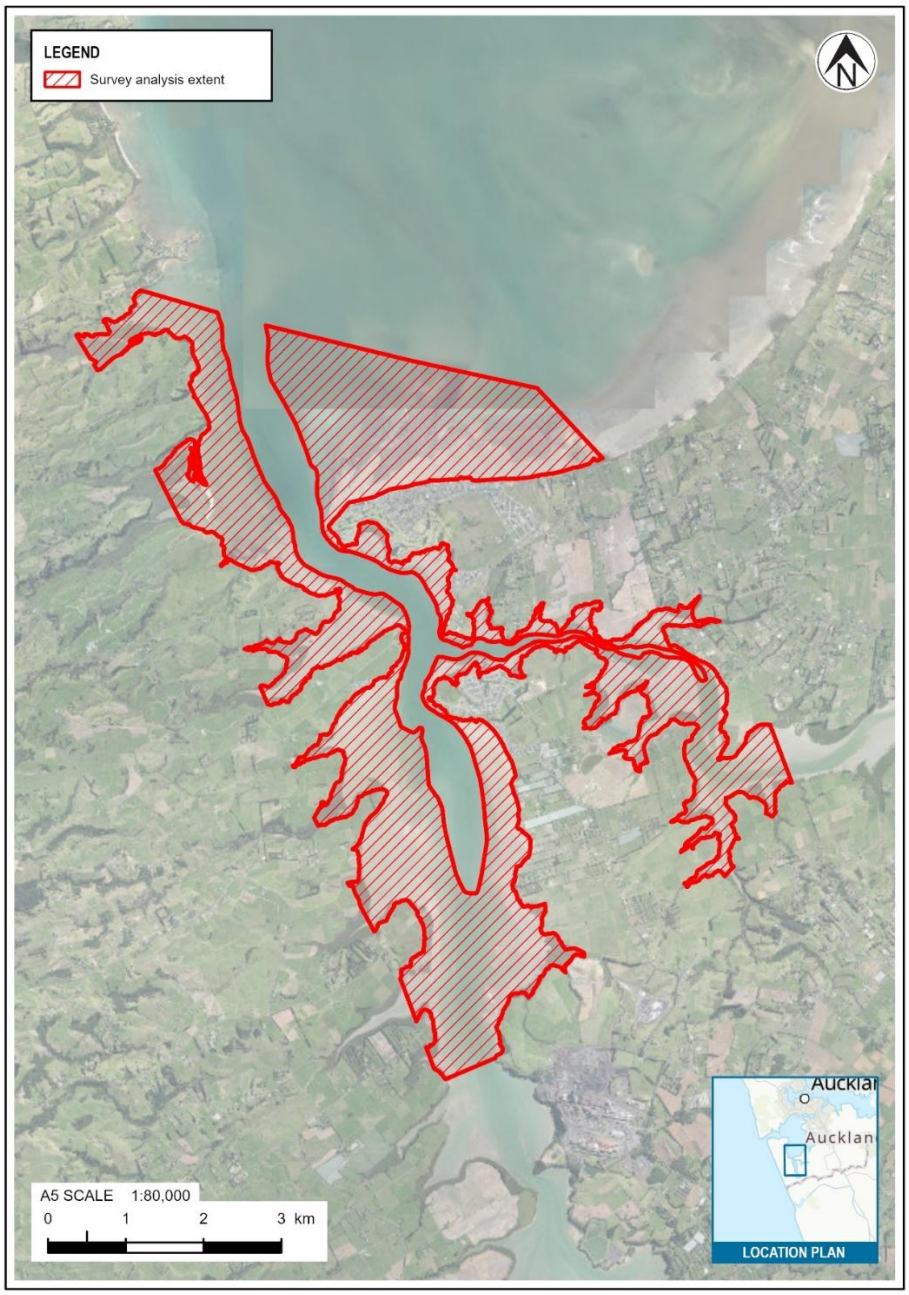


Figure 3.4 Survey extent used for comparable image classification analysis

Table 3.4 presents the areal extent (ha) of sand, seagrass, and mangrove habitats within the focused survey area shown in Figure 3.4. While habitat extents are directly comparable between surveys due to the consistent spatial coverage assessed, differences in imagery capture conditions should be considered when interpreting temporal patterns. Mangrove extent remained relatively stable throughout the survey period, ranging from 204–229 ha (11–12% of the mapped area). In contrast, seagrass extent exhibited greater variability, ranging from 153 ha in March 2026 to 303 ha in May 2025 (8–16% of the mapped area). Seagrass was predominantly concentrated around Clarks Beach, with smaller patches detected around Matakawau Point and areas further north during the December 2024, May 2025, and July 2025 surveys only (Appendix B). Following the peak extent

recorded in May 2025, mapped seagrass coverage generally declined through July 2025 and March–April 2026, suggesting temporal variability that may reflect seasonal influences, although the greater inter-annual differences observed may also indicate the influence of broader catchment-related pressures.

Table 3.4: Indicative quantification of generalised habitat extents from overlapping aerial imagery.

Survey	Sand Habitat Class (indicative area (hectares)	Sand %	Mangrove Habitat Class (indicative area (hectares)	Mangrove %	Seagrass Habitat Class (indicative area (hectares)	Seagrass %	Total extent of processed imagery
December 2024	1,476	76%	229	12%	240	12%	**1,944**
May 2025	1,437	74%	204	11%	303	16%	**1,944**
July 2025	1,526	78%	218	11%	200	10%	**1,944**
November 2025	Orthomosaic could not be used due to imagery quality						
March 2026	1,571	81%	220	11%	153	8%	**1,944**
April 2026	1,560	80%	212	11%	172	9%	**1,944**

Note:

1) Conditions of the imagery capture should be considered when viewing habitat quantifications (effect of conditions are outlined in the classification methodology).
2) Cloud cover within the imagery may account for some inaccuracies within the habitat classifications.

The results should be viewed with consideration to the limitations of the aerial imagery collected and the image classification, and that the extent of seagrass can be difficult to accurately quantify given the differences in density especially at the edges of the extent.

3.3.2 *Ulva* spp. and *Gracilaria* spp. detection

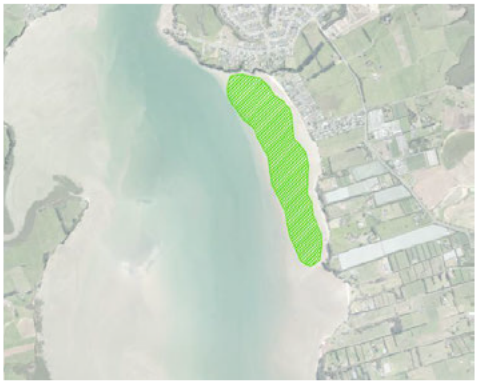
During all of the ground truthing surveys the presence of *Ulva* spp. was identified at Glenbrook beach (Table 3.2 above). In some surveys the coverage across the beach was low and other surveys the coverage was high and found across a large expanse of the beach. The density of the plants was also variable over the surveys (Photograph 3.14 to Photograph 3.17). *Gracilaria* spp. presence was recorded during the ground truth surveys in March and April 2026, both instances were of individual plants / small clumps of plants.

To obtain an estimate of extent, ground truth photographs were used to map the observations of *Ulva* spp. for each survey and generate coverage extents. Imagery collected from the UAV surveys was geolocated and used to generate extents of the known locations by matching known points in the imagery with aerial imagery base maps. The extent boundaries were then manually adjusted to match what was photographed during the ground truth surveys. The output of this was a polygon around the estimated extent of *Ulva* spp. coverage across Glenbrook beach, acknowledging that within each polygon the density of the *Ulva* spp. was not estimated and varied with each survey. The coverage extents of *Gracilaria* spp. were not generated as only singular plants were recorded in the ground truth surveys and these have been mapped in Figure Appendix C.1.

Table 3.5 below presents the indicative extent of *Ulva* spp. coverage at Glenbrook beach for each survey. During late summer and autumn 2025, vegetation was widespread across the entire Glenbrook Beach, with the indicative coverage was 33.4 ha in February and 30.4 ha in May, consisting predominantly of small plants (<30 cm). The extent of *Ulva* spp. increased during winter and was the highest coverage of all surveys at 57.6 ha in July 2025.

By spring and early autumn 2025, the coverage reduced to the northern section of the beach, declining to 12.5 ha in November 2025 and reaching a minimum extent of 0.7 ha in March 2026. The April 2026 survey recorded an increase in coverage to 27.8 ha, occurring across most of Glenbrook Beach. Overall, the data indicate some seasonal fluctuations in *Ulva* spp. extent, with greatest coverage observed during winter and lowest coverage during late summer to early autumn.

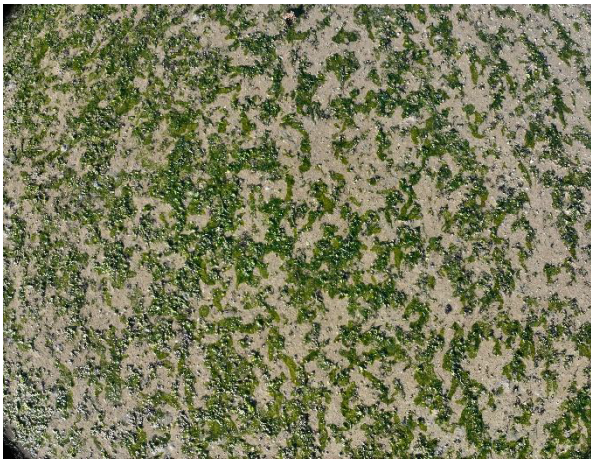
Table 3.5 Indicative quantification of Ulva spp. extent at Glenbrook beach.

Survey	Location	Qualitative expanse description	Indicative area (hectares)	Indicative coverage extents
February 2025	Glenbrook Beach	Across the entire beach / small plants (< 30 cm)	33.4	
May 2025	Glenbrook Beach	Across the entire beach / small plants (< 30 cm)	30.4	
July 2025	Glenbrook Beach	Across the entire beach / small plants (< 30 cm)	57.6	

Survey	Location	Qualitative expanse description	Indicative area (hectares)	Indicative coverage extents
November 2025	Glenbrook Beach	Northern section of beach / small plants (< 30 cm)	12.5	
March 2026	Glenbrook Beach	Northern section of beach / small plants (< 30 cm)	0.7	
April 2026	Clarks beach and Glenbrook Beach	Across most of Glenbrook beach	27.8	



Photograph 3.14 Ulva spp. found at Glenbrook beach during July 2025 ground truthing survey (Photo image collected using a UAV).



Photograph 3.15 Ulva spp. found at Glenbrook beach during July 2025 ground truthing survey (Photo image collected using a UAV).



Photograph 3.16 Ulva spp. found at Glenbrook beach during November 2025 ground truthing survey (Photo image collected using a UAV).



Photograph 3.17 Ulva spp. found at Glenbrook beach during March 2026 ground truthing survey (Photo image collected using a UAV).

3.3.3 Marine vegetation imagery classification limitations

Although the image classification method can provide a level of detail there is the potential for areas to be misclassified as a different habitat type. This is largely a result of the high radiometric detail of the orthomosaics and similar spectral signatures of different habitat types. During the classification process, a GIS Specialist and Ecologist reviewed the classification and manually corrected significant areas of misclassification.

An additional limitation to this method is the inability to distinguish between fine-scale habitat types. Macroalgae species were not able to be confidently identified within the survey area through the classification due to the similar spectral characteristics between fine-scale habitat types (e.g. red algae and seagrass). In general, mangroves throughout the survey areas were easily identified and mapped through supervised classification. However, where sun glint (reflection off the water) occurred in the image capture, compensatory adjustment in exposure resulted in darker inundated areas and the false identification of mangrove coverage.

Environmental conditions at the time of image capture can contribute variation to the spectral properties of a habitat class and add noise to the machine learning model resulting in misclassifications. The presence of the clouds and the shadows cast, changes the spectral properties of all habitats and introduces greater variation. The timing of image capture with the tidal cycle also has an impact in the way the habitats present in the image. The spectral properties of sand can change drastically between wet and dry sand. Inundated areas in the subtidal zone will appear bluer while recently inundated areas will appear darker in colour.

Data input requirements

- The 'Object' needs to be identifiable in the aerial imagery in order to be classified.
  - The 'object' must be larger than the captured pixel size to have an identifiable spectral signature
  - Eg – individual sea lettuce plants, seen during 2025 July ground truthing was typically <5 cm. The helicopter imagery captured a 20 cm resolution. Pixels where sea lettuce is present would have an averaged radiance value from the surrounding substrate (sands) and sea lettuce, resulting in no distinctive spectral signature and therefore was not identifiable in the imagery.
- Object based image classification
  - During this method, the imagery under-goes segmentation. Neighbouring pixels with similar spectral properties are grouped together to identify where there are objects in the image. These clusters of pixels are turned into segments which then get classified into the different classes
  - Objects must be multiple pixels in order to be identified as an object in the in the segmentation process, therefore image classification is nor suitable for picking up small scale objects relative to the pixel size
  - With the 20 cm pixel size, the minimum size of sea lettuce must be greater than 1 m and be a minimum density to have an identifiable spectral signature
- Pixel based image classification is not suitable for large scale areas (Entire Manukau Harbour) due the amount of spectral variation present in each vegetation class. There will be too much noise in the analysis that meaningful results will not be produced.

4 Nutrient budget contribution and modelling

The SW REMP requires that changes in vegetation coverage over time are assessed in relation to the catchment nutrient budget, including any potential increasing contribution from the WWTP. The results presented in this report represent the baseline receiving environment conditions, with existing catchment influences (i.e. the baseline catchment nutrient budget). Therefore, the nutrient budget has not been described on the basis that there are currently no additional inputs from the WWTP.

The nutrient budget of the catchment can be derived based on inputs from contributing catchments in the South-West Manukau harbour (Figure 4.1). Auckland Council's Freshwater Management Tool (FWMT) provides a suitable basis to undertake this work in future monitoring reports. The FWMT is a process-based water quality accounting model that estimates contaminant generation, transport, and delivery from both rural and urban sources across Auckland catchments. Nutrient sources represented include diffuse land-use runoff as well as point-source discharges such as wastewater and stormwater. FWMT outputs can be incorporated into existing harbour hydrodynamic models to provide a proportional load from the WWTP in relation to the nutrient budget from catchments in the South-West Manukau harbour.

The outputs from the model could then be validated against the baseline and ongoing results from other SW REMP workstreams, particularly water column nutrients and sediment nutrients.

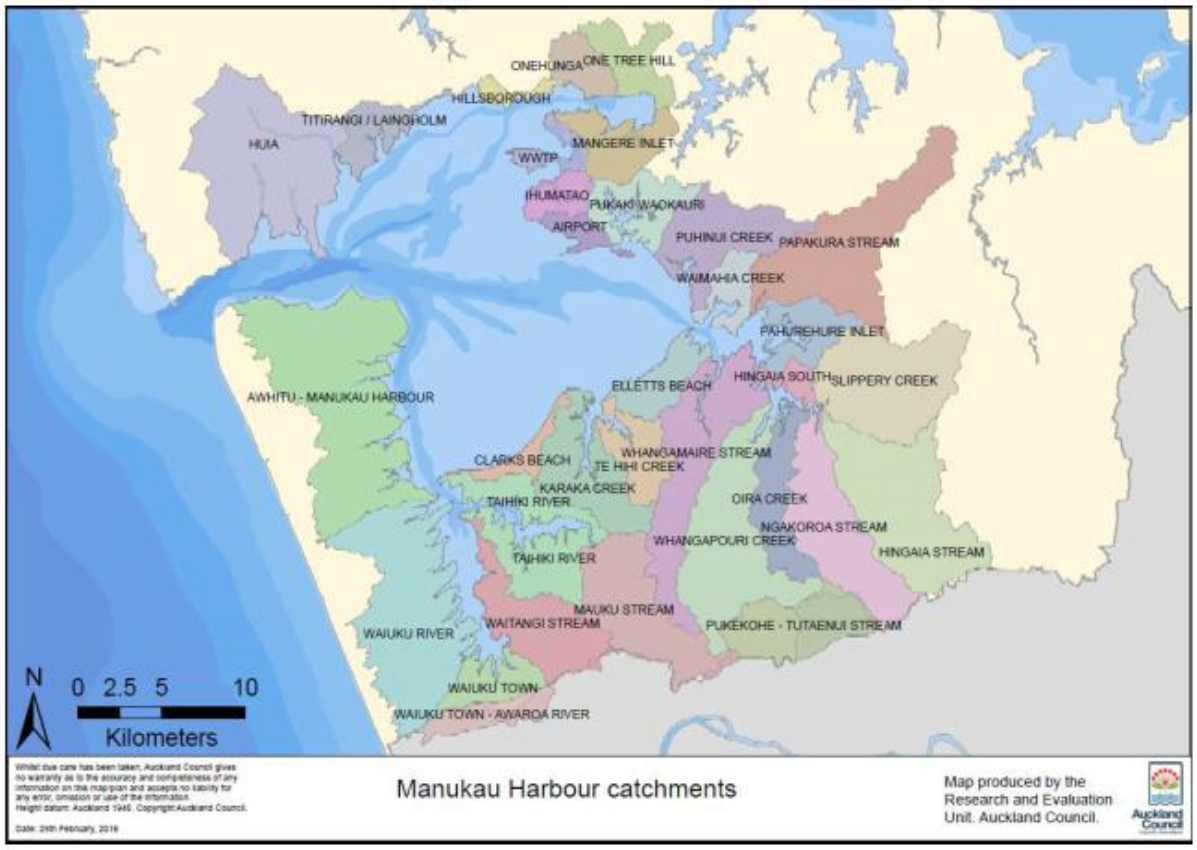


Figure 4.1 Manukau Harbour catchments (Auckland Council) (accessed from DHI, 2016)

5 Project summary

Marine vegetation monitoring was undertaken in accordance with the SW REMP methodology, with several refinements to survey timing, survey extent, and flight specifications agreed with Watercare and Auckland Council to improve image quality and ensure collection of a representative seasonal baseline dataset. Of the eight seasonal aerial surveys originally proposed, two could not be completed due to unsuitable environmental conditions and one additional survey (November 2025) could not be used for habitat classification because an orthomosaic could not be successfully generated. Consequently, five surveys were available for quantitative habitat analysis.

To ensure vegetation coverage could be compared consistently through time, habitat extents were quantified within a focused survey area covered by all surveys. This approach removed differences associated with varying aerial survey extents and allowed for direct comparison between survey periods. A generalisation methodology to seagrass habitats was applied to account for the difference in seagrass density on the edges and within the seagrass. This approach allowed for an outer extent to be captured and compared between surveys.

The baseline monitoring identified a receiving environment characterised by extensive seagrass meadows present at Clarks Beach, stable mangrove habitat, and generally low levels of nuisance macroalgae. Mangrove extent remained relatively consistent throughout the monitoring period (11–12% cover), while seagrass extent showed moderate temporal variability (8–16% cover), with the highest coverage recorded in May 2025 and lower coverage observed during July 2025 and March–April 2026. No clear trend of increasing or decreasing seagrass extent was evident over the baseline monitoring period.

Ground-truthing surveys confirmed the presence of Ulva spp. and Gracilaria spp. however, their presence could not be reliably detected from the aerial image or the classification processing. To quantify the extent of *Ulva* spp. and *Gracilaria* spp. georeferenced ground-truth photographs were used. *Ulva* spp. was present during all surveys at Glenbrook beach and showed some seasonal variation, with coverage between 0.7 ha in March 2026 and 57.6 ha in July 2025. *Gracilaria* spp. extent was not quantified as only isolated plants were observed during surveys at Clarks beach and a point between Kaikaka Point to Gordons Landing.

The results presented in this report establish a baseline of marine vegetation presence under the existing catchment nutrient budget in the absence of the nutrient contribution of the WWTP.

5.1 Future recommendations

Following the methodology as outlined within the SW REMP, collecting aerial imagery to detect changes over time in seagrass, *Ulva* spp. or *Gracilaria* spp. over four days per year has presented a number of potential future opportunities to refine the vegetation mapping process:

- Seasonal patterns may be more evident if more regular imagery is collected. For example, due to the transient nature of nuisance macroalgae species, aerial imagery and ground truthing did not necessarily identify all such blooms over the course of the baseline monitoring period.
- The aerial imagery has limitations and was unable to detect *Ulva* spp. and *Gracilaria* spp. and successfully map these using an imagery classification process. However, the aerial imagery was sufficient to map the extent of seagrass, notably the bed at Clarks beach and should be continued to be collected.
- The imagery collected using the UAV provided a methodology in which those areas where *Ulva* spp. and *Gracilaria* spp. were present could be detected through the identification while on site by the marine ecologist, and the imagery capture to confirm the presence.

- To detect changes in extent with a focus on the nuisance macroalgae species, a methodology which includes the utilisation of a UAV could be employed at a higher frequency throughout the year to detect the localised extent changes over time. A reduced aerial imagery capture focussed on seagrass extent may be sufficient to understand if any changes as a result of the wastewater outfall are occurring.

6 Applicability

This report has been prepared for the exclusive use of our client Watercare. with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that our client will submit this report as part of a monitoring report for adherence for resource consent conditions and that Auckland Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

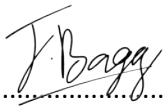
Report prepared by:



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Melanie Tupe
Marine Ecologist

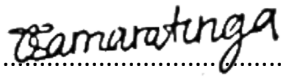
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Joshua Bagg
Coastal Engineer

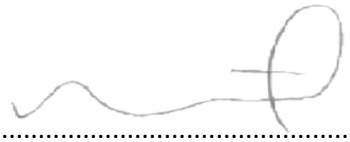
Report prepared by:



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Chloe Samaratunga
Geospatial Analyst

Authorised for Tonkin & Taylor Ltd by:



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Rob Van De Munckhof
Project Director

This report has been technically reviewed by Peter Quilter – Senior Coastal Engineer and Susan Jackson, Senior Marine Ecologist

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Appendix A Orthomosaics

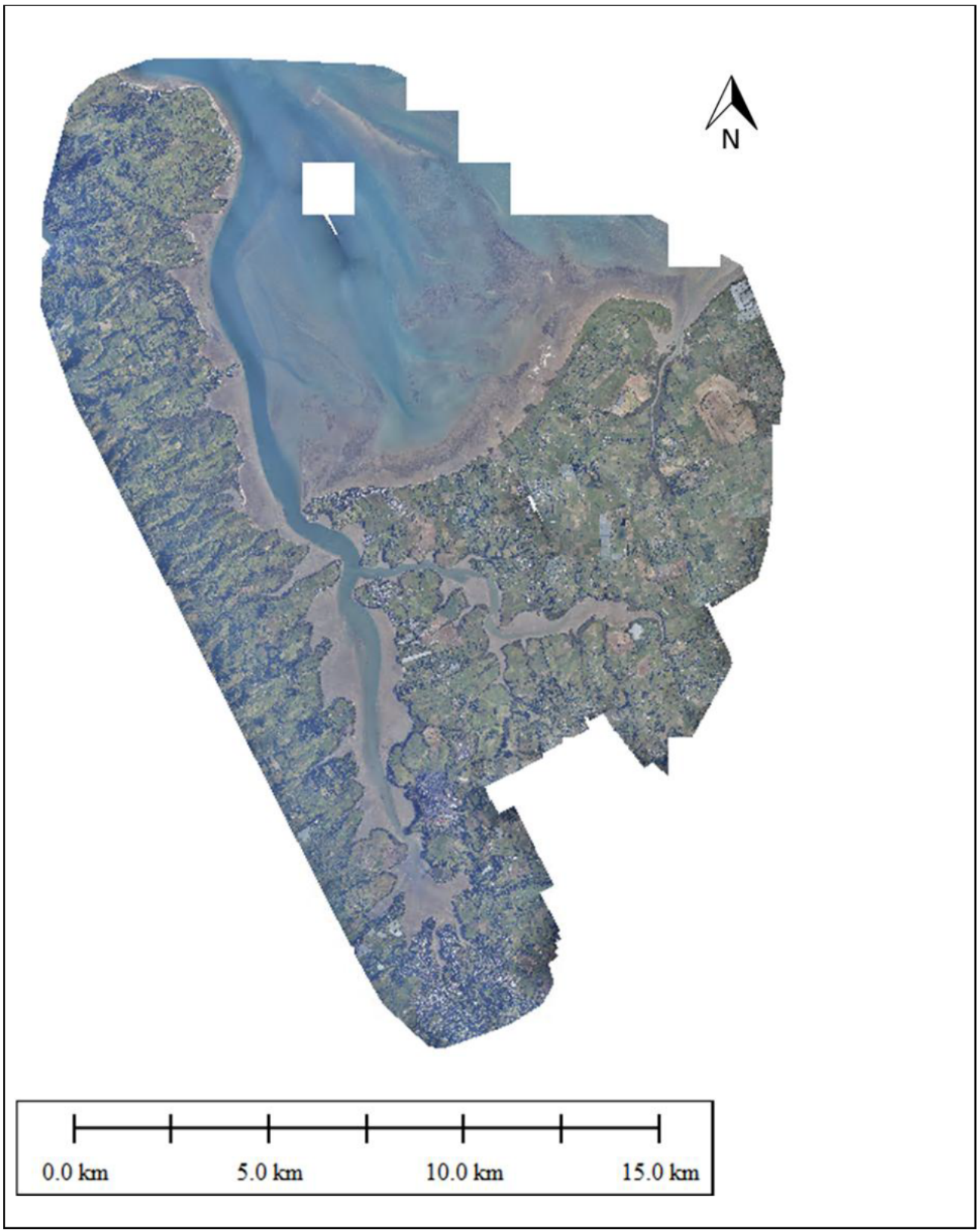


Figure Appendix A.1: 18 December 2024 orthomosaic imagery capture.



Figure Appendix A.2: 24 May orthomosaic imagery capture



Figure Appendix A.3: 23 July 2025 orthomosaic imagery capture

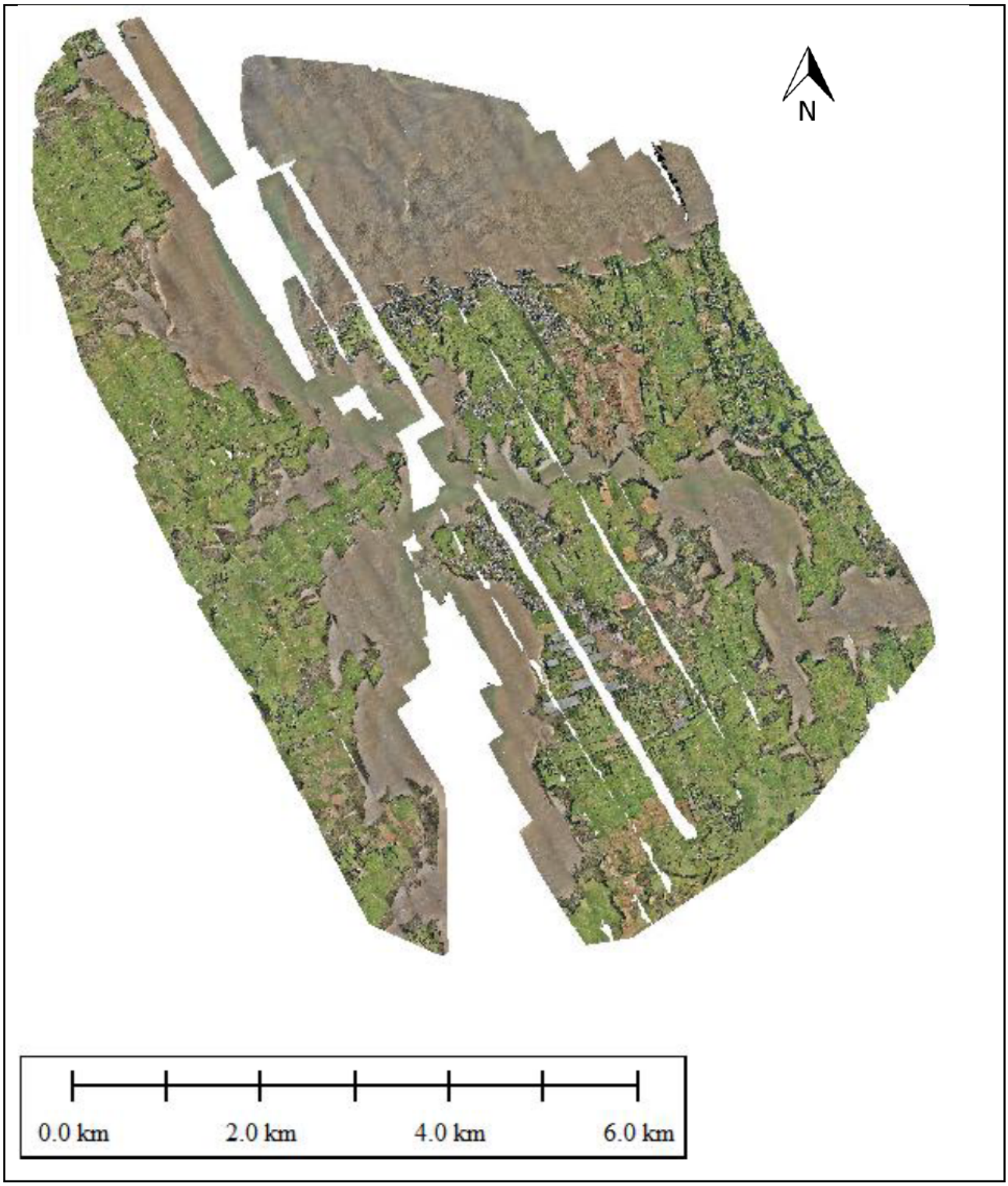


Figure Appendix A.4: 4 November 2025 orthomosaic which was unsuccessfully constructed due to low sidelap (38%)

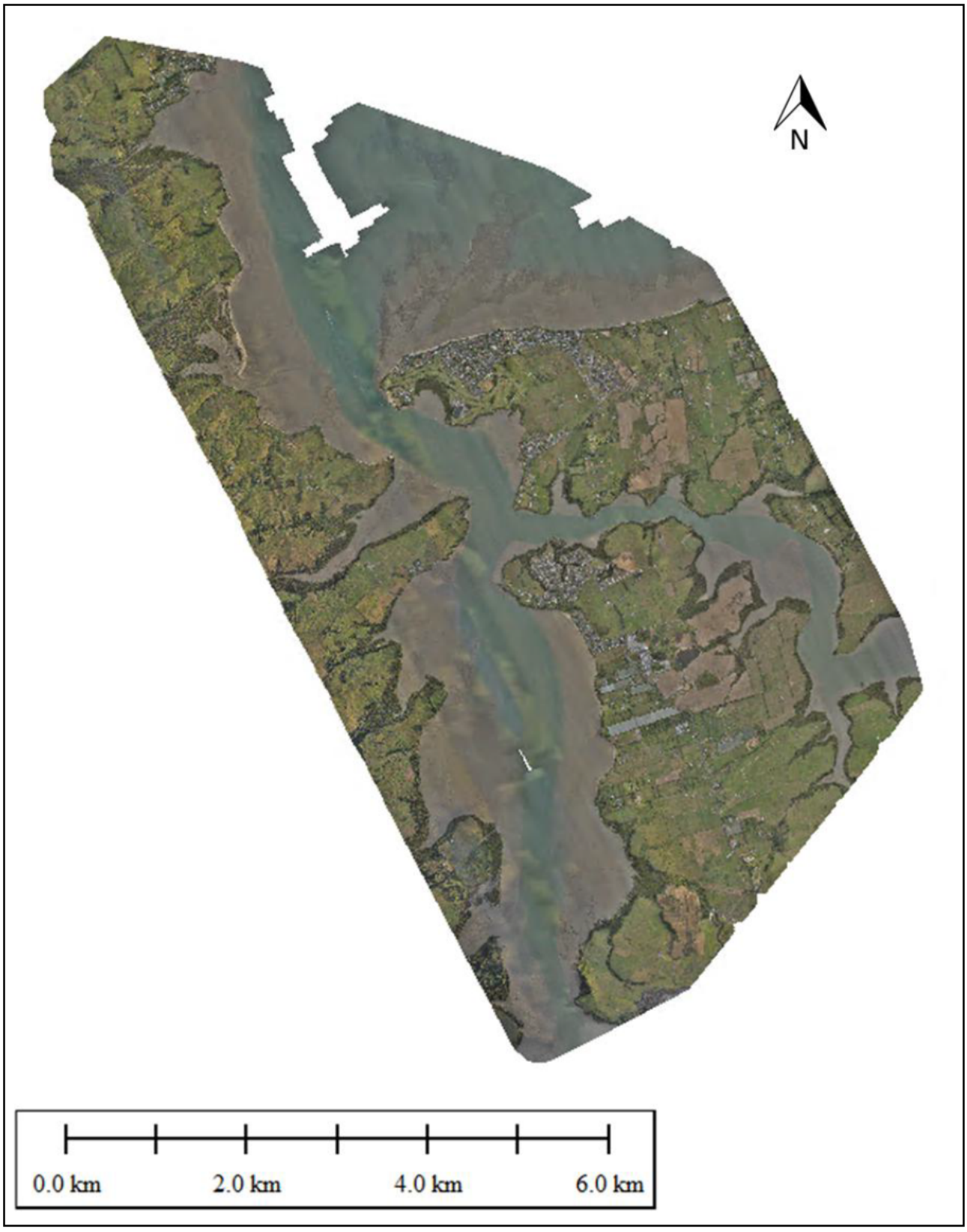


Figure Appendix A.5: 7 March 2026 orthomosaic imagery capture



Figure Appendix A.6: 30 April 2026 orthomosaic

Appendix B Marine vegetation and habitat classification

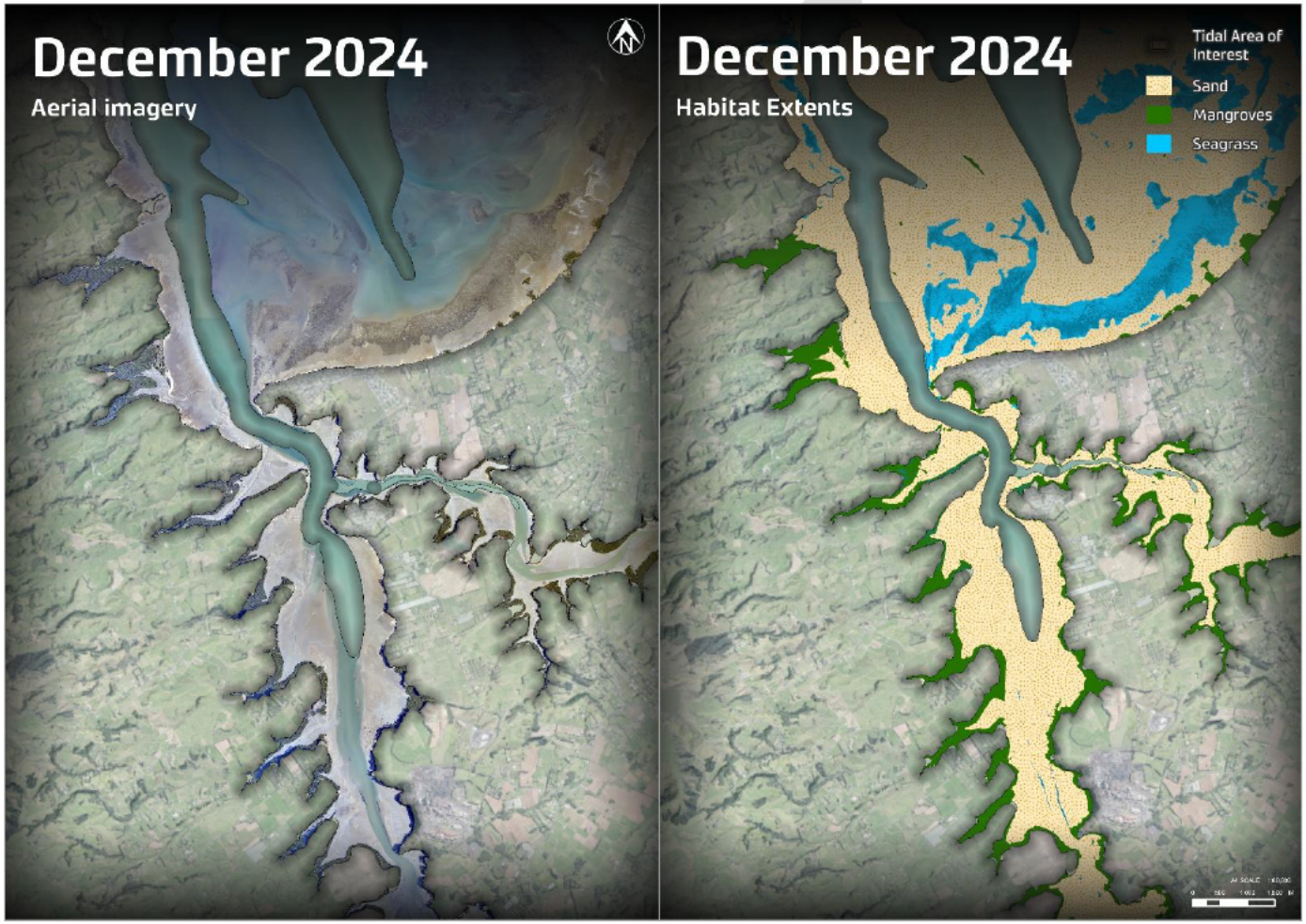


Figure Appendix B.1: December 2024 orthomosaic and image classification results. Note that the dark blue seagrass colour is the object based classification and the lighter blue is the generalised polygon created for the habitat extent.

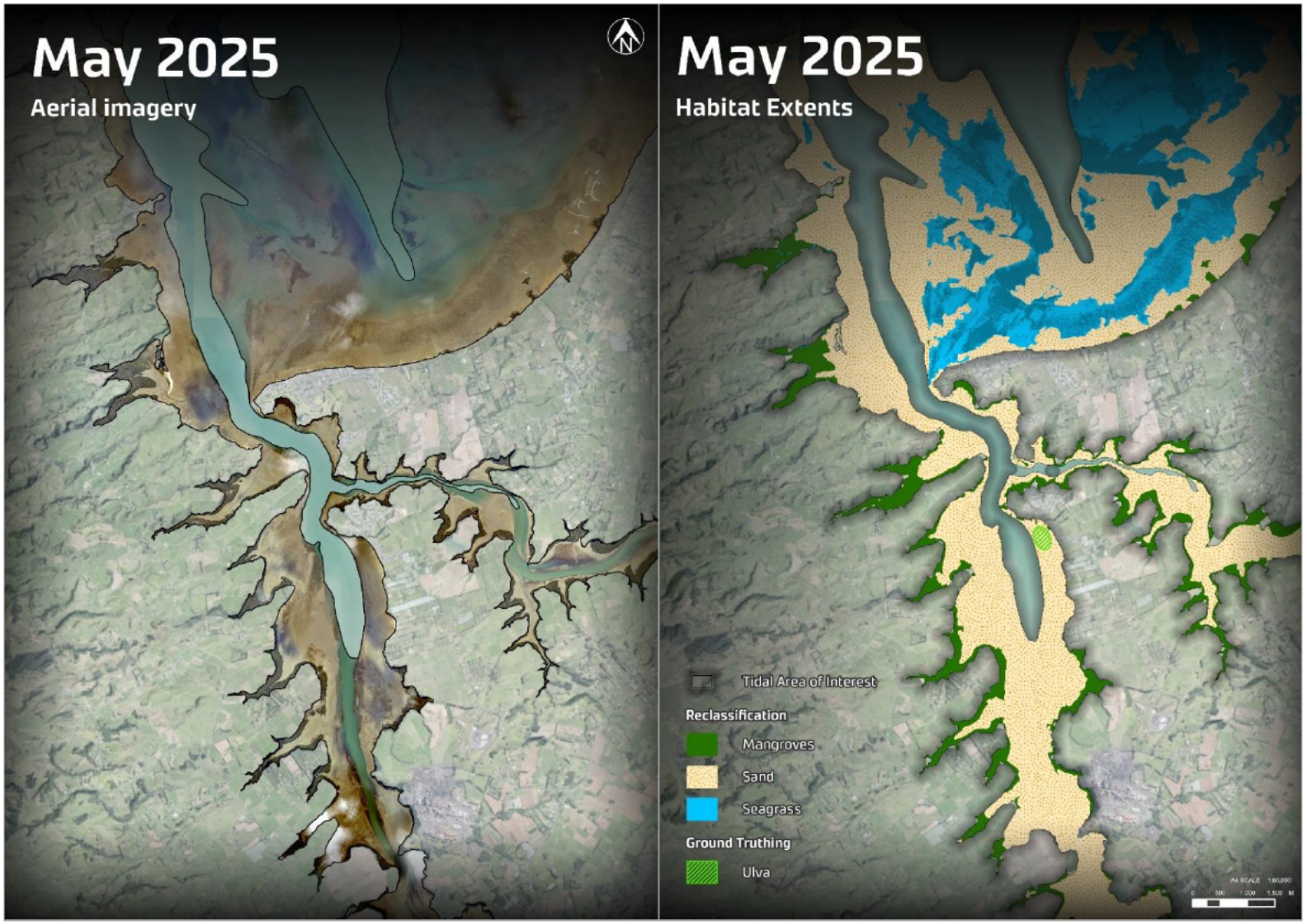


Figure Appendix B.2: May 2025 orthomosaic image classification results and ground truth extents. Note that the dark blue seagrass colour is the object based classification and the lighter blue is the generalised polygon created for the habitat extent.

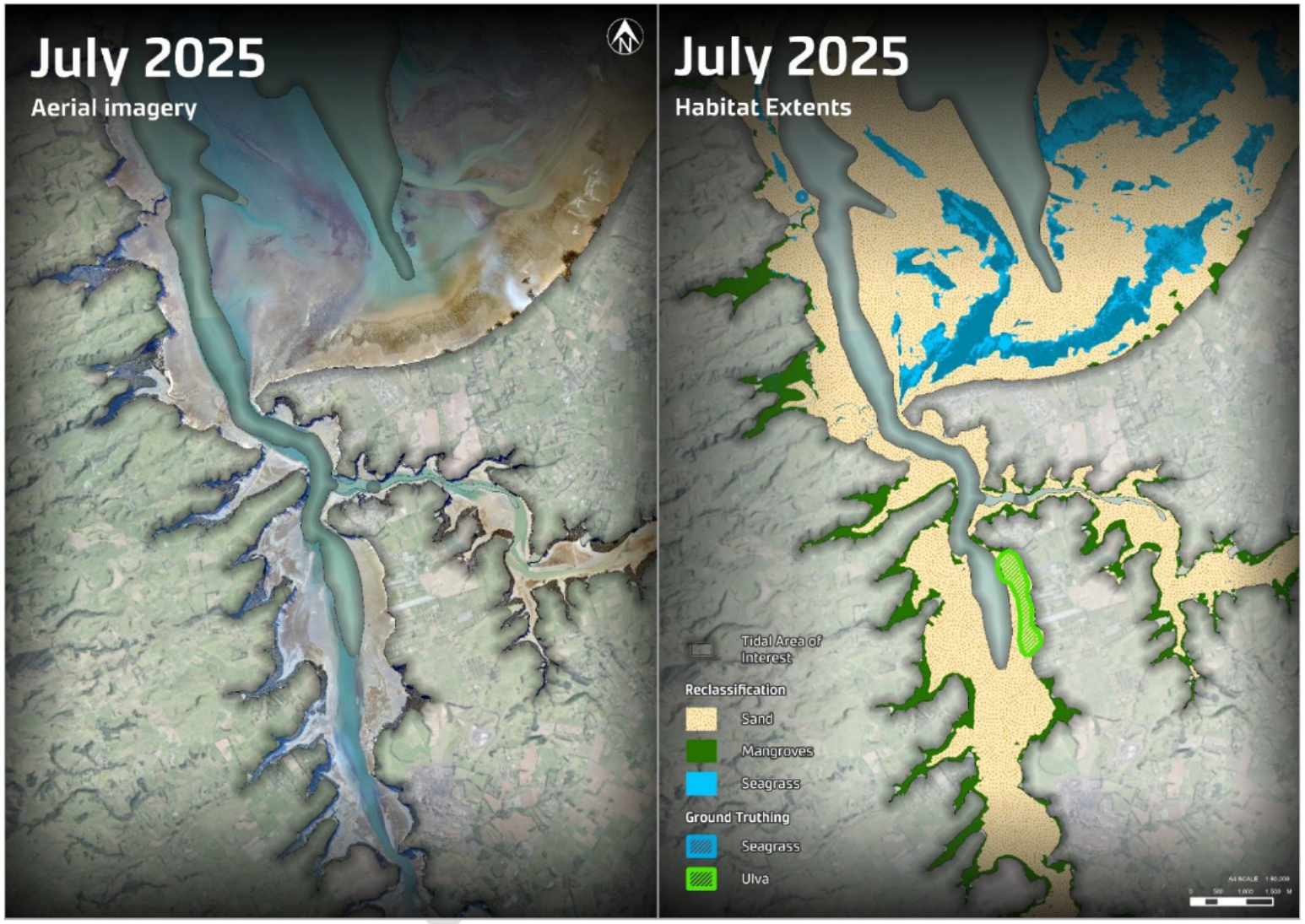


Figure Appendix B.3: July 2025 orthomosaic image classification results and ground truth extent. Note that the dark blue seagrass colour is the object based classification and the lighter blue is the generalised polygon created for the habitat extent.

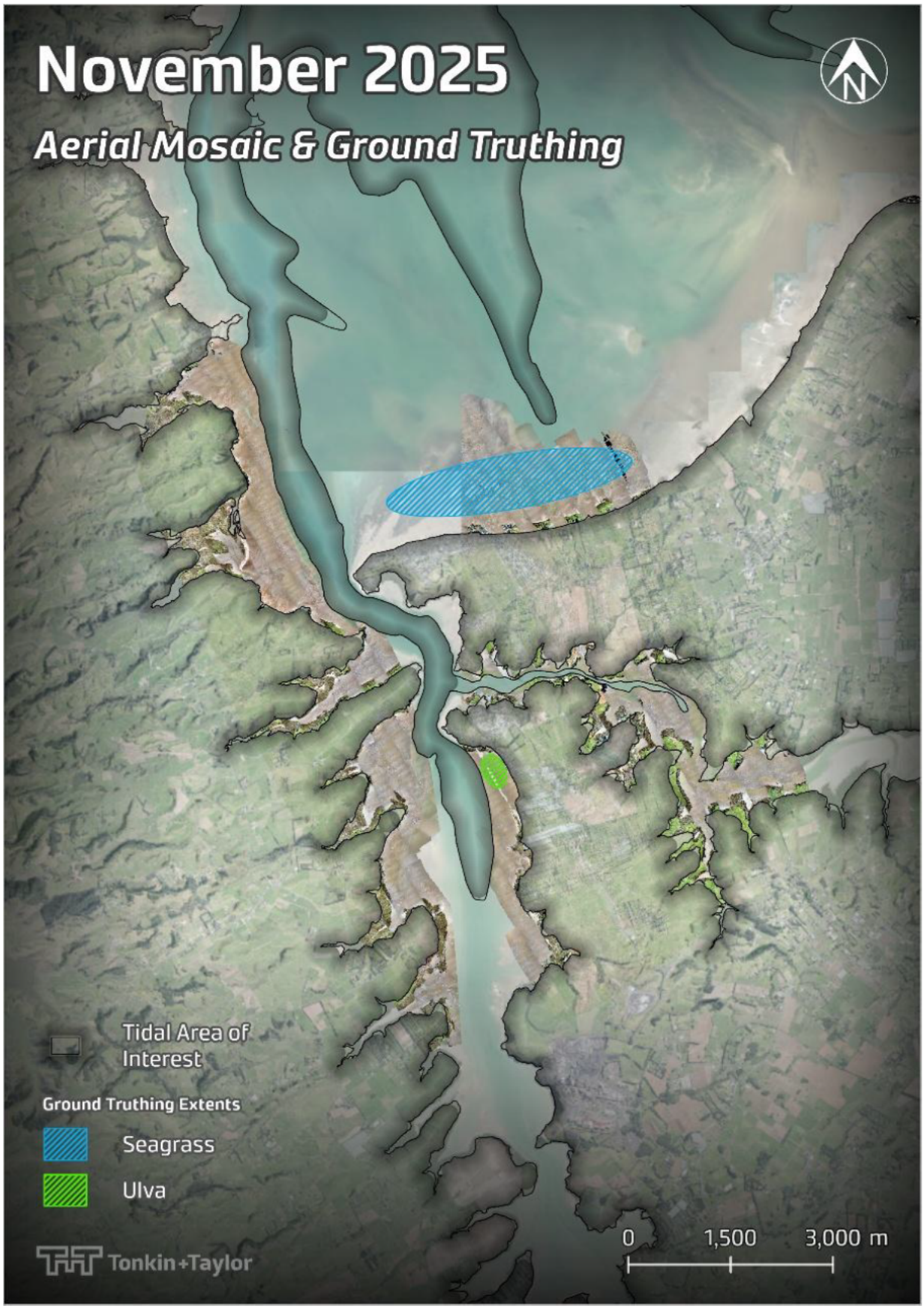


Figure Appendix B.4: November 2025 orthomosaic and ground truth extent

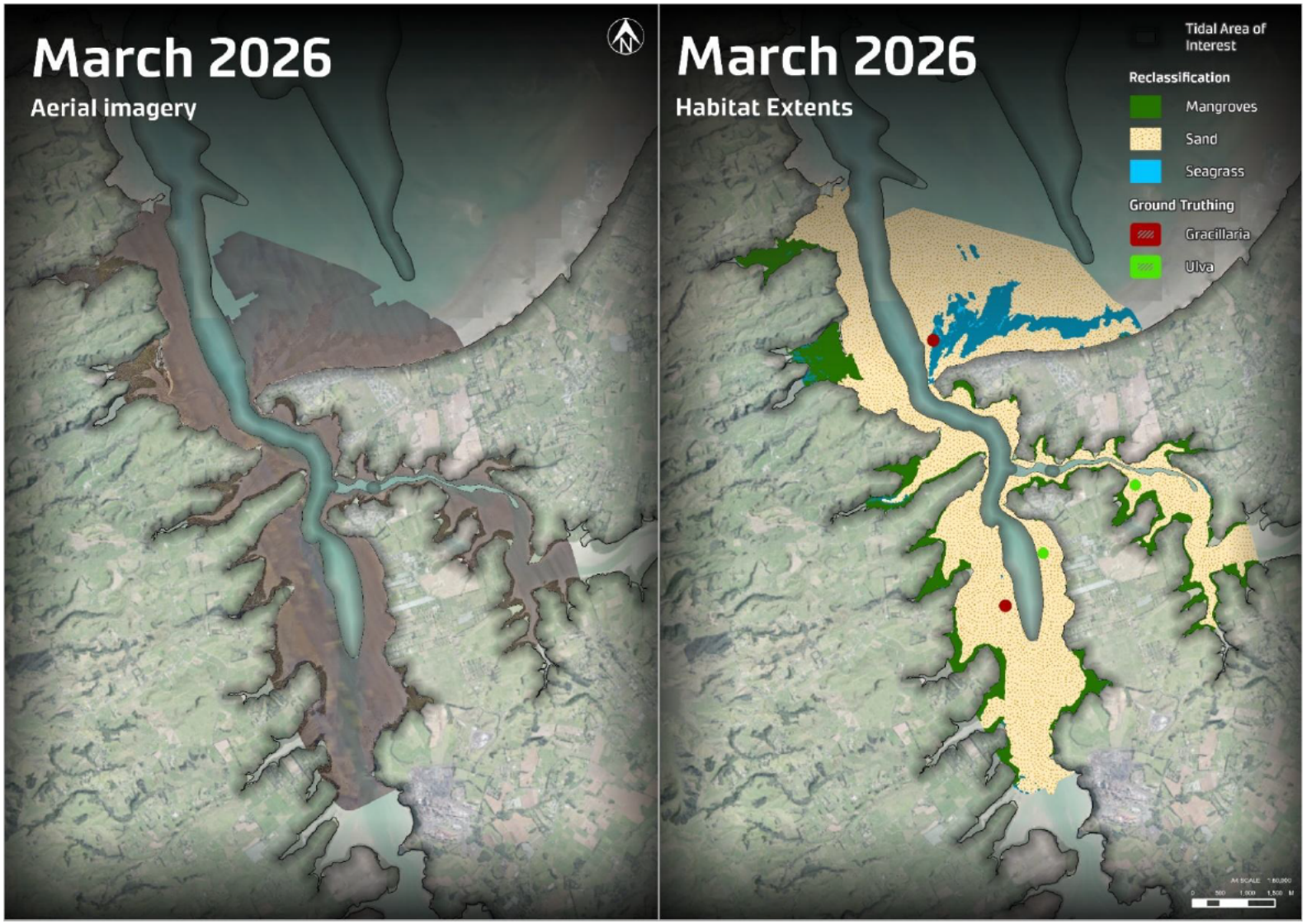


Figure Appendix B.5: March 2026 orthomosaic image classification results and ground truth extent. Note that the dark blue seagrass colour is the object based classification and the lighter blue is the generalised polygon created for the habitat extent.

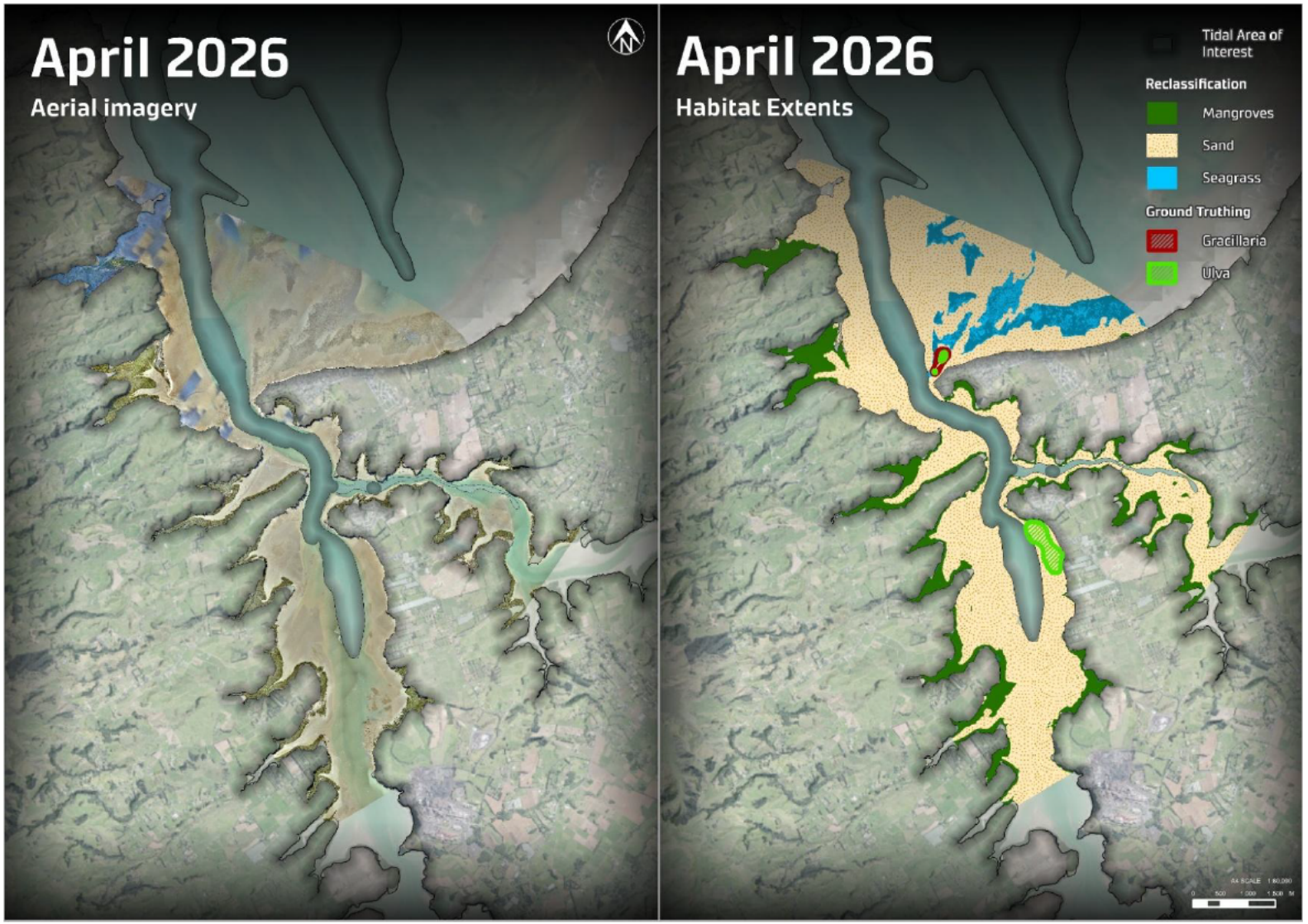


Figure Appendix B.6: April 2026 orthomosaic image classification results and ground truth extent. Note that the dark blue seagrass colour is the object based classification and the lighter blue is the generalised polygon created for the habitat extent.

Appendix C Locations of *Ulva* spp. and *Gracilaria* spp. detected during ground truthing surveys

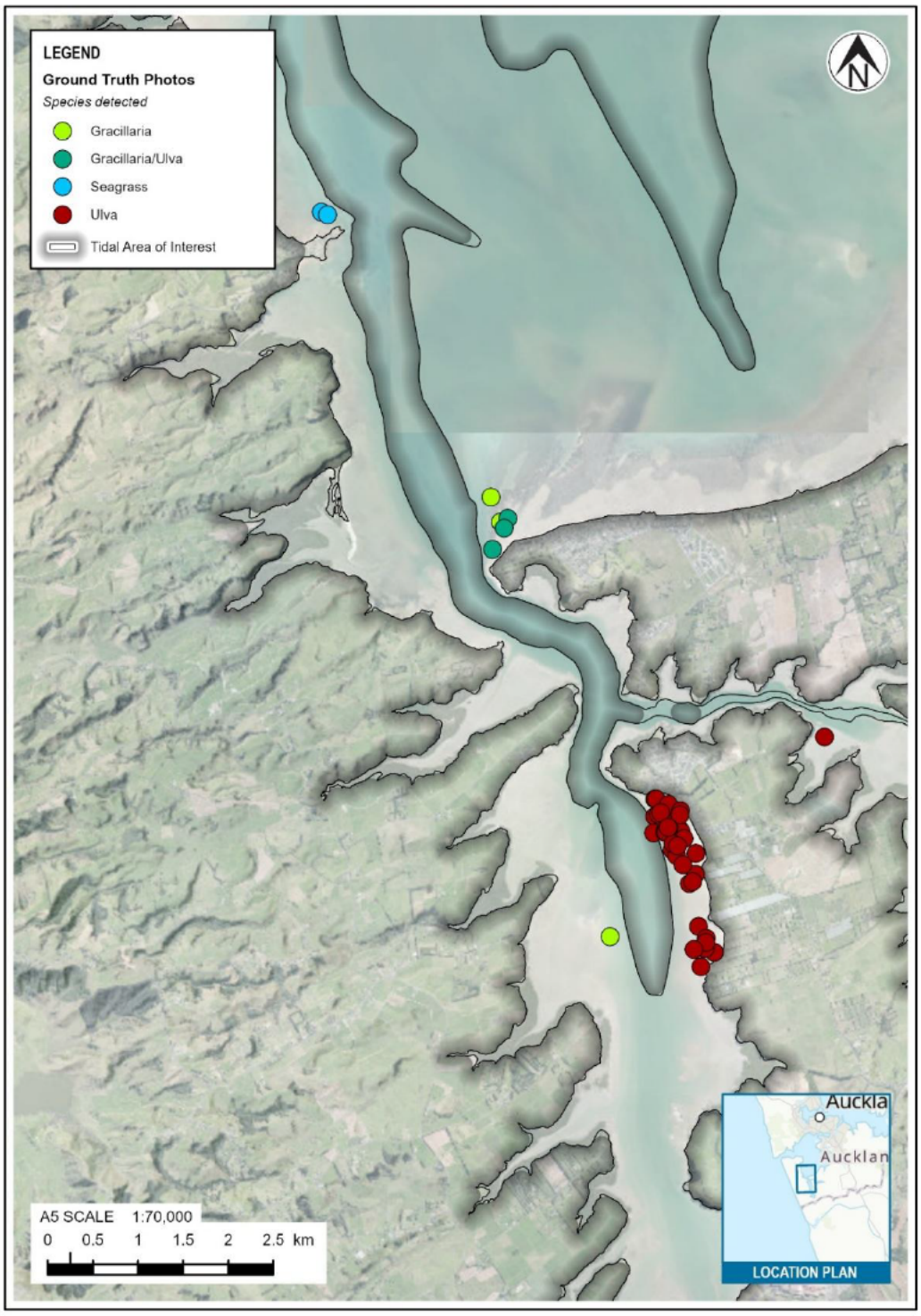


Figure Appendix C.1: Location of identified Ulva spp. and Gracilaria spp. during ground truthing surveys.

Appendix D Imagery collected during ground truthing surveys



Photograph Appendix D.1: Cyanobacteria and organic matter at Clarks beach. Photo taken May 2025.



Photograph Appendix D.2: Organic matter at Glenbrook beach. Photo taken May 2025.



Photograph Appendix D.3: Cyanobacteria and organic matter at Clarks Beach. Photo taken May 2025.



Photograph Appendix D.4: Mangroves at Matakawau Creek. Photo taken May 2025.



Photograph Appendix D.5: Undulating sand patterns, Waiuku Estuary, opposite Glenbrook Beach. at Matakawau Point. Photo taken May 2025.



Photograph Appendix D.6: Seagrass meadows south near south of Grahams beach. Photo taken May 2025.

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Clarks Beach Wastewater Treatment Plant upgrade:

Shellfish baseline monitoring 2024-2026

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Cover Illustration: Farmed oyster site at Karaka Point (K) looking west into the Waiuku Estuary (August 2024)

EXECUTIVE SUMMARY

This report documents the results of the two years (July 2024 to June 2026) of baseline monitoring for shellfish quality and population dynamics in the Waiuku Estuary. The monitoring establishes a baseline ahead of the upgrade to the Clarks Beach Wastewater Treatment Plant and its new outfall that will be operational in July 2026. The shellfish monitoring is part of the Receiving Environmental Monitoring Programme (REMP), which aims to identify and analyse noticeable patterns over time in water quality, shellfish quality, and marine ecology of the Southern Manukau Harbour in relation to the release of treated wastewater from the new outfall.

Contaminant Monitoring of Farmed Oysters (August 2024 – May 2026)

Contaminant monitoring involved five sampling events across five sites Matakawau Headland (M), Karaka Point (K), Te Toro Road Ramp (R), Te Toro Road Settlement (S), and Gordon's Landing (G) using farmed Pacific oysters. Due to logistical constraints related to tides, laboratory capacity, and weather, the REMP requirement for collecting three wet samples and two dry samples each year was met only in the second year of monitoring.

Metal concentrations revealed several elevated baseline levels:

• **Arsenic (Total)** concentrations ranged between 12 and 16 mg/kg dry weight (d.w.) and are comparable to the highest levels detected in the Manukau Harbour. The highest calculated inorganic arsenic concentration (0.35 mg/kg w.w.) was 35% of the 1 mg/kg w.w. guideline.

• **Copper** levels ranged from 250 to 650 mg/kg d.w., with one upstream site (Site G) reaching 944 mg/kg d.w. in May 2025. The highest replicate concentration (78.1 mg/kg w.w.) was higher than the Generally Expected Level (GEL) of 30 mg/kg w.w..

• **Lead** concentrations were low, with the highest replicate (0.071 mg/kg w.w.) measuring only 3% of the required Food Standard limit (2 mg/kg w.w.).

• **Zinc** concentrations were also high (1000 to 2000 mg/kg d.w.), reaching 3300 mg/kg d.w. at Site G in May 2025. However, the highest replicate value (234.3 mg/kg w.w.) was within the expected range compared to the GEL of 290 mg/kg w.w..

Overall, upstream Site G frequently showed the highest concentrations for Copper, Zinc, and Arsenic in later sampling events. All samples were below the regulatory limits for Polycyclic Aromatic Hydrocarbons (PAH4 and Benzo[a]pyrene), adopting European Union reference values in the absence of New Zealand guidelines.

Microbial analysis indicated compliance issues:

• **Faecal Coliforms** exceeded the marginal threshold of 230 MPN/100g in more than two replicates at Site M during August 2024, October 2024, January 2025, August 2025, April 2026, and May 2026, site R during May 2025, August 2025, April 2026 and May 2026; site K during December 2025 and April 2026; site S during April 2026; and site G during August 2025, December 2025, April 2026 and May 2026. The origin of these high bacteria levels remains unknown. No consistent negative impact was observed from rainfall during the wet-weather sampling events, with conditions being generally comparable to those of dry-weather sampling events.

• **Enterovirus** results were below minimum detection levels.

Shellfish Population Monitoring (October 2024 to February 2026)

Population monitoring of wild oysters (5 sites) and cockles (5 sites) was conducted in October 2024, February 2025, August 2025, and February 2026.

- **Wild Oysters (*Magallana gigas*):** Mean lengths ranged from 35 mm to 51 mm over the two-year monitoring period. Densities ranged from 3 to 26 oysters/0.25m^2, showing small variation (<10%) between sampling periods, suggesting seasonal stability in population numbers.

- **Wild Cockles (*Austrovenus stutchburyi*):** Mean lengths (10 mm to 20 mm) were typically below the attractive edible size of 25 mm. Densities ranged from 275 to 2251 per m^2 and generally increased between October 2024 and February 2025, before decreasing in subsequent monitoring.

TABLE OF CONTENTS

Document Control and Revision Record i

Executive Summary ii

Table of Contents iv

List of Tables v

1 Introduction 8

1.1 Context 8

1.2 Waiuku Estuary catchment and pollution sources 8

1.3 Previous records of oyster quality in the Waiuku Estuary 8

2 Contaminant monitoring of oysters 11

2.1 Methodology 11

2.1.1 Condition Index of Oysters 12

2.1.2 Metal Concentrations in Oysters 13

2.1.3 Polycyclic Aromatic Hydrocarbons in Oysters 13

2.1.4 Microbial Contaminants in Oysters 13

2.1.5 Data visualisation 14

2.1.6 Food standards 14

2.2 Results and Discussion 15

2.2.1 Sampling and limitations 15

2.2.2 Condition of Oysters 17

2.2.3 Metal Contaminants in Oysters 19

2.2.4 Polycyclic Aromatic Hydrocarbon contaminants in oysters 25

2.2.5 Microbial contaminants in oysters 27

3 Shellfish Population Monitoring 30

3.1 Oyster Abundance and Size 30

3.1.1 Methodology 30

3.1.2 Results and Discussion 32

3.2 Cockle Abundance and Size 35

3.2.1 Methodology 35

3.2.2 Results and Discussion 35

4 References 39

List of Tables

Table 2.1 New Zealand and International Food Standards for Metals in Shellfish (mg/kg w. w.).. 14

Table 2.2 Characteristics of the sampling events 2024 to 2026 16

Table 2.3 Comparison of Food Standards with the highest replicates from August 2024 to May 2026. 19

Table 2.4 Comparison of regulatory limits with the highest replicates from August 2024 to May 2026 27

Table 3.1 Summary of length and abundance of Pacific Oyster (Magallana gigas) between October 2024 and February 2026. 32

Table 3.2 Summary of the length and abundance of cockle (Austrovenus stutchburyi) between October 2024 and February 2026. 35

List of Figures

Figure 1.1 Waiuku Estuary in relation to the Manukau Harbour. The star marks the position of the Clarks new outfall 10

Figure 2.1 Map showing the Farmed Oyster sites. The star marks the position of the new Clarks Beach outfall 11

Figure 2.2 Example of oyster bags installed on the reef. Here at Te Toro Road Settlement 12

Figure 2.3 Mean ± 95% CI Condition Index in Farmed Oysters from August 2024 to May 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 18

Figure 2.4 Mean ± 95% CI Total Arsenic concentrations in Farmed Oysters between August 2024 and May 2025 (mg/kg dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 20

Figure 2.5 Mean ± 95% CI Copper concentrations in Farmed Oysters between August 2024 and May 2025 (mg/kg dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 21

Figure 2.6 Mean ± 95% CI Lead concentrations in Farmed Oysters between August 2024 and May 2025 (mg/kg dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 24

Figure 2.7 Mean ± 95% CI Zinc concentrations in Farmed Oysters between August 2024 and May 2025 (mg/kg dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 25

Figure 2.8 Mean ± 95% CI Total PAH and PAH4 concentrations in Farmed Oysters between August 2024 and May 2026 (ng/g dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 26

Figure 2.9 Boxplot showing the concentration of faecal coliforms and enterococci in farmed oysters from August 2024 to May 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 29

Figure 3.1 Monitoring sites for wild oyster populations and wild cockle populations. 31

Figure 3.2 Oyster Abundance August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 33

Figure 3.3 Oyster length August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 33

Figure 3.4 Oyster Size Frequency August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 34

Figure 3.5 Cockle Abundance August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 36

Figure 3.6 Cockle length August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 36

Figure 3.7 Cockle Size Frequency August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall. 37

List of Appendices

Appendix 1 Site Information and past weather Data

Table A 1.1 Geographic Coordinates of Farmed Oyster Bags (WGS84)

Table A 1.2 Geographic Coordinates of oyster population monitoring sites (WGS84)

Table A 1.3 Geographic Coordinates of cockle population monitoring sites (WGS84)

Figure A 1.1 Map showing the rainfall sites used to determine wet and dry events.

Table A 1.4 Past weather data in relation to the collection of oysters

Appendix 2 Condition index data

Table A 2.1 Condition Index of Farmed Oysters - August 2024

Table A 2.2 Condition Index of Farmed Oysters - October 2024

Table A 2.3 Condition Index of Farmed Oyster - January 2025

Table A 2.4 Condition Index of Farmed Oysters - March 2025

Table A 2.5 Condition Index of Farmed Oysters - May 2025

Appendix 3 Contaminant data in farmed oysters

Table A 3.1 Raw Data Metals (mg/kg dry weight) - August 2024

Table A 3.2 Raw Data Metals (mg/kg dry weight) - October 2024

Table A 3.3 Raw Data Metals (mg/kg dry weight) - January 2025

Table A 3.4 Raw Data Metals (mg/kg dry weight) - March 2025

Table A 3.5 Raw Data Metals (mg/kg dry weight) - May 2025

Table A 3.6 Raw Data PAH (ng/g dry weight) - August 2024

Table A 3.7 Raw Data PAH (ng/g dry weight) - October 2024

Table A 3.8 Raw Data PAH (ng/g dry weight) - January 2025

Table A 3.9 Raw Data PAH (ng/g dry weight) - March 2025

Table A 3.10 Raw Data PAH (ng/g dry weight) - May 2025

Table A 3.11 Raw Data for Faecal Coliforms (MPN/100g) from August 2024 to May 2025

Table A 3.12 Raw Data for Enterococci (MPN/100g) and Enterovirus (pfu/100g) from August 2024 to May 2025.

Appendix 4 Wild Shellfish population monitoring

Table A 4.1 Wild Oyster Lengths (mm)

Table A 4.2 Wild Oyster Density (nb/0.25m^2)

Table A 4.3 Cockle size frequency data

Table A 4.4 Cockle Density (nb/m2)

1 INTRODUCTION

1.1 Context

Watercare Services Ltd is upgrading the Southwest wastewater treatment network to support future population growth in Auckland's Southwest region. At Clarks Beach, a new 100 m outfall pipe was completed in late 2025. It will go online in July 2026, and will have capacity to carry treated wastewater of up to 30,000 people.

To comply with Condition 27 of the resource consent granted in 2018, a Receiving Environmental Monitoring Programme (REMP) was implemented to identify and analyse noticeable patterns over time in water quality, shellfish quality, and marine ecology of the Southern Manukau Harbour (Figure 1.1) in relation to the release of treated wastewater from the new Clarks Beach outfall. Environmental monitoring was scheduled to begin two years prior to the completion of the new outfall, *i.e.* in June 2024, to provide a baseline before the release of treated wastewater *via* the new outfall. The current volume of treated wastewater discharged from the Clarks Beach plant is ~250 m^3/day, while that from the Waiuku Plant is ~1,150 m^3/day. The discharge volume of treated wastewater *via* the new outfall will gradually increase in line with population growth, reaching a maximum of 5,000m^3/day.

A REMP was finalised in June 2024 (Watercare 2024). Bioresearches has been tasked with completing the contaminant monitoring of shellfish, and population monitoring of oysters (*Magallana gigas*, previously *Crassostrea gigas*) and cockles (*Austrovenus stutchburyi*).

This report presents the results from the first two years of the baseline monitoring (June 2024 to June 2026).

1.2 Waiuku Estuary catchment and pollution sources

The Waiuku Estuary extends approximately 11km from its mouth at Clarks Beach upstream to the town of Waiuku. The catchment of the Waiuku Estuary is predominantly rural, with dairy and dry stock farming as the main land uses (Mills 2014, Hart *et al.* 2025). During rainfall events, agricultural runoff is a significant contributor of diffuse sediment and nutrients into the estuary. Increased mud content in the sediment is impacting benthic ecosystem health (Bioresearches 2025a). A small but growing proportion of the catchment is urban with small townships such as Waiuku, Glenbrook and Clarks Beach. There are two wastewater treatment plants discharging treated effluent into the estuary: Waiuku, and Clarks Beach. The effluents introduce nutrients, suspended sediments and potential pathogens to the estuary. The New Zealand Steel mill at Glenbrook on the eastern side is one of the largest industrial sites in the Auckland region. It was identified as a source of zinc and copper in the environment (Bioresearches 2025a).

1.3 Previous records of oyster quality in the Waiuku Estuary

Pacific oysters in the Waiuku Estuary are being monitored as part of the consent conditions for the operations of the Waiuku Wastewater Treatment Plant, and the New Zealand Steel plant at Glenbrook. At a larger scale, the Manukau Harbour benefits from regular monitoring run by the Auckland Council under the Shellfish Contaminant Monitoring Programme.

For the Waiuku Wastewater Treatment Plant, bacteria levels in oysters are monitored annually in February at five sites, located upstream from the REMP sites, except for OYSE (Bioresearches 2025b). OYSE

matches the Gordons site (Gordon's Landing) in the present study. Faecal coliforms were very low at a median of 20 MPN/100g during the past two surveys (Feb 2024 and 2025) when no rain had occurred in the week prior to sampling. Before 2024, the oyster sampling was conducted after significant rain events (>20 mm rain in the week prior to sampling), and high faecal coliform concentrations were detected in oyster flesh at OYSE site (>300 MPN/100g). It was concluded that rainfall significantly affects water quality in the Waiuku catchment, which is predominantly farmland. Farmed animals are a significant source of faecal coliforms which get transported into the Waiuku Estuary via runoff. Elevated nutrient levels were highlighted during the monitoring programme of the Manukau Estuary run by the Auckland Council, which regularly monitors water quality in the upper Waiuku Estuary and at Clarks Beach (Kelly and Kamke 2023).

For the New Zealand Steel plant, oysters are sampled annually for metal analysis from sites in the receiving environment of the plant outfalls, and from a control site in the Taihiki River, which joins the Waiuku Estuary further downstream. Copper and zinc in oyster flesh are markedly higher than in the Taihiki River, especially for zinc. It was concluded the NZ Steel discharge is the source of these contaminants in the receiving environment near the outfalls (Bioresearches 2025a). The metal results from the Taihiki River site is used as a comparative reference for the present study's results. During the past five years, the copper concentrations in oysters ranged from 177 to 313 mg/kg dry weight, while the zinc concentrations ranged from 1683 to 2150 mg/kg dry weight.

The shellfish Contaminant Monitoring Programme run by the Auckland Council has no regular oyster monitoring sites in the Waiuku Estuary (Stewart *et al.* 2013). The closest sites are Cornwallis and Mill Bay on the northern side of the Manukau Harbour entrance, south of the Waitakere Ranges. These sites are considered control points for contaminants as direct human activities are minimal, with only light urbanisation and surroundings catchments dominated by native forest. Copper, lead, and zinc concentrations in oyster flesh were the lowest among Manukau monitoring sites (median values between 2009 and 2011 were 110, 0.2, 1500 mg/kg dry weight respectively at Cornwallis as per Auckland Council's most recent published report; Stewart *et al.* 2013). Arsenic, however, showed a high median concentration in oysters (13.0 mg/kg), which could be related to historical sediment contamination from timber treatment activities in the Waitakere Ranges. PAH showed a similar profile to lead in the Manukau Harbour. Their concentrations at Cornwallis were low (17 µg/kg dry weight).



Figure 1.1 ***Waiuku Estuary in relation to the Manukau Harbour. The star marks the position of the Clarks new outfall***

2 CONTAMINANT MONITORING OF OYSTERS

2.1 Methodology

As outlined by the REMP, contaminant monitoring was conducted at five locations within the Waiuku Estuary. These sites were identified as Matakawau Headland (M), Karaka Point (K), Te Toro Boat Ramp (R), Te Toro Road Settlement (S), and Gordons Landing (G) (Figure 2.1). This allows for samples taken near the discharge location (Sites K and R) as well as locations further away from the discharge point (Sites M, S, and G). The GPS coordinates of the sites are shown in Appendix 1 Table A1.1.

At these five sites, bags of farmed Pacific oysters from the Mahurangi oyster farm were deployed the 18th of July 2024 to sustain the sampling regime of the monitoring plan and limit the impact on wild oyster populations. These bags of oysters were replenished after each sampling event. After a minimum of a month of acclimation to the new environment, the farmed oysters were able to be collected for contaminant testing.



Figure 2.1 *Map showing the Farmed Oyster sites. The star marks the position of the new Clarks Beach outfall*



Figure 2.2 Example of oyster bags installed on the reef. Here at Te Toro Road Settlement

The REMP states that monitoring of contaminants is to be carried out over the two years prior to the commencement of discharge from the outfall. Sampling was to be undertaken a minimum of five times throughout the first year of monitoring, with sampling events scheduled to target seasonal monitoring.

In addition to seasonal monitoring, the REMP specifies that two samples should be collected after two weeks of dry weather where the average rainfall/day is <5 mm (dry event) and three samples should be collected after significant rainfall where there has been >15 mm of rain in the preceding 24 hours (wet event), or as close as feasible. The 24-hour period was considered too short and changed to a 48-hour period preceding sampling to validate a wet event. In some instances, seasonal sampling events also met the required rainfall criteria and were therefore considered representative of both seasonal and weather-event monitoring requirements. Rainfall was determined using data from Auckland Council, specifically looking at the four sites Awhitu @ Brook Road (741611), Waitangi @ Diver Road (742736), Waiuku @ Cosmopolitan Club (742740), and Waiuku Rain @ Waiuku-Otaua Road (742739)(Appendix 1).

2.1.1 Condition Index of Oysters

Condition Index was determined using the oyster tissue from metal and PAH analyses. The REMP specifies a size range of 60 to 70 mm. However, oysters outside this range were occasionally used where stock availability from the oyster farm was limited.

During the first year of sampling, ten replicate samples of six oysters were collected from each site. From August 2025 onwards, laboratory procedures were updated to allow metals and PAHs to be analysed from the same six oyster replicate, therefore only five replicates were taken from each site for condition index. Control samples for condition index were also incorporated into the monitoring programme from August 2025 onwards, with five replicate control samples of six oysters collected before the farmed oysters were

deployed into the environment. The inclusion of control oysters also reduced the influence of variation in oyster condition arising from environmental conditions experienced prior to deployment.

Upon return to the laboratory, the oysters were thoroughly cleaned by scrubbing the shells and removing any major fouling organisms. Any broken or damaged shellfish were discarded. The total volume of each replicate was then measured, and the oysters were frozen in separate plastic containers for later processing. The oysters were then thawed and shucked into a pre-weighed clean plastic vial. While thawing, the oysters were placed cupped side facing up to minimise the loss of fluid. The total tissue sample per replicate was then weighed to obtain a wet weight. The total volume of the empty shells was also measured. Tissue samples were re-frozen as soon as possible after shucking. Frozen tissue samples were delivered to Watercare Laboratory Services to determine a dry weight.

The Condition Index (an indicator of how well an oyster has utilised the internal shell volume available for tissue growth) was calculated as follows:

$$Conditon\ Index = \frac{Dry\ Weight * 100}{Internal\ shell\ volume}$$

2.1.2 Metal Concentrations in Oysters

Five samples of six oysters were collected per site for metals analysis and processed for condition index (see above). Frozen tissue samples were then delivered to the Watercare Laboratory Services for metal analysis. Concentrations of arsenic, copper, lead, and zinc were tested to total recoverable trace levels dry weights with the additional percentage moisture measured, so that wet weight can be calculated. The laboratory analysis followed the standardised analytical procedure APHA 3125 B with digestion of shellfish tissue in strong acid, then the determination of metal concentrations using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) (APHA 2017).

2.1.3 Polycyclic Aromatic Hydrocarbons in Oysters

Five samples of six oysters were collected per site for Polycyclic Aromatic Hydrocarbon (PAH) analysis and processed for condition index (see above). Frozen tissue samples were then delivered to the Watercare Laboratory Services for PAH analysis. There is no analytical standard for PAHs in New Zealand (refer to Watercare Laboratory Services Certificates of Analysis). PAHs in oysters were extracted with organic solvents, then detected and quantified *via* Gas Chromatography coupled with Mass Spectrometry (GC-MS).

2.1.4 Microbial Contaminants in Oysters

Five samples of twelve oysters were collected per site for Enterococci and Faecal Coliform analysis. Three samples of 20 oysters were collected for Enterovirus. The oysters were shucked using sterile equipment and the flesh was placed in sterile plastic vials. The equipment was sterilised between sites. Samples were placed in the fridge until they were delivered to the Watercare Laboratory within 4 hours of being open in the case of bacteria, and within 24 hours of being open in the case of virus.

2.1.5 Data visualisation

Contaminant data were summarised using the arithmetic mean and 95% confidence intervals, or the median and quartiles in tables and figures. The use of the mean or median depended on the distribution characteristics of the data. Normality was assessed with a Shapiro-wilk test. Most metal and PAH concentrations from each sampling event followed a normal distribution and were summarised by the mean and 95% confidence intervals. Bacteria and virus data did not follow a normal distribution and were instead summarised by a median and quartiles.

2.1.6 Food standards

2.1.6.1 Metal Contaminants in shellfish

New Zealand ensures shellfish safety through regulatory limits on metal contaminants, using Maximum Levels (MLs), Generally Expected Levels (GELs), and internationally aligned standards. MLs, set under the Australia New Zealand Food Standards Code (ANZFA 2001), are legally enforceable limits that define the maximum allowable concentrations of certain metal contaminants in food. During a scientific, risk-based review of legacy standards, many older MLs were found not justified on public health grounds and were removed. To address the resulting information gap, GELs were introduced. GELs are non-enforceable guidance values that represent the typical contaminant levels found in food. All contaminant limits are expressed on a wet weight basis (i.e. the food as eaten). The wet weight for the replicate with the highest contaminant concentration was calculated using the percentage moisture associated with that replicate (Appendix 2).

The summary of current regulations for metal contaminants in shellfish across the regulatory frameworks is presented in Table 2.1.

Table 2.1 New Zealand and International Food Standards for Metals in Shellfish (mg/kg w. w.)

Chemical / Compound	ANZFA		
	Standard	GEL[2]	GEL[2]
	1.4.1[1]	(median)	(90 percentile)
Arsenic (inorganic)*	1	-	-
Copper	-	5	30
Lead	2	-	-
Zinc	-	170	290

* Inorganic arsenic is conservatively estimated to be 10% of the total arsenic (USFDA 1993).

1 FSANZ (2024) Schedule 19 – Maximum Levels of Contaminants and Natural Toxicants

2 ANZFA (2001)

2.1.6.2 Polycyclic Aromatic Hydrocarbon Contaminants in shellfish

New Zealand currently does not have specific regulatory guidelines for PAH concentrations in shellfish. In the absence of national limits, reference values will be adopted from the European Union Regulation No. 835/2011 (European Commission 2011), which established a limit in shellfish of 5µg/kg wet weight for benzo{a}pyrene (BaP) and 30 µg/kg wet weight for the sum of four key carcinogenic PAHs (benzo[a]pyrene, chrysene, benzo[a]anthracene, and benzo[b]fluoranthene) collectively referred to as PAH4.

The laboratory results for this study report benzo[b]fluoranthene and benzo[k]fluoranthene as a combined result of benzo[f+k]fluoranthene. To estimate the concentration of benzo[b]fluoranthene for the PAH4 calculation, benzo[b]fluoranthene is assumed to be 70% of the combined benzo[b+k]fluoranthene value (FSANZ 2014).

Many of the PAHs returned concentrations below the minimum detection level. For the purposes of this study, these values have been considered as zero. Additionally, because the laboratory results are reported on a dry weight basis, a moisture content of 85% has been assumed to convert results to a wet weight basis for comparison with regulatory limits. This moisture value is a conservative estimate based on the moisture content calculated from the replicate samples used for metal contaminant analysis. From August 2025 onwards, revised laboratory procedures allowed for both metals and PAH to be tested from the same six oyster replicate, therefore the measured moisture content for each replicate was used to convert PAH concentrations to wet weight for comparison with regulatory standards.

2.1.6.3 Microbial Contaminants in Shellfish

The Ministry of Health (1995) established criteria for faecal coliform bacteria in untreated shellfish. These guidelines require five samples, each comprising of no less than twelve oysters. Of these replicates, no more than two samples should exceed the marginal threshold of 230 MPN/100g and none may exceed the maximum limit of 330 MPN/100g.

There are currently no standards or regulations in New Zealand or Internationally that regulate the acceptable level of enterococci and enterovirus in shellfish flesh. Positive findings of virus in shellfish typically result in area closures rather than compliance-based regulatory decisions.

2.2 Results and Discussion

The results presented below correspond to the two years of baseline monitoring of the Clarks Beach WWTP upgrade project.

2.2.1 Sampling and limitations

The REMP described the conditions for sampling oysters in the Waiuku Estuary. The protocol aims to detect:

1) any seasonal variation with sampling events spaced through the year,

2) weather effects with an attempt to match sampling with dry or wet weather conditions,

on contaminant concentrations in the environment using oysters as bioindicators.

During the two-year baseline, farmed oysters placed at sites Matakawau Headland, Karaka Point, Te Toro Road Ramp, Te Toro Road Settlement, and Gordons Landing were collected in August 2024, October 2024, January 2025, March 2025, May 2025, August 2025, October 025, December 2025, January 2026, March 2026, April 2026, and May 2026 (Table 2.2).

Table 2.2 Characteristics of the sampling events 2024 to 2026

Sampling Date	Days in Environment	Time Period preceding event	Rainfall Monitoring Site (mm)				Classification
			Cosmopolitan club	Waiuku-Otaua Road	Brook Road	Diver Road	
15/08/24	28 days	24-Hour	0	0	0	0	Dry
		48-hour	0	0	0.5	0	
		2-Week	19	20	18	21	
		2-Week Ave/d	1.4	1.4	1.3	1.5	
30/10/24	103 except for M 76 days	24-Hour	5	5	8	5	Dry
		48-hour	7	7	10	8	
		2-Week	17	15	21	16	
		2-Week Ave/d	1.2	1.1	1.5	1.1	
22/01/25	84 Days	24-Hour	4	4	12	6	Dry
		48-hour	8	9	12	7	
		2-Week	8	9	12	7	
		2-Week Ave/d	0.6	0.6	0.9	0.5	
6/03/25	43 days for M, S, and G. 30 days for K and R.	24-Hour	0	0	0	0	Wet
		48-hour	17	15	9	15	
		2-Week	24	17	20	18	
		2-Week Ave/d	1.7	1.2	1.4	1.3	
20/05/25	76 days except R 106 days.	24-Hour	0	0	4	0	Dry
		48-hour	6	6	8.5	6	
		2-Week	40	39	41	60	
		2-Week Ave/d	2.8	2.8	2.9	4.3	
20/08/25	29	24-Hour	15	18	12	14	Wet
		48-hour	23	25	22	21	
		2-Week	58	61	59	55	
		2-Week Ave/d	4.1	4.3	4.2	4.0	
16/10/25	57	24-Hour	0	0	0	0	Wet
		48-hour	23	27	31	25	
		2-Week	71	80	75	88	
		2-Week Ave/d	5.0	5.7	5.4	6.3	
15/12/25	60	24-Hour	0	0	0	0	Dry
		48-hour	0	0	0	0	
		2-Week	33	42	20	19	
		2-Week Ave/d	2.3	3.0	1.4	1.4	
28/01/26	50	24-Hour	0	0	0	0	Neutral
		48-hour	2	0	0	5	
		2-Week	117	177	177	118	
		2-Week Ave/d	8.3	12.6	12.6	8.4	
12/03/26	43	24-Hour	0	0	0	0	Dry
		48-hour	0	0	0	0	
		2-Week	12	7	6	6	
		2-Week Ave/d	0.8	0.5	0.4	0.4	
13/04/26	32	24-Hour	44	-	35	47	Wet
		48-hour	47	-	40	49	
		2-Week	79	-	89	77	
		2-Week Ave/d	5.6	-	6.4	5.5	
13/05/26	28	24-Hour	0	-	1	3	Dry
		48-hour	3	-	2	4	
		2-Week	18	-	28	22	
		2-Week Ave/d	1.3	-	2.0	1.6	

Note: The classification of the event was based on the highlighted rainfall data. The "Neutral" event showed high rainfall values two weeks before the sampling event but dry weather within the 48-hour preceding.

The requirement to collect at least three wet samples and two dry samples could not be met during the first year of sampling due to practical constraints organising fieldwork, however this requirement was met during the second year of sampling. For the purposes of the monitoring programme, dry-weather conditions were defined as an average daily rainfall of less than 5 mm/day during the preceding two weeks, while wet-weather conditions were defined as greater than 15 mm of rainfall during the preceding 48 hours.

Several factors limited the ability to target weather specific conditions. Firstly, sampling could only be undertaken during daylight hours and suitable low-tide windows, generally between 10:00 am and 4:30pm. Secondly, the large number of bacteria samples collected during each survey required immediate laboratory processing. Watercare Laboratory Services required advance notice of sample delivery so that culture media could be prepared prior to receiving the samples. Limited laboratory staffing during weekends and public holidays further restricted the ability to undertake sampling later in the week, as there was insufficient capacity to process the 25 bacteria samples immediately. Once these logistical constraints had been satisfied, the weather forecast was monitored to identify suitable wet-weather and dry-weather sampling opportunities.

In addition to the fieldwork challenges presented above, bags of farmed oysters were stolen from several monitoring locations on several occasions during the first year of the monitoring programme, resulting in the loss of samples. To minimise the likelihood of further losses, the oyster deployment locations at Matakawau Headland, Karaka Point, and Te Toro Road Ramp were relocated to nearby sites that were less accessible to the public. This approach was successful in retaining oysters for subsequent monitoring. The coordinates of the relocated deployment sites are provided in Appendix 1 (Table A1.1).

2.2.2 Condition of Oysters

The mean condition index based on dry weight is presented in Figure 2.3 and the raw data are presented in Appendix 2 (Tables A2.4 to A2.15).

The condition index is an indicator of how well an oyster has utilised the internal volume available for tissue and shell growth. The condition of farmed oysters is known to fluctuate seasonally due to the cycles of tissue growth and reproduction, with higher values in winter and spring, and lower values in summer and autumn. This seasonal pattern was evident during the two years of monitoring, with higher condition indices generally recorded during spring sampling events and lower values observed during late summer and early autumn sampling events (Figure 2.3). The consistency of this pattern across all monitoring sites suggests that seasonal biological processes were a primary driver of the observed variability in oyster condition.

Considerable variation in condition index was observed both between sampling events and among sites. However, temporal variation within individual sites was generally greater than the differences observed between sites, indicating that seasonal influences had a stronger effect on oyster condition than spatial location within the estuary. Despite the seasonal fluctuations, a consistent spatial pattern was evident throughout much of the monitoring period, with oysters deployed at the sites nearest to the harbour entrance (sites M and K) generally exhibiting higher condition indices than those deployed further up the estuary, particularly at site G. As condition index reflects the cumulative influence of long-term environmental conditions such as food availability and sediment load in the water column, it is not expected to be affected by short-term rainfall events, as they occur over a relatively short period of time. The consistently lower condition indices at site G may reflect differences in local environmental

conditions associated with the site's location along the mangrove fringe, including the presence of a substantial sediment layer.

From August 2025 onwards, condition index was also determined for oysters immediately prior to deployment. These control samples provided a baseline condition index against which the condition of deployed oysters could be assessed. By determining the condition of oysters at the time of deployment, the control samples allowed any unusually high or low condition indices recorded during monitoring to be considered in the context of the oysters' initial condition. This approach reduced the potential for pre-existing differences in oyster condition prior to deployment to influence the interpretation of results from the monitoring sites.

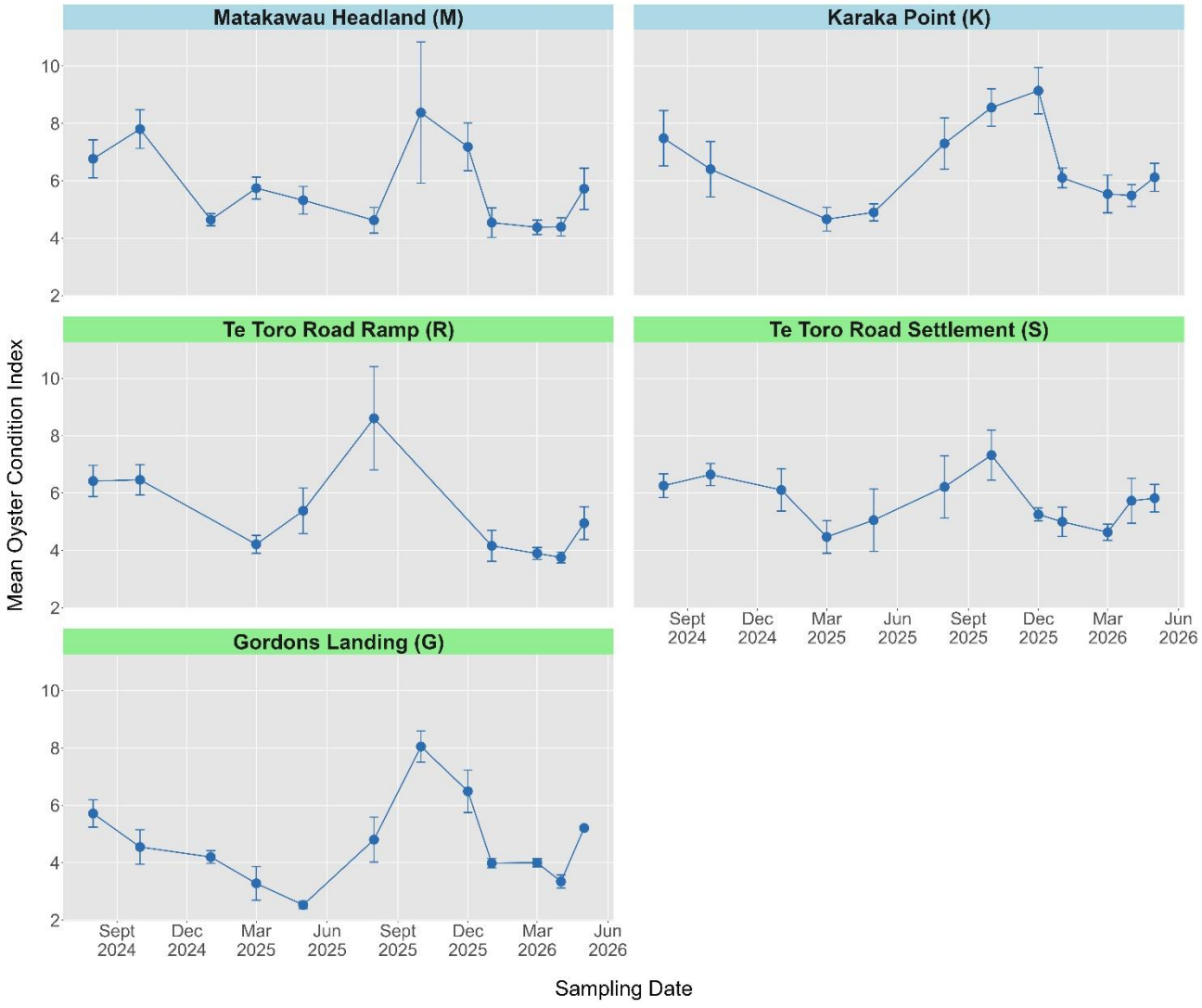


Figure 2.3 ***Mean ± 95% CI Condition Index in Farmed Oysters from August 2024 to May 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.***

2.2.3 Metal Contaminants in Oysters

2.2.3.1 Arsenic in oysters

The concentration of total arsenic was analysed from five replicates from each of the five sites, across twelve sampling events. The raw results are presented in Appendix 3 (Tables A3.16 to A3.27).

The mean concentrations of arsenic in the farmed oysters exhibited limited spatial variability throughout the monitoring period, with concentrations at all five sites generally falling within a similar range of 12 to 16 mg/kg (d.w.). No consistent differences were observed between upstream and downstream sites, indicating a uniform distribution of arsenic throughout the monitoring sites. However, temporal variation was significant, with total arsenic concentrations increasing at all sites during spring and summer 2025, especially sites M, K, and S. The concurrent nature of these increases suggests that seasonal or estuary-wide processes may have influenced arsenic accumulation.

The sampling undertaken under wet conditions occurred in March 2025, August 2025, October 2025, and April 2026. The highest concentrations of total arsenic were recorded in December 2025, which was considered a dry event, and the lowest concentration was recorded after the March 2025 rainfall event, indicating that short-term rainfall is unlikely to have an impact on the pattern of arsenic concentrations. The total arsenic concentrations are likely to reflect cumulative exposure over longer periods, potentially influenced by broader seasonal, hydrological, or biological factors. The arsenic concentrations are at the highest levels detected in oysters in the Manukau Harbour by the Auckland Council monitoring programme (Stewart *et al.* 2013). These values might be related to historical sediment contamination from timber treatment activities in the region.

There are currently no food standards concerning Total arsenic, however the guidelines for Inorganic Arsenic state that it should not exceed 1 mg/kg (w.w.). Inorganic arsenic, if not directly tested for, is conservatively estimated to be 10% of the total Arsenic in shellfish (USFDA 1993). Across all the sampling events, the replicate with the highest concentration of arsenic was at Karaka Point in December 2025, with an estimated inorganic arsenic concentration of 0.35 mg/kg w. w. (Table 2.3). The two-year baseline data demonstrates that inorganic arsenic concentrations in oysters from the Waiuku Estuary remained substantially below the food standard prior to the commencement of wastewater discharge from the new outfall.

Table 2.3 Comparison of Food Standards with the highest replicates from August 2024 to May 2026.

Contaminant	Standard/Guideline (mg/kg w.w.)	Highest value in study (mg/kg w.w.)
Arsenic (Inorganic)	1	0.35
Copper	30	78.1
Lead	2	0.071
Zinc	290	234.3

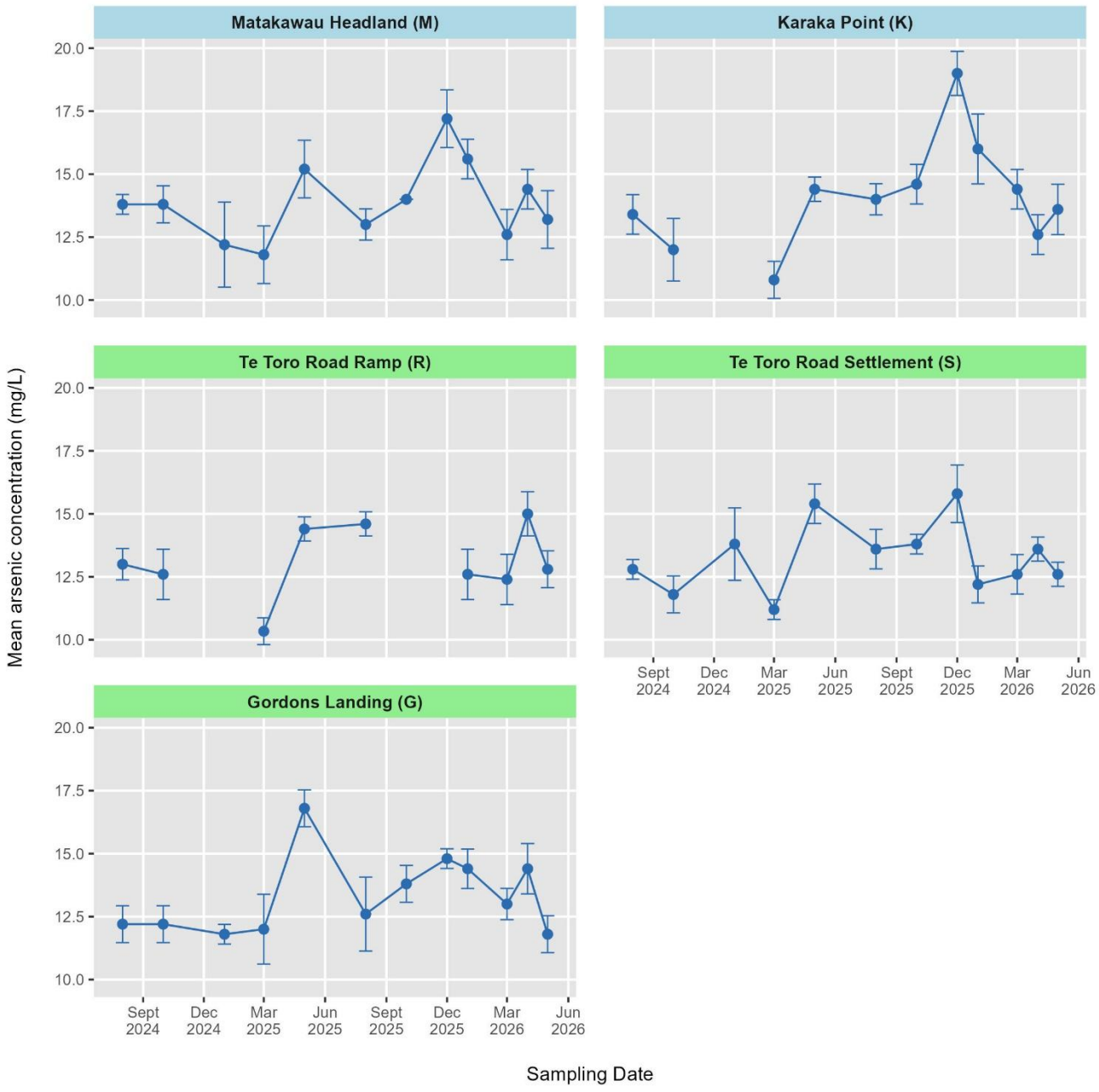


Figure 2.4 ***Mean ± 95% CI Total Arsenic concentrations in Farmed Oysters between August 2024 and May 2025 (mg/kg dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.***

2.2.3.2 Copper in oysters

The concentration of copper was analysed from five replicates from each of the five sites, across twelve sampling events. The results are presented in Figure ***2.5*** and the raw data are presented in Appendix 3 (Tables A3.16 to A3.27).

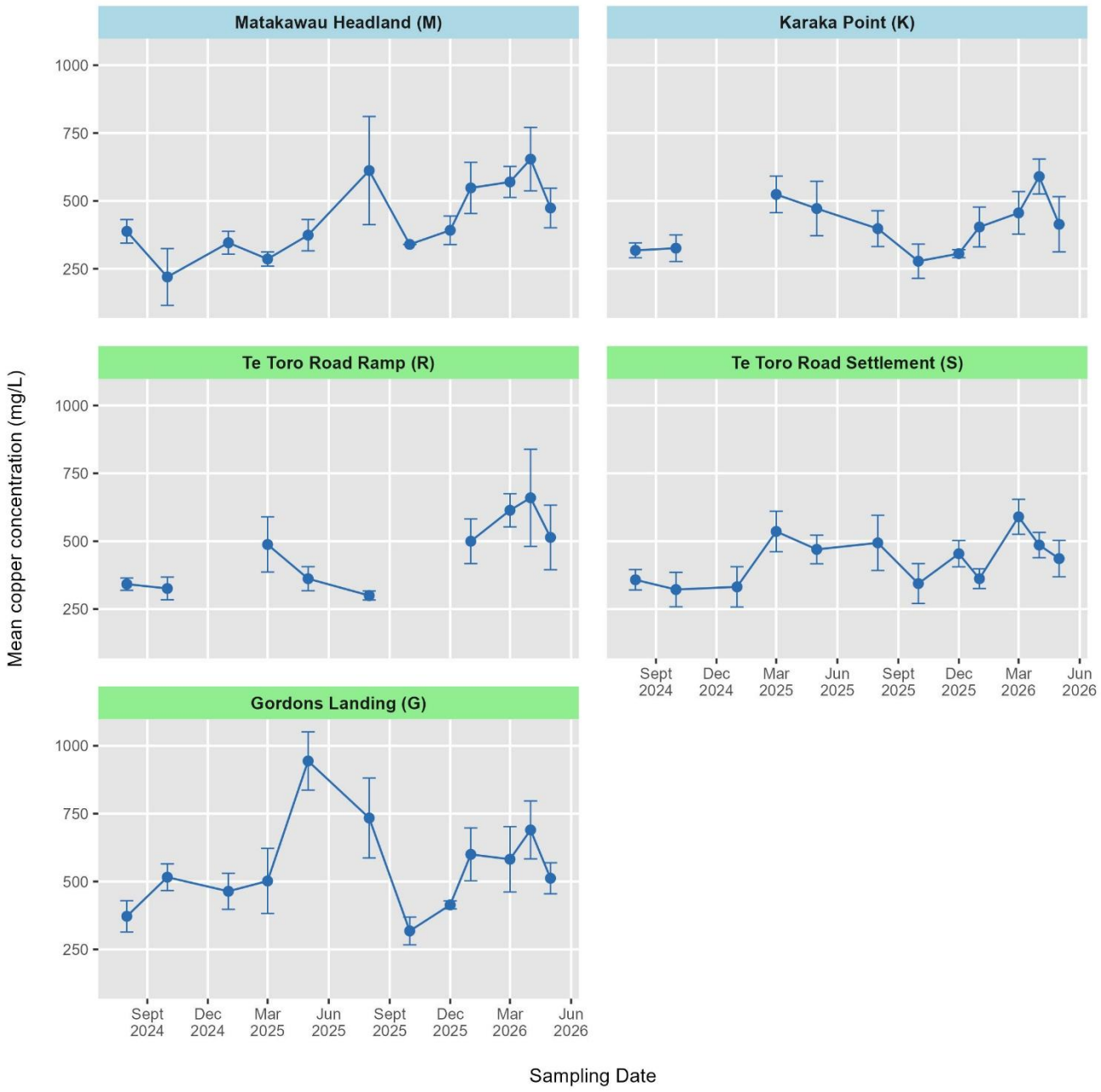


Figure** 2.5* ***Mean ± 95% CI Copper concentrations in Farmed Oysters between August 2024 and May 2025 (mg/kg dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.

The mean concentrations of copper in the farmed oysters exhibited temporal variability throughout the monitoring period with mean values ranging from 250 to 650 mg/kg d.w. across the five monitoring sites (Figure ***2.5***). The highest concentration was recorded at site G in May 2025 where the mean concentration reached 944 mg/kg d.w. Despite this variability, copper concentrations remained elevated at all sites throughout the two-year baseline monitoring programme and no consistent trend was evident.

Spatial variation between sites was generally less pronounced than temporal variation between sampling events. While site G typically exhibited the highest copper concentrations and greatest variability, no consistent upstream-downstream gradient was evident across the monitoring sites.

Sampling undertaken following wet-weather events did not indicate any consistent relationship between rainfall and copper concentrations in oyster tissue. Wet-weather sampling events occurred in March 2025, August 2025, October 2025, and April 2026. Copper concentrations recorded during these events fell within the range of concentrations observed during dry and neutral conditions. The highest copper concentrations were observed during dry-weather sampling in May 2025. These results suggest that short-term rainfall events are unlikely to be a primary driver of copper accumulation, with concentrations instead reflecting longer-term environmental and biological influences.

Copper concentrations recorded during the baseline monitoring programme were generally higher than those reported in oysters collected near the New Zealand Steel outfalls (last 5-year range of 177 to 313 mg/kg; Bioresearches 2025a). The consistently elevated copper concentrations across the five monitoring sites, together with the absence of elevated zinc concentrations (see below), suggest a broad-scale copper source rather than a localised industrial source from the New Zealand Steel Mill.

There are currently no limits concerning copper concentration in shellfish, however the GELs established by ANZFA have found a 90th percentile value of 30 mg/kg w.w. The highest replicate found during sampling had a value of 78.1 mg/kg w.w. (Table 2.3), equivalent to approximately 260% of the GEL value. The two-year baseline data establishes that copper concentrations in oysters within the Waiuku Estuary exceeded the GEL values reported for shellfish prior to the commencement of wastewater discharge from the new outfall, providing and important baseline against which future monitoring results can be assessed.

2.2.3.3 Lead in oysters

The concentration of lead was analysed from five replicates from each of the five sites, across twelve sampling events. The raw results are presented in Appendix 3 (Tables A3.16 to A3.27).

The mean concentrations of lead in the farmed oysters remained low throughout the monitoring period, ranging from 0.15 to 0.45 mg/kg (d.w.) across all five monitoring sites (Figure ***2.6***). Concentrations varied between sampling events, with the greatest variation occurring during the first year of monitoring. Lead concentrations generally declined from the initial sampling events in 2024 through to late 2025, before showing a slight increase at several sites in early 2026. Despite the fluctuations, no consistent increasing or decreasing trend was evident during the two-year baseline.

Spatial variation between sites was limited, with concentrations generally comparable among the five monitoring locations. Site K recorded the highest lead concentrations during the August and October 2024 sampling events and was significantly higher than other sites during these surveys. Site R generally exhibited the lowest lead concentrations throughout the monitoring programme. Although occasional differences were identified between individual sites, no consistent upstream-downstream gradient was evident across the monitoring programme.

Sampling undertaken following wet-weather events did not indicate any consistent relationship between rainfall and lead concentrations in oyster tissue. Wet-weather sampling events occurred in March 2025, August 2025, October 2025, and April 2026. Lead concentrations recorded during these events fell within the range observed during dry-weather events, suggesting that short-term rainfall events are unlikely to be a primary driver of lead accumulation.

The Food Standards require shellfish to contain less than 2 mg/kg (w.w.) of lead. The highest concentration found was 0.06 mg/kg (w.w.), which is 3% of the standard (Table 2.4). The two-year baseline data demonstrates that lead concentrations in oysters from the Waiuku Estuary remained substantially below the food standard prior to the commencement of wastewater discharge from the new outfall.

2.2.3.4 Zinc in oysters

The concentration of zinc was analysed from five replicates from each of the five sites, across five sampling events. The results are presented in Figure ***2.7*** and the raw data are presented in Appendix 3 (Tables A3.16 to A3.27).

Mean zinc concentrations in the farmed oysters exhibited moderate temporal variability throughout the monitoring period, ranging between approximately 1,100 and 2,200 mg/kg d.w. across the five monitoring sites (Figure ***2.7***). The highest concentrations were recorded at site G, with elevated concentrations observed in March 2025, May 2025, and April 2026, and a maximum mean lead concentration reaching 2900 mg/kg d.w. in May 2025. Despite these elevated values, zinc concentrations remained within a broadly similar range across the monitoring sites and no consistent increasing or decreasing trend was evident over the two-year baseline monitoring programme. ANOVA tests revealed no significant variation between sites during the first three sampling events.

Sampling undertaken following the wet-weather events did not indicate a consistent relationship between rainfall and zinc concentrations in oyster tissue. Wet-weather sampling events occurred in March 2025, August 2025, October 2025, and April 2026. Elevated zinc concentrations were recorded at site G during both March 2025 and April 2026; however, similarly elevated concentrations were also recorded during May 2025, which was a dry-weather event sampling. These results suggest that short-term rainfall events are unlikely to be the primary driver of zinc accumulation, with concentrations more likely reflecting longer-term environmental and biological influences.

The zinc concentrations found during the baseline monitoring programme were generally comparable to those reported in oysters collected near the New Zealand Steel outfalls (1683 to 2150 mg/kg d.w.; Bioresearches 2025a). Unlike copper, zinc concentrations did not appear to be consistently elevated across all monitoring sites.

There are currently no regulatory limits for zinc concentration in shellfish, however the GELs established by ANZFA have found a 90th percentile value of 290 mg/kg (w.w.). The highest concentration during the baseline period had a value of 251 mg/kg w.w. (Table 2.3). The two-year baseline data therefore indicates that zinc concentrations in oysters for the Waiuku Estuary were lower than the food standard prior to the commencement of wastewater discharge from the new outfall.

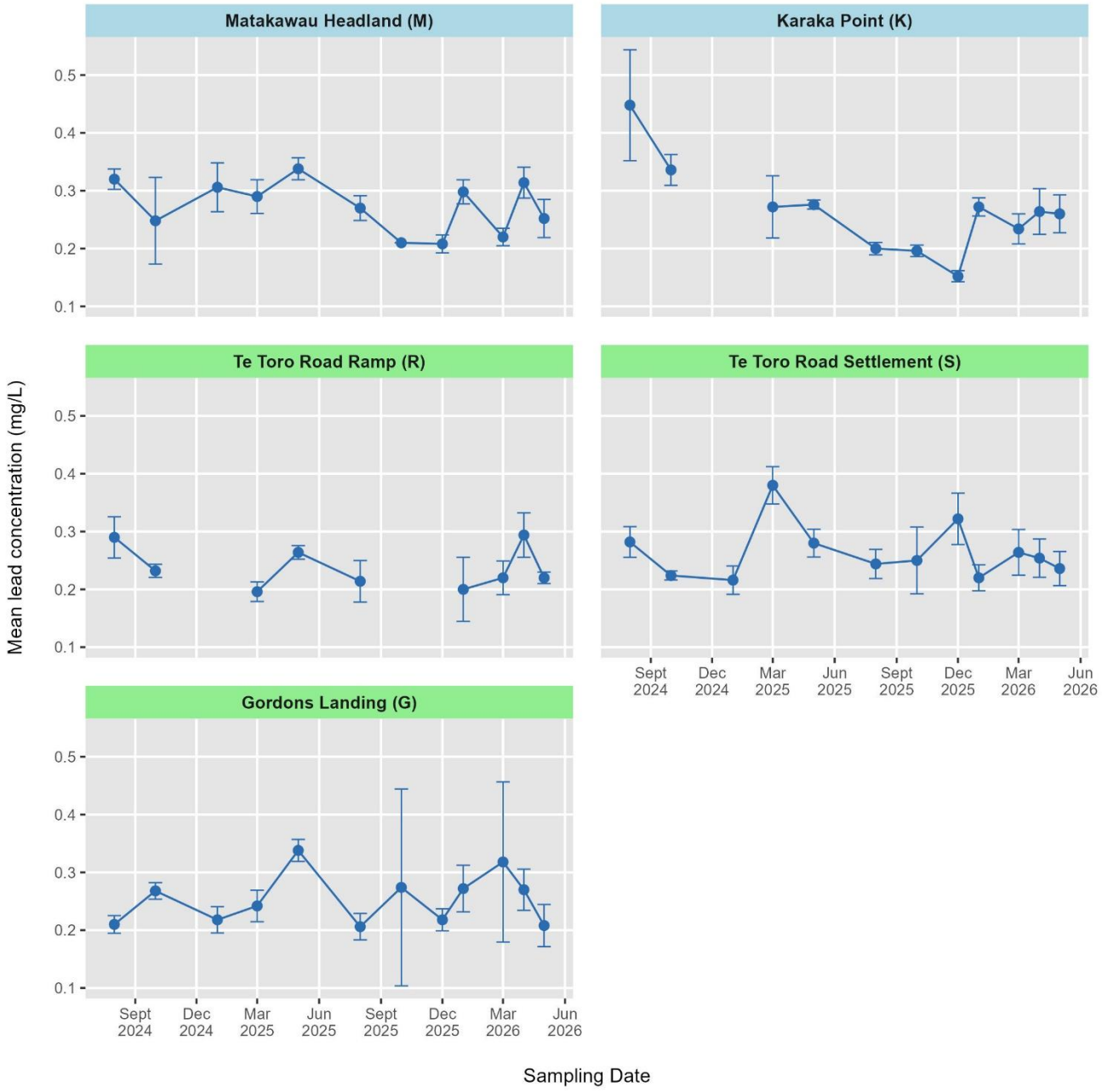


***Figure** 2.6 Mean ± 95% CI Lead concentrations in Farmed Oysters between August 2024 and May 2025 (mg/kg dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.*

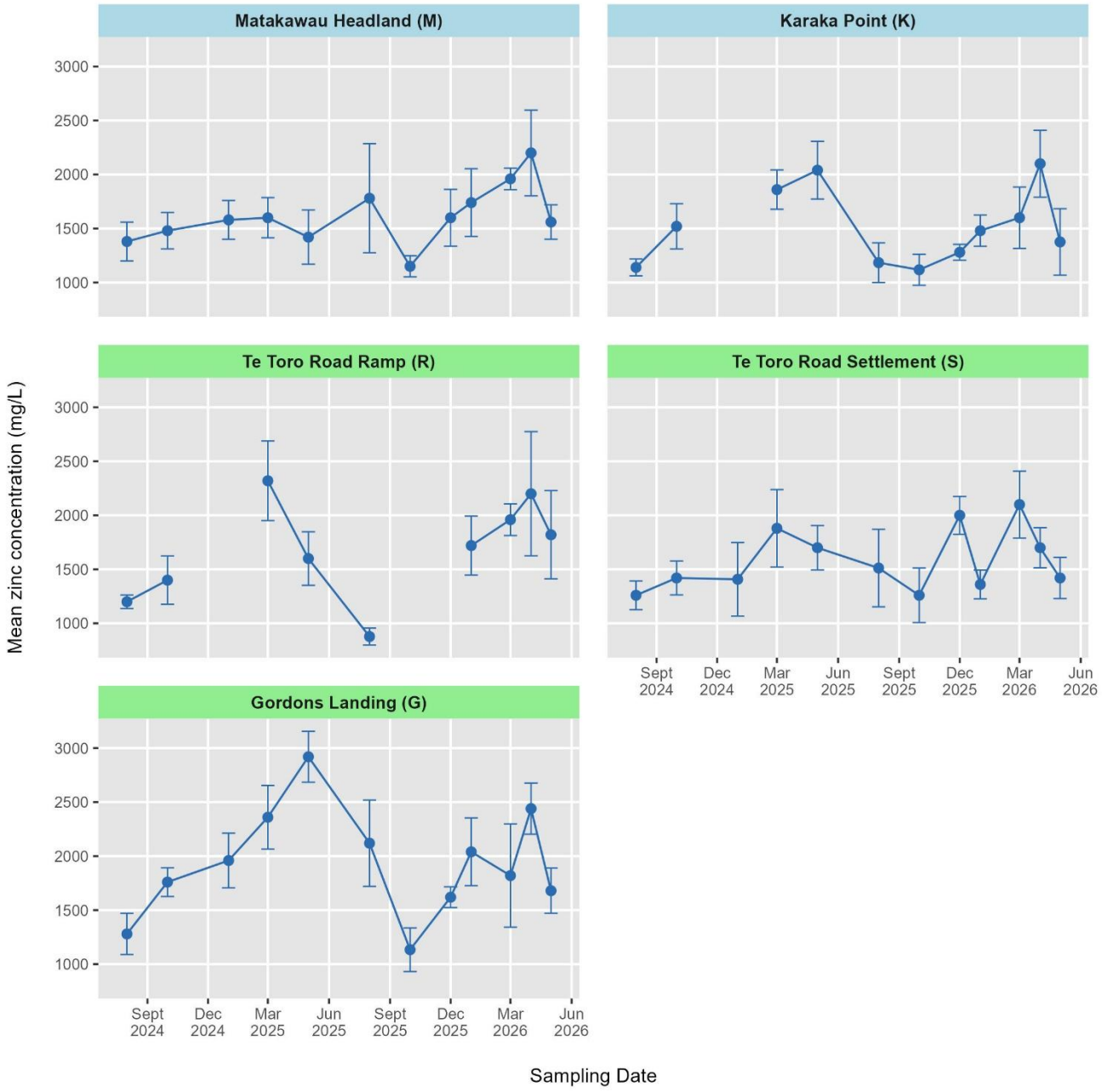


***Figure** 2.7 Mean ± 95% CI Zinc concentrations in Farmed Oysters between August 2024 and May 2025 (mg/kg dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.*

2.2.4 Polycyclic Aromatic Hydrocarbon contaminants in oysters

The results of for PAH4 and BaP concentrations are presented in Figure 2.8 and raw data are presented in Appendix 3 (Tables A3.28 to A3.39). Any results that were below the detection limit were considered to equal zero.

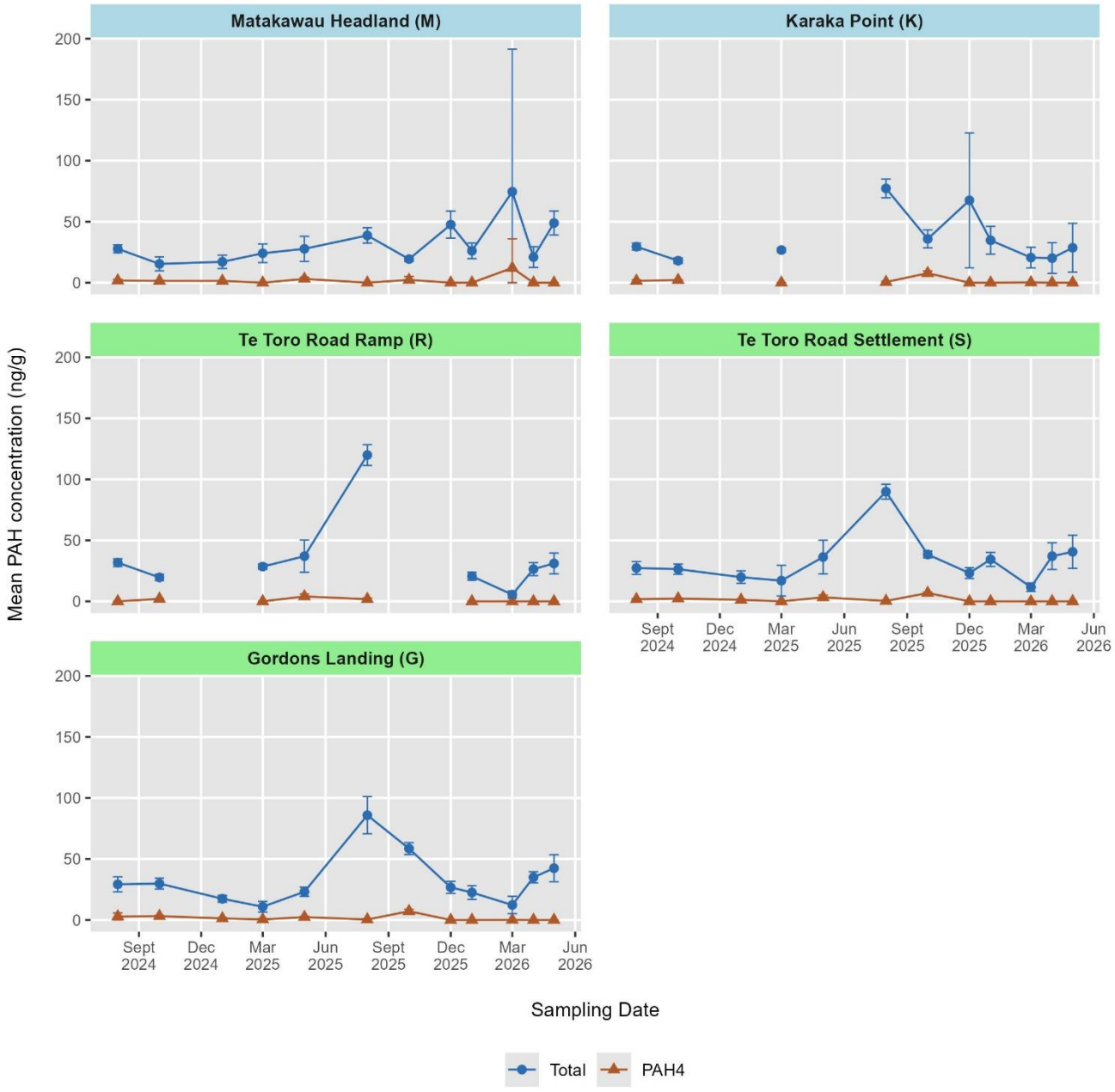


Figure 2.8 ***Mean ± 95% CI Total PAH and PAH4 concentrations in Farmed Oysters between August 2024 and May 2026 (ng/g dry weight). Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.***

The mean concentrations of Total PAH in the farmed oysters exhibited temporal variability throughout the monitoring period, with concentrations ranging between approximately 10 to 90 ng/g d.w. (Figure 2.8). Elevated total PAH concentrations were recorded at several sites during 2025, with the highest mean concentration observed at site R during August 2025. Sites G and S also exhibited elevated concentrations during mid-2025. Despite these fluctuations, Total PAH generally declined during late 2025 and early 2026 to a level seen at the beginning of the monitoring period. No consistent spatial trend was evident between sites. Site R showed the highest PAH values in August 2025, and the lowest values in March 2026.

Wet-weather sampling events occurred in March 2025, August 2025, October 2025, and April 2026. Elevated Total PAH concentrations were recorded during some wet-weather events, particularly at site R during August 2025. However, elevated concentrations were not consistently observed across all sites during wet-weather sampling, and similar concentrations were also recorded during non-wet-weather events. These results suggest that short-term rainfall events are unlikely to be the primary driver of PAH concentrations within oyster tissue, with concentrations more likely reflecting longer-term environmental processes.

Due to the nature of shellfish flesh as a testing media, some replicates may require additional dilution to reduce the interference during analysis. As a result, the August 2024 replicates had higher detection limits than subsequent sampling events, resulting in several benzo[a]pyrene (BaP) results being reported as <2.0 ng/g d.w. Laboratory extraction and clean-up procedures were refined during the course of the baseline monitoring programme, resulting in lower detection limits for later sampling events.

All replicates were below the regulatory limit for PAH4 and BaP (Table 2.4). The highest PAH4 concentration was recorded in a replicate from site M during the March 2026 sampling event, with a concentration of 60.60 of ng/g d.w. Using the measured moisture content of 92.9%, this result is equivalent to 4.30 ng/g w.w. or 14% of the regulatory limit of 30 ng/g. The highest BaP concentration was found in a replicate from Site R during the August 2025 sampling event, with a concentration of 2.9 ng/g d.w. Using the measured moisture content of 86.8%, this equates to 0.38 ng/g w.w. or 7.7% of the regulatory limit of 5 ng/g w.w.

Table 2.4 Comparison of regulatory limits with the highest replicates from August 2024 to May 2026

Contaminant	Standard	ML (µg/kg w.w.)	Highest Replicate (ng/g w.w.)
PAH4	EU No. 835/2011	30	4.30
BaP	EU No. 835/2011	5	0.38

2.2.5 Microbial contaminants in oysters

2.2.5.1 Bacteria in Oysters

The results of faecal coliforms and Enterococci in the farmed oysters are presented in Figure ***2.9*** and the raw data are presented in Appendix 3 (Table A3.40 and A3.41).

Throughout the monitoring period, faecal coliform and enterococci concentrations generally followed similar temporal patterns across the estuary with concentrations increasing and decreasing concurrently between sites (Figure ***2.9***). Site M and Site G recorded some of the highest bacterial concentrations, particularly for enterococci. No consistent spatial trend was apparent during the latter stages of monitoring, with bacterial concentrations varying between sampling events and sites.

March 2025, August 2025, October 2025, and April 2026 sampling events followed rainfall and are considered wet events. The March 2025, August 2025, and October 2025 results did not indicate a clear influence of rainfall on faecal coliform or enterococci concentrations, as concentrations were generally comparable to those recorded during adjacent dry-weather sampling events. In contrast, concentrations

were elevated across all sites during the April 2026 sampling event, which followed approximately 40 mm of rainfall in the preceding 24 hours. These results suggest that rainfall may contribute to elevated bacterial concentrations in the Waiuku Estuary under some conditions, however the influence of rainfall was not consistent throughout the monitoring period.

The standards for faecal coliforms in shellfish require no more than two replicates out of five to exceed 230 MPN/100g and no replicates to exceed 330 MPN/100g. As presented in Appendix 3 (Table A3.41), Site M exceeded the standard during August 2024, October 2024, January 2025, August 2025, April 2026, and May 2026. Additional exceedances occurred at site R during May 2025, August 2025, April 2026 and May 2026; site K during December 2025 and April 2026; site S during April 2026; and site G during August 2025, December 2025, April 2026 and May 2026. The April 2026 had the most widespread non-compliance, with all monitoring sites exceeding the faecal coliform guideline. The source of bacterial concentrations remains unknown but may be influenced by the dominant presence of livestock in the catchment surrounding Waiuku Estuary.

2.2.5.2 Virus in Oysters

All results were below the minimum detection levels and therefore no trends can be determined.

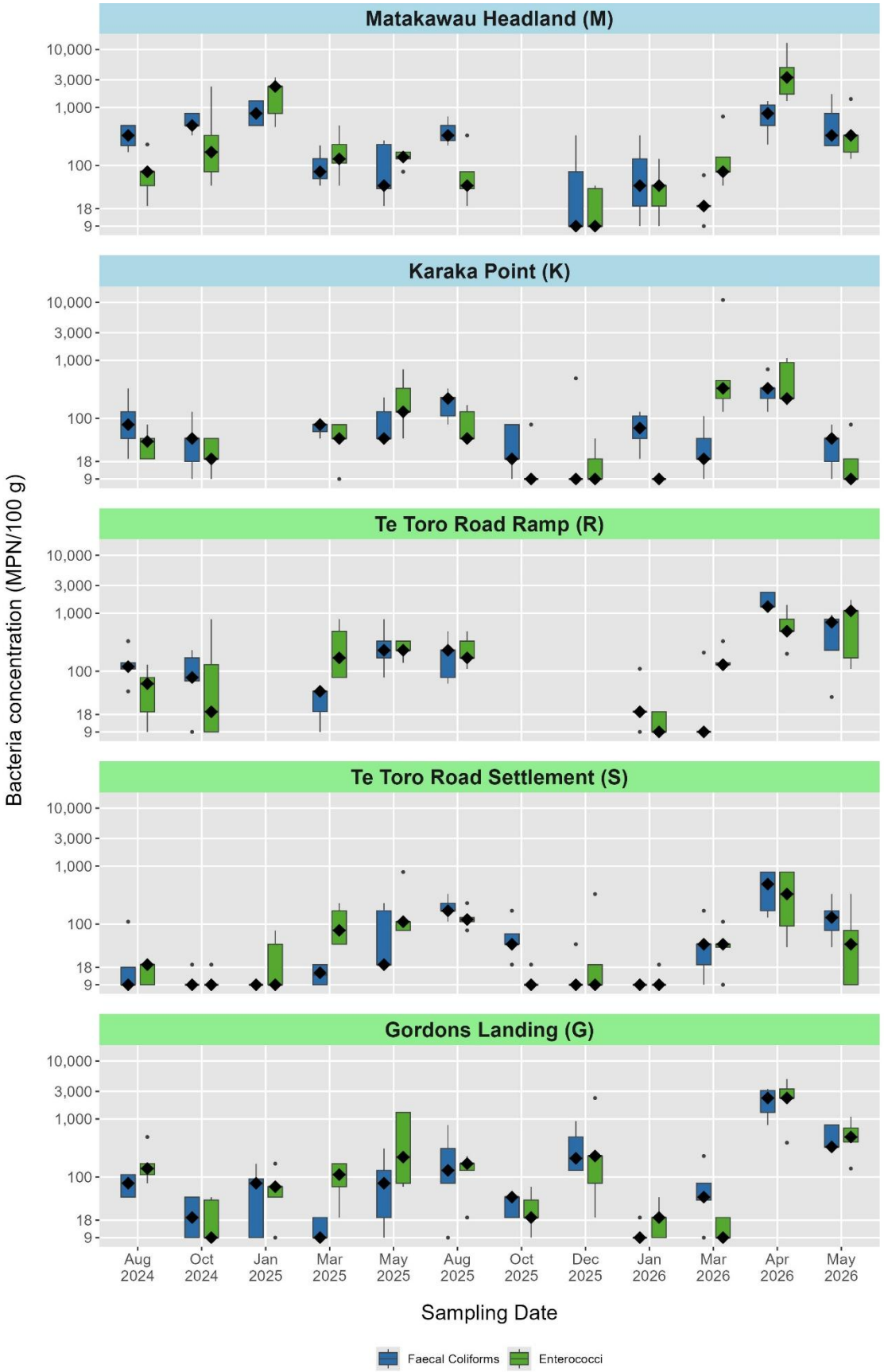


Figure** 2.9 **Boxplot showing the concentration of faecal coliforms and enterococci in farmed oysters from August 2024 to May 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.

3 SHELLFISH POPULATION MONITORING

3.1 Oyster Abundance and Size

3.1.1 Methodology

The REMP specifies that the wild oyster populations are to be monitored at five sites (Figure 3.1). These sites will be monitored every six months in February and August, starting two years prior to discharge. Due to an initial attempt to match time periods between shellfish population monitoring and benthic biota monitoring, the first sampling in 2024 was undertaken in October[1].

Shellfish stations have been permanently marked with pegs. Each sample station consists of an area measuring 50 m long by 3m wide, parallel to the low or high tide mark.

Thirty 0.25 m^2 quadrats were located in the sampling area using random numbers to generate X and Y co-ordinates. A minimum of one hundred oysters (*Magallana gigas*) per station were measured in the field and the individuals returned to the sample quadrat. All oysters were measured in the initial quadrat and the measurement of oysters in the entire quadrat was repeated until at least 100 individuals were measured. The 30 density quadrats were also counted in the field with as little disturbance as possible. In the instance where there were less than 100 oysters in the 30 random quadrats, additional random quadrats were assessed to ensure that at least 100 oysters were measured at each site.

It is important to note that C3Oys has been renamed from C3 to differentiate it from the cockle population monitoring site C3. For the August 2025 and February 2026 monitoring, K3 was relocated due to a large decline in the wild oyster population at the site. The GPS coordinates for the relocated site are presented in Appendix 1 (Table A1.2).

[1] The monitoring in 2025 was in August 2025, and not October 2025, following a discussion with Watercare Services highlighting the importance of more demarked seasons (winter and summer sampling, instead of spring and summer sampling)



Figure 3.1 Monitoring sites for wild oyster populations and wild cockle populations.

3.1.2 Results and Discussion

Table 3.1 and Figure 3.2 to Figure 3.4 presents the length and abundance data of wild oysters at each site over the four sampling periods. Oyster size/frequency data are presented in Appendix 4 Tables A4.1 and A4.2.

Table 3.1 Summary of length and abundance of Pacific Oyster (Magallana gigas) between October 2024 and February 2026.

Station	Date	Size (mm)			Density (N/0.25 m^2)	
		n	mean	95% CL	Mean N	95% CL
K1	Oct-24	121	37.3	2.0	3.9	2.5
	Feb-25	104	36.5	2.0	3.4	3.2
	Aug-25	107	42.3	2.5	3.5	2.3
	Feb-26	102	39.7	2.2	5.2	3.3
K2	Oct-24	158	34.9	1.9	22.9	9.2
	Feb-25	105	37.9	1.8	19.6	7.0
	Aug-25	135	44.6	2.0	14.9	7.2
	Feb-26	105	47.0	2.5	7.4	3.9
C3Oys	Oct-24	132	36.0	1.8	17.0	9.4
	Feb-25	105	42.6	2.4	18.7	13.6
	Aug-25	137	37.0	1.7	21.5	12.8
	Feb-26	100	42.1	2.1	7.0	4.6
K3	Oct-24	114	51.2	2.2	3.5	2.5
	Feb-25	100	41.7	2.4	3.2	3.5
	Aug-25	112	39.3	2.2	10.3	5.3
	Feb-26	98	41.9	2.3	3.3	3.6
K4	Oct-24	113	38.8	1.9	26.2	12.2
	Feb-25	124	39.0	2.0	21.2	8.7
	Aug-25	122	44.2	2.1	11.4	7.6
	Feb-26	100	41.7	2.3	16.1	8.2

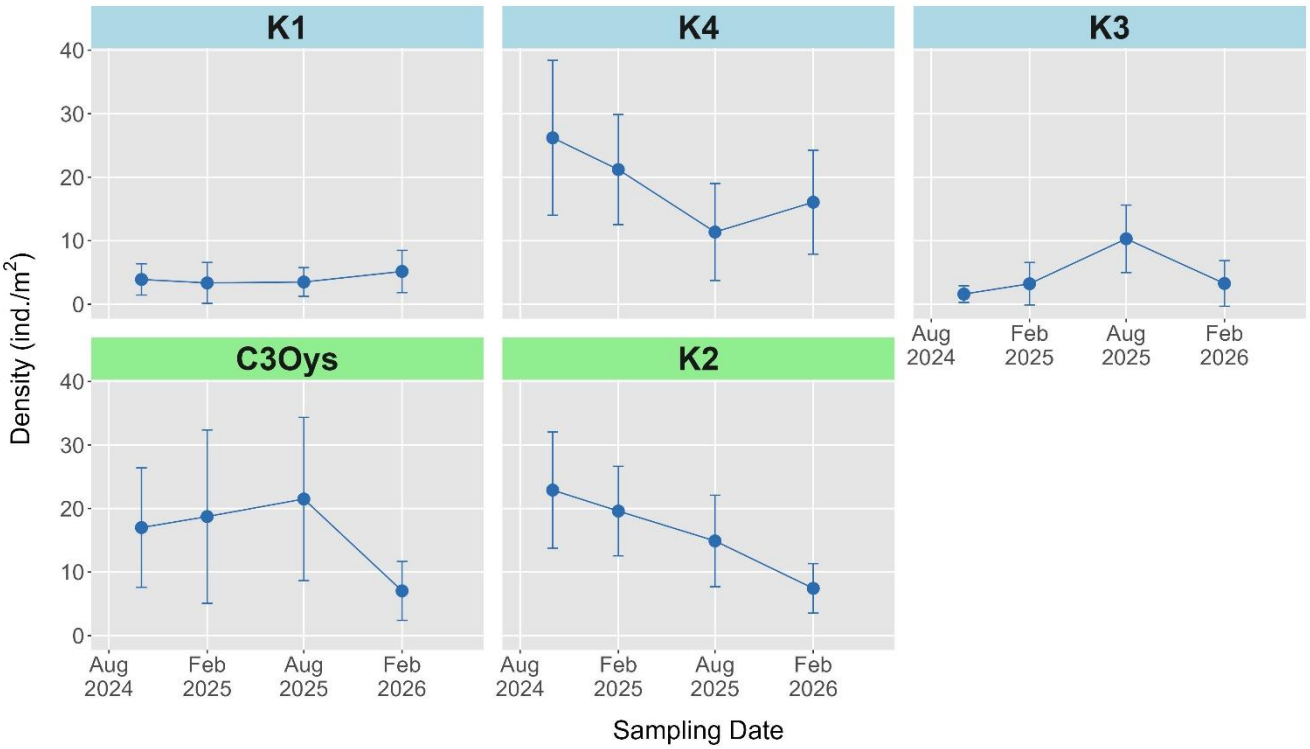


Figure 3.2 ***Oyster Abundance August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.***

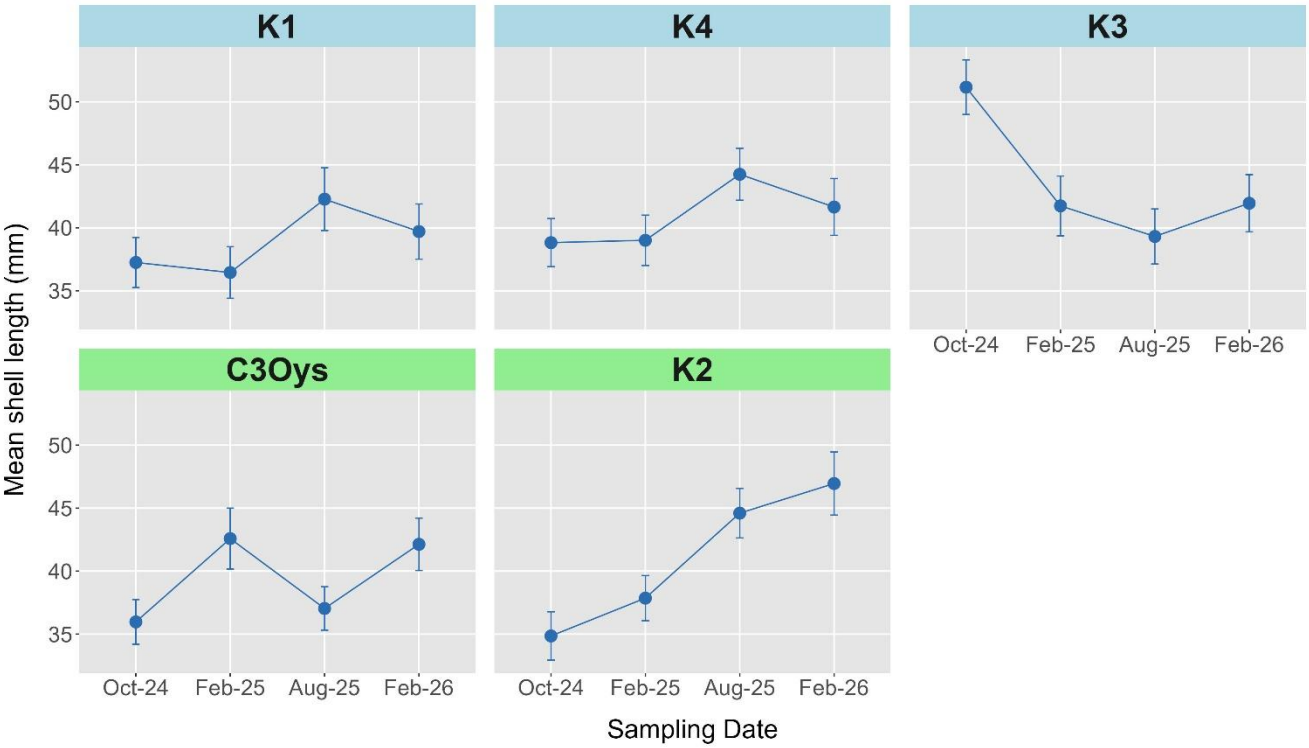


Figure 3.3 ***Oyster length August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.***

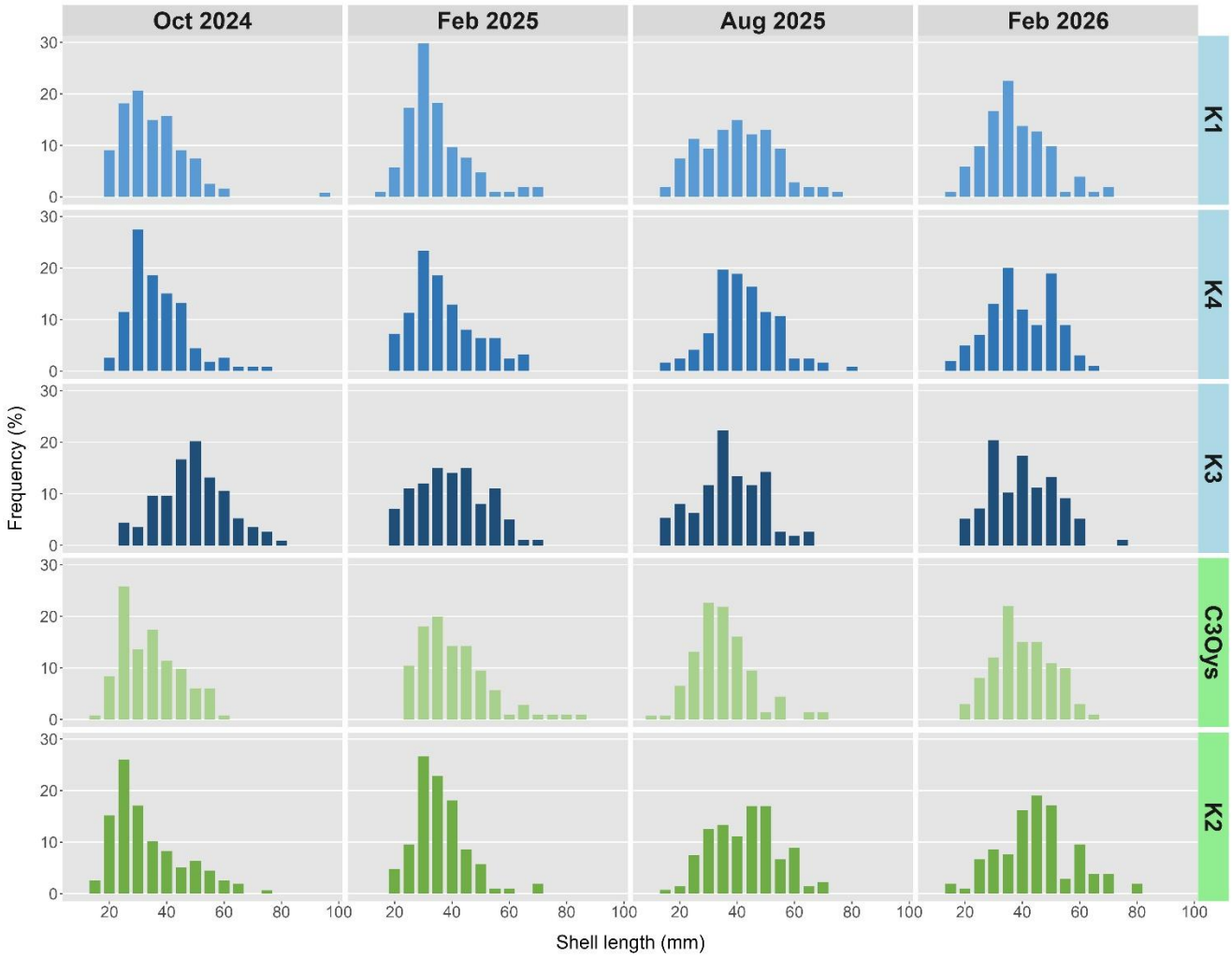


Figure 3.4 ***Oyster Size Frequency August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.***

Mean oyster densities varied substantially among sites and sampling events (Figure 3.2). Densities ranged from approximately 3 oysters/0.25 m^2 to 26 oysters/0.25 m^2 across the five sites. K1 and K3 consistently supported the lowest oyster densities, while K2, K4, and C3Oys generally supported higher densities. This spatial pattern was maintained throughout the baseline monitoring period despite temporal fluctuations in abundance.

The mean length of wild oysters across the five sites ranged from 35 mm to 51 mm during the baseline monitoring programme (Table 3.1). Mean shell lengths showed moderate variation between sampling events, with most sites exhibiting fluctuations of less than 10 mm over the two-year period. K2 exhibited the largest variation with mean shell length increasing from 35 mm in October 2024 to 47 mm in February 2026.

Size-frequency distributions were dominated by oysters approximately 25 to 55 mm shell length. Sites K2 and K4 exhibited a clear shift towards larger size classes over time, consistent with the increase in mean shell length, while the remaining sites maintained relatively similar size distributions throughout the monitoring period.

3.2 Cockle Abundance and Size

3.2.1 Methodology

The REMP specifies that the wild cockle populations will be monitored at five sites (Figure 3.1). These sites will be monitored every six months in February and August, starting two years prior to discharge. Due to an initial attempt to match time periods between shellfish population monitoring and benthic biota monitoring, the first sampling in 2024 was undertaken in October.

At each of the five sites, an area of 75 m*100 m was marked using GPS coordinates. The area was divided into 12 cells, with two 0.25 m^2 quadrats randomly placed in each cell, excavated to at least 10 cm, sieved though a 3 mm sieve, and the number of live cockles were recorded. All cockles were measured in the initial quadrat, and the measurement of cockles in the entire quadrat was repeated until at least 100 individuals were measured to the nearest millimetre. As outlined in the REMP, if the number of cockles were >500/m^2 then the quadrat size could be halved and if the number of cockles were >1000/m^2 then the size of the quadrat could be quartered. All cockles ≤3 mm were excluded from the data.

3.2.2 Results and Discussion

3.2.2.1 Population characteristics per site

Table 3.2 and Figure 3.5 to Figure 3.7 present the mean length and density of cockles at each site over the four sampling periods. Raw cockle size/frequency data are presented in Appendix 4 Tables A4.3 and A4.4 and the distribution of cockles throughout the sites are presented in Figures A4.1 to A4.5

Table 3.2 Summary of the length and abundance of cockle (Austrovenus stutchburyi) between October 2024 and February 2026.

Station	Date	Size (mm)			Density (N/0.25 m^2)		Density (N/ m^2)	% Edible Size
		n	mean	95% CL	Mean N	95% CL		
C1	Oct-24	172	16.2	0.7	320.0	45.1	1280.0	0.6
	Feb-25	100	16.3	1.2	427.0	66.9	1708.0	1.0
	Aug-25	141	17.0	0.8	199.8	17.6	799.3	0.8
	Feb-26	108	15.0	0.9	205.7	31.2	822.7	0.9
C2	Oct-24	132	10.2	0.9	103.3	45.0	413.2	1.5
	Feb-25	160	19.7	0.7	149.9	51.0	599.7	13.8
	Aug-25	106	16.1	0.8	78.0	21.0	312.0	0.8
	Feb-26	103	17.4	1.3	68.8	24.1	275.3	1.3
C3	Oct-24	124	12.2	0.7	497.2	112.9	1988.7	0
	Feb-25	170	12.9	0.6	562.8	122.2	2251.4	0
	Aug-25	123	15.2	0.5	169.2	35.7	676.7	0.5
	Feb-26	236	15.8	0.6	123.5	36.9	494.0	0.6
C4	Oct-24	232	16.5	0.6	348.2	88.7	1392.7	0.4
	Feb-25	124	16.7	0.6	362.7	104.2	1450.7	0
	Aug-25	100	13.7	0.9	125.5	40.2	502.0	0.9
	Feb-26	175	14.2	0.7	102.6	30.3	410.3	0.7
C5	Oct-24	183	13.8	0.7	416.0	93.2	1664.0	0.6
	Feb-25	205	16.0	0.6	517.3	102.7	2069.3	0.5
	Aug-25	107	17.8	0.8	290.8	123.8	1163.3	0.8
	Feb-26	131	13.3	1.0	138.8	21.0	555.3	1.0

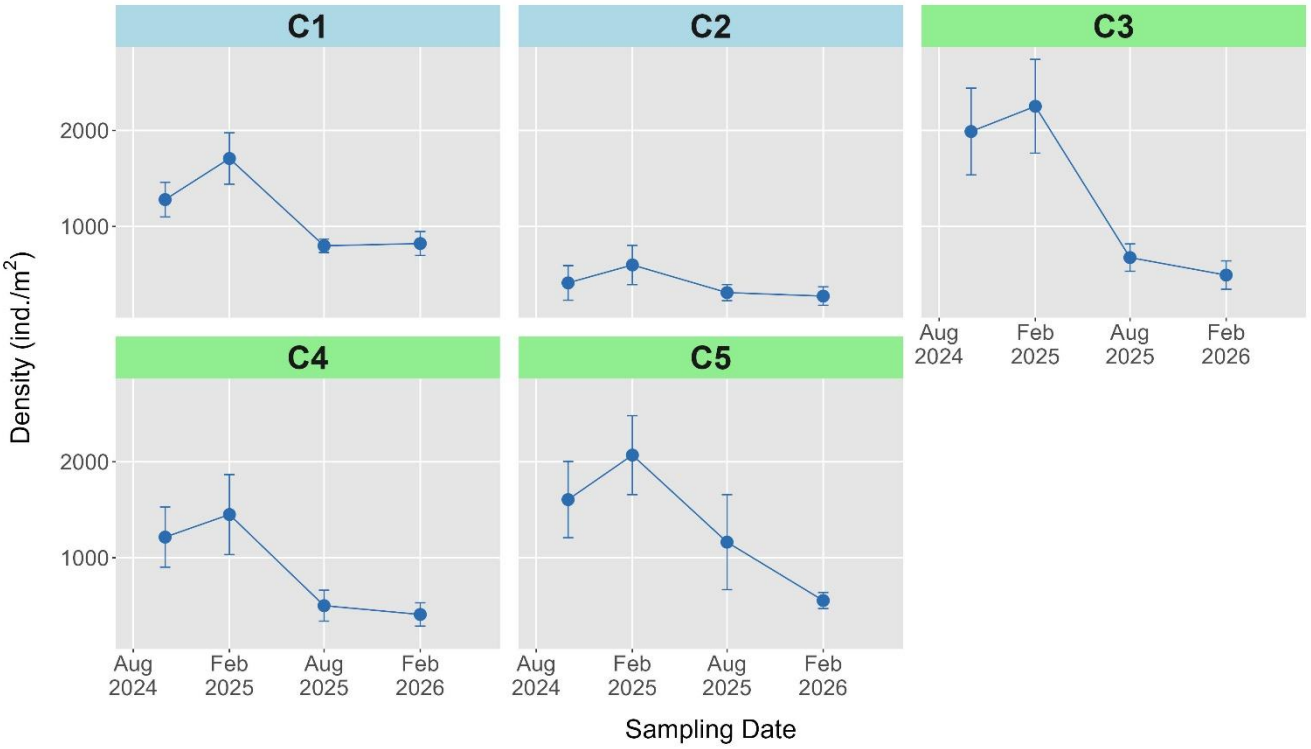


Figure 3.5 ***Cockle Abundance August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.***

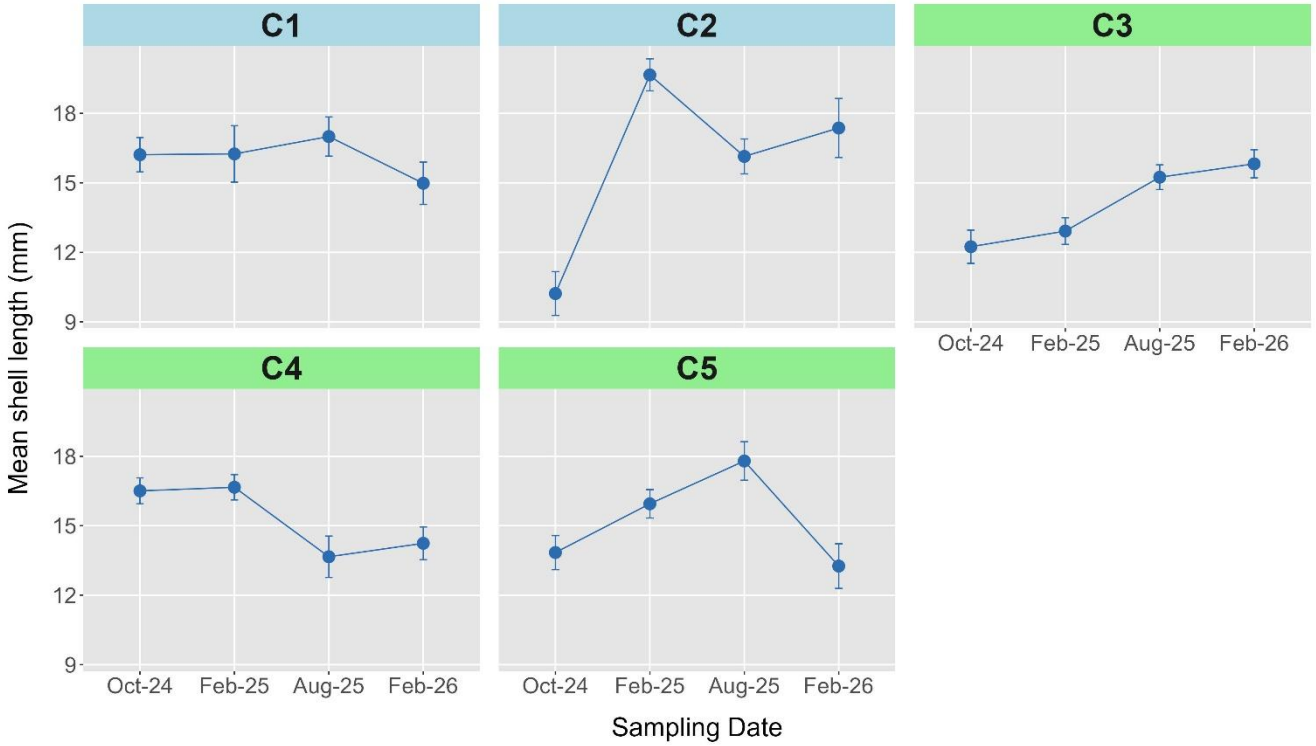


Figure 3.6 ***Cockle length August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.***

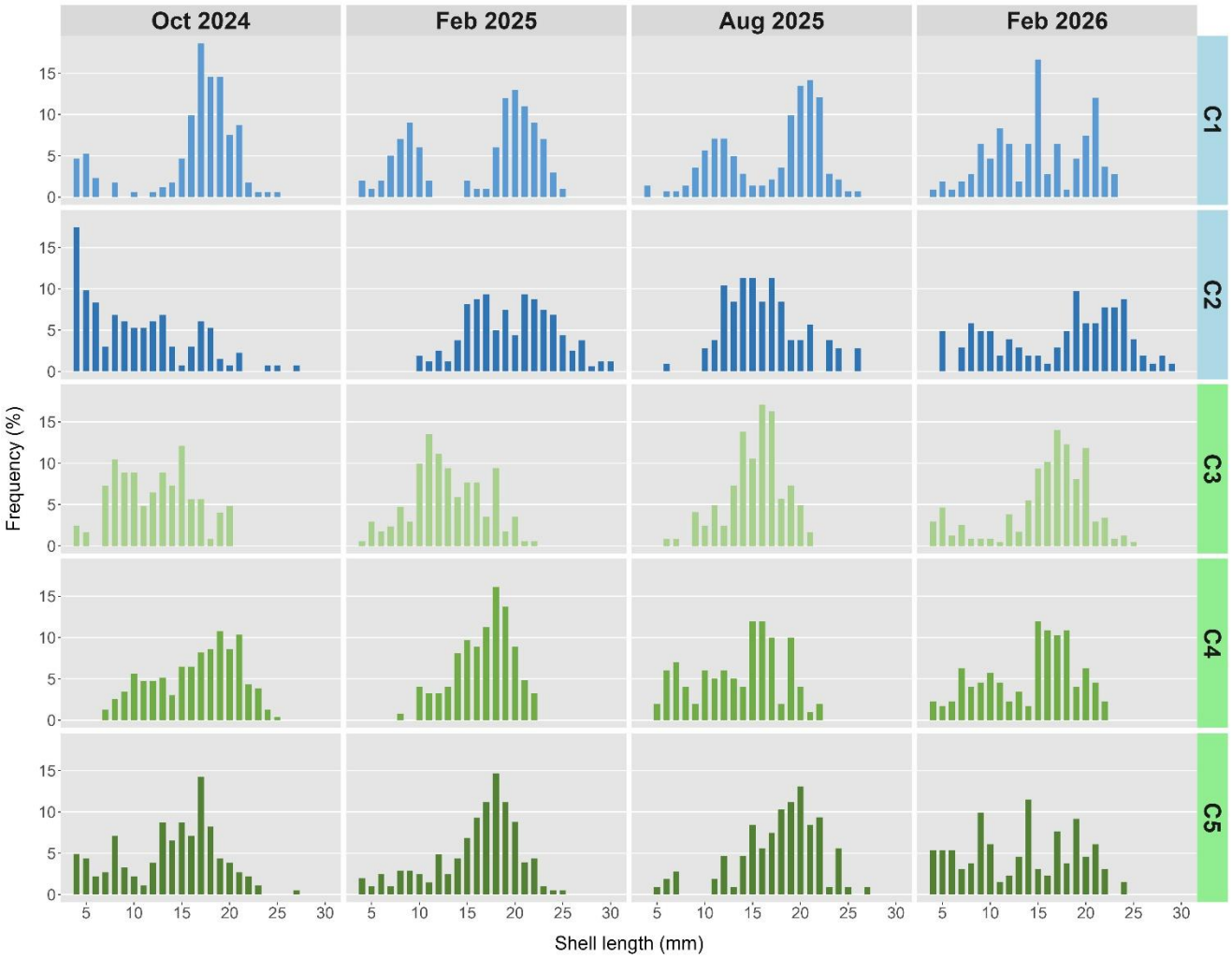


Figure 3.7 Cockle Size Frequency August 2024 to February 2026. Blue panel headers represent sites located down-estuary of the outfall and green panel headers represent sites located up-estuary of the outfall.

The mean density of cockle at the five sites varied substantially among sites and sampling events. Densities generally increased between October 2024 and February 2025 before declining during the subsequent monitoring events. The greatest variation occurred at site C3, where mean density decreased from 2251 cockles/m^2 in February 2025 to 494 cockles/m^2 in February 2026. Site C2 exhibited the lowest densities throughout the monitoring period and the least variation, with the mean cockle density ranging from 600 to 275 cockles/m^2.

Mean cockle length varied among sites and sampling events. The largest variation was seen at C2, with the mean length recorded at 10.2 mm in October 2024 and increasing to 19.7 mm in February 2025, before declining slightly in subsequent surveys. Site C3 exhibited a steady increase in mean cockle length throughout the monitoring period, white sites C1 and C4 remained relatively stable. At site C5, mean cockle length increased between October 2024 and August 2025, before declining in the February 2026 sampling. Most of the recorded cockle lengths were well below the minimum attractive edible size of 25 mm. Site C2 had the largest number of edible size cockles, with 14% in February 2025.

Size-frequency distributions indicate the presence of multiple cohorts at several sites. Site C1 consistently exhibited a bimodal distribution, particularly during February 2025 and August 2025, with distinct peaks centred around 8-12 mm and 18-22 mm. Across all sites, the length generally increased

between October 2024 and February 2025, consistent with the growth of resident cockles. Small individuals (<10 mm) were present at most sites during the October 2024 and February 2026 sampling events, suggesting ongoing recruitment. By February 2026, distributions at most sites had broadened, and several exhibited multiple peaks, suggesting the continual presence of both younger and older individuals.

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APPENDIX 1 SITE INFORMATION AND PAST WEATHER DATA

Table A1.1 Geographic Coordinates of Farmed Oyster Bags (WGS84)

Site	Description		Longitude	Latitude
M	Matakawau Headland	Original	E174.66768	S37.10898
		Moved	E174.66466	S37.11073
K	Karaka Point	Original	E174.69014	S37.14211
		Moved	E174.69210	S37.14203
R	Te Toro Road Ramp	Original	E174.69939	S37.15141
		Moved	E174.69867	S37.15073
S	Te Toro Road Settlement	-	E174.69710	S37.15895
G	Gordons Landing	-	E174.70354	S37.18424

Table A 1.2 Geographic Coordinates of oyster population monitoring sites (WGS84)

Site	Description	Transect Point		Longitude	Latitude
K1	Opposite Ngahere Bay on the rocky-reef		Start	E174.68199	S37.13994
			End	E174.68147	S37.13981
K2	Southern side of entrance of the Taihiki River		Start	E174.72660	S37.15304
			End	E174.72612	S37.15311
C3Oys	Southern Shore of Te Toro Settlement		Start	E174.69594	S37.15826
			End	E174.69604	S37.15870
K3	Ngahere Bay	Original	Start	E174.69031	S37.14201
			End	E174.69083	S37.14185
		Moved	Start	E174.69056	S37.14175
			End	E174.69056	S37.14196
K4	Clarks Beach western end		Start	E174.68746	S37.13918
			End	E174.68716	S37.13944

Table A1.3 Geographic Coordinates of cockle population monitoring sites (WGS84)

Site	Description	Corner Points			
		a	b	c	d
C1	Matakawau Point	E174.66547	E174.66655	E174.66677	E174.66569
		S37.10959	S37.10936	S37.11001	S37.11024
C2	Rangiriri Spit	E174.66915	E174.67020	E174.66988	E174.66884
		S37.13888	S37.13922	S37.13984	S37.13951
C3	Southern Shore of Te Toro Settlement	E174.69347	E174.69398	E174.69310	E174.69258
		S37.15887	S37.15940	S37.15996	S37.15943
C4	Pukewhau Creek	E174.69728	E174.69795	E174.69728	E174.69661
		S37.16618	S37.16690	S37.16730	S37.16658
C5	Gordons Landing	E174.70372	E174.70456	E174.70465	E174.70381
		S37.18246	S37.18240	S37.18330	S37.18336



Figure A 1.1 Map showing the rainfall sites used to determine wet and dry events.

APPENDIX 2 CONDITION INDEX DATA

Table A 2.4 Condition Index of Farmed Oysters - August 2024

Site	Replicate	Entire Oysters (ml)	Empty Shells (ml)	Shell Volume (ml)	Jar Weight (g)	Combined Weight (g)	Flesh wet weight (g)	Moisture (%)	Dry Weight (g)	Condition Index
Matakawau Headland	1	140	61	79	23.35	67.49	44.14	88.8	4.94	6.26
	2	136	57	79	23.2	70.62	47.42	88.3	5.55	7.02
	3	121	53	68	23.31	65.49	42.18	87.3	5.36	7.88
	4	133	58	75	23.32	62.95	39.63	88.8	4.44	5.92
	5	159	72	87	23.24	71.74	48.5	87.9	5.87	6.75
	Mean	**137.80**	**60.20**	**77.60**	**23.28**	**67.66**	**44.37**	**88.22**	**5.23**	**6.76**
	SD	**13.81**	**7.19**	**6.91**	**0.06**	**3.62**	**3.66**	**0.64**	**0.56**	**0.75**
	CI	**12.10**	**6.30**	**6.06**	**0.05**	**3.17**	**3.21**	**0.56**	**0.49**	**0.66**
Karaka Point	1	131	56	75	23.1	74.66	51.56	88.4	5.98	7.97
	2	134	58	76	23.21	87.87	64.66	89.3	6.92	9.10
	3	130	55	75	23.44	67.63	44.19	87.8	5.39	7.19
	4	142	59	83	23.42	73.38	49.96	88.5	5.75	6.92
	5	144	60	84	22.88	70.4	47.52	89	5.23	6.22
	Mean	**136.20**	**57.60**	**78.60**	**23.21**	**74.79**	**51.58**	**88.60**	**5.85**	**7.48**
	SD	**6.42**	**2.07**	**4.51**	**0.23**	**7.80**	**7.82**	**0.58**	**0.66**	**1.10**
	CI	**5.63**	**1.82**	**3.95**	**0.20**	**6.84**	**6.86**	**0.51**	**0.58**	**0.97**
Te Toro Road Ramp	1	151	60	91	23.07	77.38	54.31	88.7	6.14	6.74
	2	131	51	80	23.43	72.34	48.91	90	4.89	6.11
	3	131	54	77	23.41	68.15	44.74	89.7	4.61	5.98
	4	130	52	78	23.22	69.25	46.03	90	4.60	5.90
	5	133	55	78	23.16	74.87	51.71	88.9	5.74	7.36
	Mean	**135.20**	**54.40**	**80.80**	**23.26**	**72.40**	**49.14**	**89.46**	**5.20**	**6.42**
	SD	**8.90**	**3.51**	**5.81**	**0.16**	**3.84**	**3.95**	**0.62**	**0.70**	**0.62**
	CI	**7.80**	**3.07**	**5.09**	**0.14**	**3.36**	**3.46**	**0.54**	**0.62**	**0.54**
Te Toro Road Settlement	1	128	54	74	23.31	65.36	42.05	87.8	5.13	6.93
	2	152	60	92	23.3	69.43	46.13	88.1	5.49	5.97
	3	136	59	77	23.27	60.82	37.55	87.7	4.62	6.00
	4	152	60	92	23.33	70.77	47.44	88.7	5.36	5.83
	5	116	53	63	23.19	55.49	32.3	87.2	4.13	6.56
	Mean	**136.80**	**57.20**	**79.60**	**23.28**	**64.37**	**41.09**	**87.90**	**4.95**	**6.26**
	SD	**15.59**	**3.42**	**12.46**	**0.05**	**6.30**	**6.25**	**0.55**	**0.56**	**0.47**
	CI	**13.67**	**3.00**	**10.92**	**0.05**	**5.53**	**5.48**	**0.48**	**0.49**	**0.41**
Gordons Landing	1	133	51	82	23.03	69.43	46.4	91.1	4.13	5.04
	2	120	48	72	22.82	65.47	42.65	90.9	3.88	5.39
	3	159	66	93	23.09	79.29	56.2	90.2	5.51	5.92
	4	153	63	90	23.09	78.78	55.69	90.7	5.18	5.75
	5	141	62	79	23.02	83.18	60.16	91.5	5.11	6.47
	Mean	**141.20**	**58.00**	**83.20**	**23.01**	**75.23**	**52.22**	**90.88**	**4.76**	**5.72**
	SD	**15.59**	**7.97**	**8.47**	**0.11**	**7.44**	**7.35**	**0.48**	**0.71**	**0.54**
	CI	**13.67**	**6.98**	**7.42**	**0.10**	**6.52**	**6.45**	**0.42**	**0.62**	**0.48**

Table A 2.5 Condition Index of Farmed Oysters – October 2024

Site	Replicate	Entire Oysters (ml)	Empty Shells (ml)	Shell Volume (ml)	Jar Weight (g)	Combined weight (g)	Flesh wet weight (g)	Moisture (%)	Dry Weight (g)	Condition Index
Matakawau Headland	1	138	76	62	22.87	62.06	39.19	87.1	5.06	8.15
	2	120	68	52	23.21	59.37	36.16	87.1	4.66	8.97
	3	122	51	71	23.31	64.83	41.52	87.3	5.27	7.43
	4	127	49	78	23	69	46	88.1	5.47	7.02
	5	134	59	75	23.38	68.75	45.37	87.7	5.58	7.44
	Mean	**128.20**	**60.60**	**67.60**	**23.15**	**64.80**	**41.65**	**87.46**	**5.21**	**7.80**
	SD	**7.69**	**11.41**	**10.60**	**0.21**	**4.19**	**4.15**	**0.43**	**0.36**	**0.77**
	CI	**6.74**	**10.01**	**9.29**	**0.19**	**3.67**	**3.64**	**0.38**	**0.32**	**0.68**
Karaka Point	1	100	42	58	23.35	57.24	33.89	86.8	4.47	7.71
	2	112	48	64	23.07	61.75	38.68	88.3	4.53	7.07
	3	119	52	67	23.36	59.6	36.24	89.2	3.91	5.84
	4	103	38	65	23.27	54.02	30.75	89.7	3.17	4.87
	5	110	46	64	23.14	56.74	33.6	87.6	4.17	6.51
	Mean	**108.80**	**45.20**	**63.60**	**23.24**	**57.87**	**34.63**	**88.32**	**4.05**	**6.40**
	SD	**7.53**	**5.40**	**3.36**	**0.13**	**2.94**	**2.99**	**1.17**	**0.55**	**1.10**
	CI	**6.60**	**4.74**	**2.95**	**0.11**	**2.58**	**2.62**	**1.03**	**0.48**	**0.96**
Te Toro Road Ramp	1	126	51	75	23.03	64.38	41.35	88.3	4.84	6.45
	2	114	41	73	23.32	58.78	35.46	88.5	4.08	5.59
	3	118	50	68	23.15	61.31	38.16	87.2	4.88	7.18
	4	110	44	66	23.12	61.61	38.49	88.3	4.50	6.82
	5	117	47	70	23.5	57.75	34.25	87.2	4.38	6.26
	Mean	**117.00**	**46.60**	**70.40**	**23.22**	**60.77**	**37.54**	**87.90**	**4.54**	**6.46**
	SD	**5.92**	**4.16**	**3.65**	**0.19**	**2.60**	**2.78**	**0.64**	**0.33**	**0.60**
	CI	**5.19**	**3.65**	**3.20**	**0.16**	**2.28**	**2.44**	**0.56**	**0.29**	**0.53**
Te Toro Road Settlement	1	128	58	70	23.1	69.77	46.67	89.4	4.95	7.07
	2	142	60	82	23.21	72.49	49.28	89.7	5.08	6.19
	3	130	53	77	23.31	70.69	47.38	89.7	4.88	6.34
	4	144	58	86	23.09	74.84	51.75	88.1	6.16	7.16
	5	124	48	76	23.34	69.72	46.38	89.4	4.92	6.47
	Mean	**133.60**	**55.40**	**78.20**	**23.21**	**71.50**	**48.29**	**89.26**	**5.20**	**6.64**
	SD	**8.88**	**4.88**	**6.10**	**0.12**	**2.18**	**2.24**	**0.67**	**0.54**	**0.44**
	CI	**7.78**	**4.28**	**5.35**	**0.10**	**1.91**	**1.96**	**0.58**	**0.48**	**0.39**
Gordons Landing	1	119	40	79	23.26	62.69	39.43	90.4	3.79	4.79
	2	135	70	65	22.9	60.37	37.47	90.4	3.60	5.53
	3	121	36	85	23.12	55.22	32.1	90.2	3.15	3.70
	4	104	45	59	23.37	48.38	25.01	90.1	2.48	4.20
	5	124	51	73	23.06	56.73	33.67	90.2	3.30	4.52
	Mean	**120.60**	**48.40**	**72.20**	**23.14**	**56.68**	**33.54**	**90.26**	**3.26**	**4.55**
	SD	**11.15**	**13.32**	**10.45**	**0.18**	**5.49**	**5.59**	**0.13**	**0.50**	**0.68**
	CI	**9.77**	**11.67**	**9.16**	**0.16**	**4.82**	**4.90**	**0.12**	**0.44**	**0.60**

Table A 2.6 Condition Index of Farmed Oysters – January 2025

Site	Replicate	Entire Oysters (ml)	Empty Shells (ml)	Shell Volume (ml)	Jar Weight (g)	Combined weight (g)	Flesh wet weight (g)	Moisture (%)	Dry Weight (g)	Condition Index
Matakawau Headland	1	193	70	123	22.9	78.77	55.87	89.3	5.98	4.86
	2	212	84	128	23.08	86.58	63.5	90.9	5.78	4.51
	3	200	78	122	23.28	79.48	56.2	90.1	5.56	4.56
	4	202	76	126	23.12	80.17	57.05	90.4	5.48	4.35
	5	207	85	122	23.13	92.1	68.97	91.3	6.00	4.92
	Mean	**202.80**	**78.60**	**124.20**	**23.10**	**83.42**	**60.32**	**90.40**	**5.76**	**4.64**
	SD	**7.19**	**6.15**	**2.68**	**0.14**	**5.77**	**5.75**	**0.77**	**0.24**	**0.24**
	CI	**6.30**	**5.39**	**2.35**	**0.12**	**5.06**	**5.04**	**0.67**	**0.21**	**0.21**
Karaka Point	1	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-
	CI	-	-	-	-	-	-	-	-	-
Te Toro Road Ramp	1	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-
	CI	-	-	-	-	-	-	-	-	-
Te Toro Road Settlement	1	182	74	108	23.27	88.36	65.09	87.9	7.88	7.29
	2	184	67	117	23.34	88.41	65.07	90.3	6.31	5.39
	3	170	70	100	22.82	77.74	54.92	89.4	5.82	5.82
	4	172	68	104	23.48	75.68	52.2	89.3	5.59	5.37
	5	174	53	121	23.36	85.36	62	87	8.06	6.66
	Mean	**176.40**	**66.40**	**110.00**	**23.25**	**83.11**	**59.86**	**88.78**	**6.73**	**6.11**
	SD	**6.23**	**7.96**	**8.80**	**0.25**	**6.02**	**5.96**	**1.31**	**1.16**	**0.84**
	CI	**5.46**	**6.97**	**7.72**	**0.22**	**5.27**	**5.23**	**1.15**	**1.02**	**0.74**
Gordons Landing	1	159	65	94	22.93	63.42	40.49	90.3	3.93	4.18
	2	150	58	92	23.26	68.32	45.06	90.6	4.24	4.60
	3	214	90	124	23.31	79.18	55.87	91.2	4.92	3.96
	4	180	84	96	23.52	81.43	57.91	93	4.05	4.22
	5	209	86	123	23.26	78.83	55.57	91.1	4.95	4.02
	Mean	**182.40**	**76.60**	**105.80**	**23.26**	**74.24**	**50.98**	**91.24**	**4.42**	**4.20**
	SD	**28.76**	**14.17**	**16.22**	**0.21**	**7.89**	**7.72**	**1.05**	**0.48**	**0.25**
	CI	**25.21**	**12.42**	**14.22**	**0.19**	**6.92**	**6.76**	**0.92**	**0.42**	**0.22**

Table A 2.7 Condition Index of Farmed Oysters - March 2025

Site	Replicate	Entire Oysters (ml)	Empty Shells (ml)	Shell Volume (ml)	Jar Weight (g)	Combined weight (g)	Flesh wet weight (g)	Moisture (%)	Dry Weight (g)	Condition Index
Matakawau Headland	1	185	79	106	23.34	92.1	68.76	91.2	6.05	5.71
	2	186	84	102	23.49	88.75	65.26	90.6	6.13	6.01
	3	180	74	106	23.31	83.55	60.24	90.5	5.72	5.40
	4	205	92	113	23.34	88.92	65.58	89.1	7.15	6.33
	5	180	66	114	23.26	86.43	63.17	90.5	6.00	5.26
	Mean	**187.20**	**79.00**	**108.20**	**23.35**	**87.95**	**64.60**	**90.38**	**6.21**	**5.74**
	SD	**10.33**	**9.85**	**5.12**	**0.09**	**3.18**	**3.15**	**0.77**	**0.55**	**0.44**
	CI	**9.05**	**8.63**	**4.49**	**0.08**	**2.79**	**2.76**	**0.68**	**0.48**	**0.38**
Karaka Point	1	164	71	93	23.35	91.17	67.82	92.7	4.95	5.32
	2	143	57	86	22.95	74.53	51.58	92.3	3.97	4.62
	3	154	60	94	23.3	72.67	49.37	92.4	3.75	3.99
	4	163	72	91	23.29	77.09	53.8	92.1	4.25	4.67
	5	161	62	99	23.34	82.9	59.56	92.2	4.65	4.69
	Mean	**157.00**	**64.40**	**92.60**	**23.25**	**79.67**	**56.43**	**92.34**	**4.31**	**4.66**
	SD	**8.75**	**6.73**	**4.72**	**0.17**	**7.50**	**7.41**	**0.23**	**0.49**	**0.47**
	CI	**7.67**	**5.90**	**4.14**	**0.15**	**6.57**	**6.50**	**0.20**	**0.43**	**0.41**
Te Toro Road Ramp	1	166	66	100	23.18	73.48	50.3	91.8	4.12	4.12
	2	150	67	83	23.52	72.81	49.29	91.9	3.99	4.81
	3	152	66	86	23.15	65.15	42	91.7	3.49	4.05
	4	146	58	88	23.21	64.79	41.58	91.1	3.70	4.21
	5	171	78	93	23.39	60.9	37.51	90.4	3.60	3.87
	Mean	**157.00**	**67.00**	**90.00**	**23.29**	**67.43**	**44.14**	**91.38**	**3.78**	**4.21**
	SD	**10.86**	**7.14**	**6.67**	**0.16**	**5.49**	**5.47**	**0.63**	**0.27**	**0.36**
	CI	**9.52**	**6.26**	**5.85**	**0.14**	**4.81**	**4.79**	**0.55**	**0.24**	**0.31**
Te Toro Road Settlement	1	128	54	74	23.31	65.36	42.05	87.8	5.13	6.93
	2	152	60	92	23.3	69.43	46.13	88.1	5.49	5.97
	3	136	59	77	23.27	60.82	37.55	87.7	4.62	6.00
	4	152	60	92	23.33	70.77	47.44	88.7	5.36	5.83
	5	116	53	63	23.19	55.49	32.3	87.2	4.13	6.56
	Mean	**136.80**	**57.20**	**79.60**	**23.28**	**64.37**	**41.09**	**87.90**	**4.95**	**6.26**
	SD	**15.59**	**3.42**	**12.46**	**0.05**	**6.30**	**6.25**	**0.55**	**0.56**	**0.47**
	CI	**13.67**	**3.00**	**10.92**	**0.05**	**5.53**	**5.48**	**0.48**	**0.49**	**0.41**
Gordons Landing	1	176	67	109	23.34	91.45	68.11	92.9	4.84	4.44
	2	175	76	99	23.36	76.75	53.39	93.7	3.36	3.40
	3	150	62	88	23.32	82.2	58.88	93	4.12	4.68
	4	165	72	93	23.19	88.45	65.26	92.7	4.76	5.12
	5	188	87	101	23.26	89.41	66.15	92.8	4.76	4.72
	Mean	**170.80**	**72.80**	**98.00**	**23.29**	**85.65**	**62.36**	**93.02**	**4.37**	**4.47**
	SD	**14.20**	**9.52**	**8.00**	**0.07**	**6.06**	**6.09**	**0.40**	**0.63**	**0.65**
	CI	**12.45**	**8.35**	**7.01**	**0.06**	**5.31**	**5.34**	**0.35**	**0.55**	**0.57**

Table A 2.8 Condition Index of Farmed Oysters - May 2025

Site	Replicate	Entire Oysters (ml)	Empty Shells (ml)	Shell Volume (ml)	Jar Weight (g)	Combined weight (g)	Flesh wet weight (g)	Moisture (%)	Dry Weight (g)	Condition Index
Matakawau Headland	1	168	68	100	22.89	81.36	58.47	89.5	6.14	6.14
	2	186	75	111	22.98	78.06	55.08	89.5	5.78	5.21
	3	166	76	90	23.26	69.93	46.67	91	4.20	4.67
	4	167	72	95	22.99	74.41	51.42	89.8	5.24	5.52
	5	178	71	107	23.15	72.88	49.73	89.1	5.42	5.07
	Mean	**173.00**	**72.40**	**100.60**	**23.05**	**75.33**	**52.27**	**89.78**	**5.36**	**5.32**
	SD	**8.72**	**3.21**	**8.56**	**0.15**	**4.47**	**4.61**	**0.73**	**0.73**	**0.55**
	CI	**7.64**	**2.81**	**7.50**	**0.13**	**3.92**	**4.04**	**0.64**	**0.64**	**0.48**
Karaka Point	1	139	58	81	23.19	56.46	33.27	88.9	3.69	4.56
	2	134	60	74	23.3	57.41	34.11	89.9	3.45	4.66
	3	168	78	90	23.28	62.03	38.75	87.5	4.84	5.38
	4	172	75	97	23.28	66.92	43.64	88.7	4.93	5.08
	5	160	75	85	23.18	60.63	37.45	89.1	4.08	4.80
	Mean	**154.60**	**69.20**	**85.40**	**23.25**	**60.69**	**37.44**	**88.82**	**4.20**	**4.90**
	SD	**17.17**	**9.42**	**8.73**	**0.06**	**4.16**	**4.14**	**0.87**	**0.67**	**0.34**
	CI	**15.05**	**8.26**	**7.66**	**0.05**	**3.65**	**3.63**	**0.76**	**0.59**	**0.29**
Te Toro Road Ramp	1	185	80	105	22.95	68.59	45.64	89.6	4.75	4.52
	2	169	79	90	23.08	66.51	43.43	88.9	4.82	5.36
	3	156	66	90	23.15	69.57	46.42	88	5.57	6.19
	4	154	64	90	23	67.66	44.66	87.1	5.76	6.40
	5	176	70	106	22.96	62.96	40	88.2	4.72	4.45
	Mean	**168.00**	**71.80**	**96.20**	**23.03**	**67.06**	**44.03**	**88.36**	**5.12**	**5.38**
	SD	**13.17**	**7.36**	**8.50**	**0.09**	**2.56**	**2.52**	**0.94**	**0.50**	**0.91**
	CI	**11.55**	**6.45**	**7.45**	**0.07**	**2.24**	**2.20**	**0.83**	**0.44**	**0.80**
Te Toro Road Settlement	1	174	78	96	23.18	71.35	48.17	89.7	4.96	5.17
	2	181	74	107	23.27	72.05	48.78	88.8	5.46	5.11
	3	156	80	76	23.22	72.95	49.73	89.3	5.32	7.00
	4	152	65	87	23.07	70.5	47.43	92.2	3.70	4.25
	5	182	71	111	23	70.34	47.34	91.2	4.17	3.75
	Mean	**169.00**	**73.60**	**95.40**	**23.15**	**71.44**	**48.29**	**90.24**	**4.72**	**5.06**
	SD	**14.11**	**5.94**	**14.36**	**0.11**	**1.09**	**1.00**	**1.42**	**0.76**	**1.24**
	CI	**12.37**	**5.21**	**12.59**	**0.10**	**0.96**	**0.87**	**1.24**	**0.67**	**1.09**
Gordons Landing	1	197	82	115	22.99	65.45	42.46	93.5	2.76	2.40
	2	184	74	110	22.9	58.93	36.03	92.4	2.74	2.49
	3	164	60	104	22.98	61.03	38.05	93	2.66	2.56
	4	184	76	108	23.12	63.09	39.97	92.5	3.00	2.78
	5	156	65	91	23.18	54.16	30.98	92.9	2.20	2.42
	Mean	**177.00**	**71.40**	**105.60**	**23.03**	**60.53**	**37.50**	**92.86**	**2.67**	**2.53**
	SD	**16.64**	**8.82**	**9.07**	**0.11**	**4.31**	**4.35**	**0.44**	**0.29**	**0.15**
	CI	**14.59**	**7.73**	**7.95**	**0.10**	**3.77**	**3.81**	**0.39**	**0.26**	**0.13**

Table A 2.9 Condition Index of Farmed Oysters - August 2025

Site	Replicate	Entire Oyster (ml)	Empty Shells (ml)	Shell volume (ml)	Jar Weight (g)	Combined weight (g)	Flesh Wet Weight (g)	Moisture (%)	Dry Weight (g)	Condition Index (CI)	Change in CI	Days in Environment
Control	1	267	131	136	23.19	112.58	89.39	91.1	7.96	5.85	-	-
	2	302	149	153	23.1	103.23	80.13	89.8	8.17	5.34	-	-
	3	301	154	147	23.17	111.88	88.71	91.7	7.36	5.01	-	-
	4	260	140	120	23.02	83.58	60.56	89.5	6.36	5.30	-	-
	5	258	108	150	22.9	92.37	69.47	87.4	8.75	5.84	-	-
	Mean	277.60	136.40	141.20	23.08	100.73	77.65	89.90	7.72	5.47	-	-
	SD	22.07	18.15	13.48	0.12	12.60	12.50	1.67	0.91	0.37	-	-
	CI	19.35	15.91	11.82	0.10	11.04	10.96	1.46	0.80	0.32	-	-
Matakawau Headland	1	277	131	146	22.92	87.73	64.81	89.1	7.06	4.84	-0.63	29
	2	302	148	154	22.95	96.63	73.68	89.4	7.81	5.07	-0.40	29
	3	282	146	136	22.91	84.99	62.08	91	5.59	4.11	-1.36	29
	4	291	140	151	23.06	92.41	69.35	91.2	6.10	4.04	-1.43	29
	5	303	150	153	23.1	103.7	80.6	90.4	7.74	5.06	-0.41	29
	Mean	291.00	143.00	148.00	22.99	93.09	70.10	90.22	6.86	4.62	-0.84	-
	SD	11.64	7.68	7.38	0.09	7.41	7.35	0.94	0.99	0.51	0.51	-
	CI	10.20	6.73	6.47	0.08	6.50	6.44	0.82	0.87	0.45	0.45	-
Karaka Point	1	278	144	134	22.92	93.17	70.25	86.7	9.34	6.97	1.51	29
	2	270	135	135	22.97	93.33	70.36	88.7	7.95	5.89	0.42	29
	3	234	117	117	23.07	93.73	70.66	85.7	10.10	8.64	3.17	29
	4	237	125	112	23	87.42	64.42	86.4	8.76	7.82	2.36	29
	5	268	130	138	23.08	105.49	82.41	88	9.89	7.17	1.70	29
	Mean	257.40	130.20	127.20	23.01	94.63	71.62	87.10	9.21	7.30	1.83	-
	SD	20.37	10.18	11.82	0.07	6.61	6.57	1.22	0.88	1.02	1.02	-
	CI	17.85	8.93	10.36	0.06	5.79	5.76	1.07	0.77	0.90	0.90	-
Te Toro Road Ramp	1	228	108	120	23.02	90.67	67.65	87.3	8.59	7.16	1.69	29
	2	240	125	115	23.15	88.22	65.07	87.3	8.26	7.19	1.72	29
	3	224	128	96	23.26	103.02	79.76	85.6	11.49	11.96	6.50	29
	4	252	130	122	23.11	95.94	72.83	84.6	11.22	9.19	3.73	29
	5	240	130	110	23.18	85.89	62.71	86.8	8.28	7.53	2.06	29
	Mean	236.80	124.20	112.60	23.14	92.75	69.60	86.32	9.57	8.61	3.14	-
	SD	11.10	9.28	10.38	0.09	6.85	6.81	1.19	1.64	2.06	2.06	-
	CI	9.73	8.14	9.10	0.08	6.00	5.97	1.04	1.43	1.80	1.80	-
Te Toro Road Settlement	1	226	116	110	23.08	87.64	64.56	87.7	7.94	7.22	1.75	29
	2	338	170	168	23.06	100.97	77.91	89	8.57	5.10	-0.37	29
	3	250	131	119	22.82	97.29	74.47	88.2	8.79	7.38	1.92	29
	4	249	133	116	23.04	98.16	75.12	89.7	7.74	6.67	1.20	29
	5	275	132	143	22.93	100.07	77.14	91.3	6.71	4.69	-0.77	29
	Mean	267.60	136.40	131.20	22.99	96.83	73.84	89.18	7.95	6.21	0.75	-
	SD	43.00	20.03	24.10	0.11	5.34	5.38	1.41	0.82	1.24	1.24	-
	CI	37.69	17.56	21.12	0.10	4.68	4.71	1.24	0.72	1.09	1.09	-
Gordons Landing	1	323	159	164	23.11	107.49	84.38	88.3	9.87	6.02	0.55	29
	2	268	125	143	23.06	85.53	62.47	90.5	5.93	4.15	-1.32	29
	3	272	138	134	23.06	92.66	69.6	89.5	7.31	5.45	-0.01	29
	4	338	171	167	23	96.81	73.81	91.1	6.57	3.93	-1.53	29
	5	257	120	137	23.09	85.49	62.4	90.2	6.12	4.46	-1.00	29
	Mean	291.60	142.60	149.00	23.06	93.60	70.53	89.92	7.16	4.80	-0.66	-
	SD	36.32	21.89	15.44	0.04	9.15	9.14	1.07	1.61	0.89	0.89	-
	CI	31.84	19.19	13.54	0.04	8.02	8.02	0.94	1.41	0.78	0.78	-

Table A 2.10 Condition Index of Farmed Oysters - October 2025

Site	Replicate	Entire Oyster (ml)	Empty Shells (ml)	Shell volume (ml)	Jar Weight (g)	Combined weight (g)	Flesh Wet Weight (g)	Moisture (%)	Dry Weight (g)	Condition Index (CI)	Change in CI	Days in Environment
Control	1	316	160	156	23.12	112.28	89.16	86.8	11.77	7.54	-	0
	2	328	166	162	22.99	108.53	85.54	86.4	11.63	7.18	-	0
	3	285	140	145	23	106.73	83.73	85.3	12.31	8.49	-	0
	4	292	133	159	23.06	99.39	76.33	84.1	12.14	7.63	-	0
	5	368	184	184	22.99	133.13	110.14	86.6	14.76	8.02	-	0
	Mean	317.80	156.60	161.20	23.03	112.01	88.98	85.84	12.52	7.77	-	-
	SD	33.05	20.51	14.27	0.06	12.70	12.72	1.13	1.28	0.50	-	-
	CI	28.97	17.98	12.51	0.05	11.13	11.15	0.99	1.12	0.44	-	-
Matakawau Headland	1	350	171	179	22.9	129.98	107.08	88.1	12.74	7.12	-0.65	57
	2	339	165	174	23.06	134.78	111.72	85	16.76	9.63	1.86	57
	3	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-
	Mean	344.50	168.00	176.50	22.98	132.38	109.40	86.55	14.75	8.37	0.60	-
	SD	7.78	4.24	3.54	0.11	3.39	3.28	2.19	2.84	1.78	1.78	-
	CI	10.78	5.88	4.90	0.16	4.70	4.55	3.04	3.94	2.46	2.46	-
Karaka Point	1	285	134	151	23.05	112.19	89.14	86.9	11.68	7.73	-0.04	57
	2	318	154	164	23.13	133.81	110.68	86.1	15.38	9.38	1.61	57
	3	348	178	170	22.92	130.11	107.19	87.1	13.83	8.13	0.36	57
	4	308	144	164	23.11	121.5	98.39	84.5	15.25	9.30	1.53	57
	5	290	135	155	23.13	118.03	94.9	86.6	12.72	8.20	0.43	57
	Mean	309.80	149.00	160.80	23.07	123.13	100.06	86.24	13.77	8.55	0.78	-
	SD	25.18	18.11	7.66	0.09	8.82	8.84	1.04	1.60	0.74	0.74	-
	CI	22.07	15.87	6.72	0.08	7.73	7.74	0.91	1.41	0.65	0.65	-
Te Toro Road Ramp	1	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-
	CI	-	-	-	-	-	-	-	-	-	-	-
Te Toro Road Settlement	1	330	171	159	23.01	127.05	104.04	90	10.40	6.54	-1.23	57
	2	326	162	164	22.97	138.66	115.69	88.7	13.07	7.97	0.20	57
	3	276	128	148	23	110.89	87.89	86.9	11.51	7.78	0.01	57
	4	357	183	174	23.03	131.71	108.68	86.7	14.45	8.31	0.53	57
	5	320	164	156	23.04	112.28	89.24	89.5	9.37	6.01	-1.77	57
	Mean	321.80	161.60	160.20	23.01	124.12	101.11	88.36	11.76	7.32	-0.45	-
	SD	29.26	20.50	9.65	0.03	12.17	12.19	1.50	2.04	0.99	0.99	-
	CI	25.65	17.97	8.46	0.02	10.67	10.68	1.31	1.79	0.87	0.87	-
Gordons Landing	1	339	171	168	23.13	147.53	124.4	89.8	12.69	7.55	-0.22	57
	2	313	165	148	22.92	128.99	106.07	89.4	11.24	7.60	-0.18	57
	3	305	153	152	23.05	125.66	102.61	88.6	11.70	7.70	-0.08	57
	4	313	152	161	23.06	141.49	118.43	88.5	13.62	8.46	0.69	57
	5	310	146	164	22.92	138.41	115.49	87.3	14.67	8.94	1.17	57
	Mean	316.00	157.40	158.60	23.02	136.42	113.40	88.72	12.78	8.05	0.28	-
	SD	13.27	10.26	8.35	0.09	9.00	8.96	0.96	1.40	0.62	0.62	-
	CI	11.63	8.99	7.32	0.08	7.89	7.85	0.84	1.22	0.54	0.54	-

Table A 2.11 Condition Index of Farmed Oysters - December 2025

Site	Replicate	Entire Oyster (ml)	Empty Shells (ml)	Shell volume (ml)	Jar Weight (g)	Combined weight (g)	Flesh Wet Weight (g)	Moisture (%)	Dry Weight (g)	Condition Index (CI)	Change in CI	Days in Environment
Control	1	222	90	132	22.98	94.93	71.95	86.5	9.71	7.36	-	0
	2	242	98	144	23.05	99.06	76.01	85.7	10.87	7.55	-	0
	3	218	96	122	25.06	91.62	66.56	85.1	9.92	8.13	-	0
	4	230	87	143	23.07	106.8	83.73	88	10.05	7.03	-	0
	5	216	89	127	23.08	111.44	88.36	88.2	10.43	8.21	-	0
	Mean	225.60	92.00	133.60	23.45	100.77	77.32	86.70	10.19	7.65	-	-
	SD	10.62	4.74	9.71	0.90	8.23	8.79	1.37	0.46	0.51	-	-
	CI	9.31	4.16	8.51	0.79	7.21	7.71	1.20	0.40	0.44	-	-
Matakawau Headland	1	246	110	136	22.89	92.22	69.33	88.1	8.25	6.07	-1.59	60
	2	225	98	127	23.04	92.68	69.64	84.6	10.72	8.44	0.79	60
	3	232	104	128	23	89.83	66.83	86.6	8.96	7.00	-0.66	60
	4	247	102	145	23.12	99.54	76.42	85.2	11.31	7.80	0.15	60
	5	230	98	132	22.95	89.93	66.98	87	8.71	6.60	-1.06	60
	Mean	236.00	102.40	133.60	23.00	92.84	69.84	86.30	9.59	7.18	-0.47	-
	SD	9.92	4.98	7.30	0.09	3.96	3.90	1.41	1.34	0.95	0.95	-
	CI	8.70	4.37	6.40	0.08	3.47	3.42	1.23	1.18	0.83	0.83	-
Karaka Point	1	212	90	122	23.04	97.19	74.15	84.7	11.34	9.30	1.64	60
	2	238	92	146	23.05	111.15	88.1	82.5	15.42	10.56	2.91	60
	3	235	96	139	23.1	107.03	83.93	85.4	12.25	8.82	1.16	60
	4	232	103	129	22.99	102.38	79.39	85.4	11.59	8.99	1.33	60
	5	226	98	128	23.12	95.52	72.4	85.8	10.28	8.03	0.38	60
	Mean	228.60	95.80	132.80	23.06	102.65	79.59	84.76	12.18	9.14	1.48	-
	SD	10.29	5.12	9.58	0.05	6.56	6.57	1.32	1.95	0.92	0.92	-
	CI	9.02	4.49	8.39	0.05	5.75	5.76	1.16	1.71	0.81	0.81	-
Te Toro Road Ramp	1	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-
	CI	-	-	-	-	-	-	-	-	-	-	-
Te Toro Road Settlement	1	230	96	134	23.05	85.37	62.32	89.1	6.79	5.07	-2.59	60
	2	224	93	131	23.05	92.87	69.82	89.9	7.05	5.38	-2.27	60
	3	236	102	134	23.05	90.58	67.53	89.3	7.23	5.39	-2.26	60
	4	225	98	127	22.89	87.23	64.34	89.1	7.01	5.52	-2.13	60
	5	233	102	131	23.1	84.87	61.77	89.6	6.42	4.90	-2.75	60
	Mean	229.60	98.20	131.40	23.03	88.18	65.16	89.40	6.90	5.25	-2.40	-
	SD	5.13	3.90	2.88	0.08	3.45	3.45	0.35	0.31	0.26	0.26	-
	CI	4.50	3.42	2.53	0.07	3.02	3.02	0.30	0.27	0.23	0.23	-
Gordons Landing	1	238	96	142	23.1	90.48	67.38	88.7	7.61	5.36	-2.29	60
	2	236	104	132	23.03	104.58	81.55	87.9	9.87	7.48	-0.18	60
	3	209	90	119	23.04	88.03	64.99	88.9	7.21	6.06	-1.59	60
	4	206	87	119	22.97	100.27	77.3	89	8.50	7.15	-0.51	60
	5	239	90	149	23.03	110.49	87.46	89.1	9.53	6.40	-1.26	60
	Mean	225.60	93.40	132.20	23.03	98.77	75.74	88.72	8.55	6.49	-1.17	-
	SD	16.59	6.77	13.48	0.05	9.45	9.47	0.48	1.16	0.85	0.85	-
	CI	14.54	5.93	11.82	0.04	8.29	8.30	0.42	1.02	0.74	0.74	-

Table A 2.12 Condition Index of Farmed Oysters - January 2026

Site	Replicate	Entire Oyster (ml)	Empty Shells (ml)	Shell volume (ml)	Jar Weight (g)	Combined weight (g)	Flesh Wet Weight (g)	Moisture (%)	Dry Weight (g)	Condition Index (CI)	Change in CI	Days in Environment
Control	1	248	120	128	23.12	104.79	81.67	89.5	8.58	6.70	-	0
	2	273	138	135	22.94	95.31	72.37	90.3	7.02	5.20	-	0
	3	244	120	124	23.11	88.9	65.79	89.6	6.84	5.52	-	0
	4	229	123	106	23.09	80.03	56.94	91.4	4.90	4.62	-	0
	5	307	162	145	22.91	121.25	98.34	91.7	8.16	5.63	-	0
	Mean	260.20	132.60	127.60	23.03	98.06	75.02	90.50	7.10	5.53	-	-
	SD	30.57	18.05	14.47	0.10	15.81	15.87	1.01	1.43	0.76	-	-
	CI	26.80	15.82	12.68	0.09	13.86	13.91	0.89	1.26	0.67	-	-
Matakawau Headland	1	221	114	107	22.96	85.4	62.44	90.5	5.93	5.54	0.01	50
	2	272	149	123	22.97	87.52	64.55	92.1	5.10	4.15	-1.39	50
	3	232	115	117	23.09	89.68	66.59	92.2	5.19	4.44	-1.09	50
	4	257	131	126	23.14	89.83	66.69	91.5	5.67	4.50	-1.03	50
	5	255	129	126	22.98	87.19	64.21	92	5.14	4.08	-1.46	50
	Mean	247.40	127.60	119.80	23.03	87.92	64.90	91.66	5.41	4.54	-0.99	-
	SD	20.55	14.28	8.04	0.08	1.86	1.78	0.70	0.37	0.59	0.59	-
	CI	18.01	12.51	7.05	0.07	1.63	1.56	0.62	0.33	0.52	0.52	-
Karaka Point	1	276	147	129	23.08	100.75	77.67	89.4	8.23	6.38	0.85	50
	2	259	124	135	23.14	99.31	76.17	89.9	7.69	5.70	0.17	50
	3	230	116	114	23.03	87.45	64.42	89.3	6.89	6.05	0.51	50
	4	233	112	121	23.02	100.69	77.67	89.7	8.00	6.61	1.08	50
	5	232	116	116	22.96	91.84	68.88	90.3	6.68	5.76	0.23	50
	Mean	246.00	123.00	123.00	23.05	96.01	72.96	89.72	7.50	6.10	0.57	-
	SD	20.55	14.11	8.86	0.07	6.04	6.01	0.40	0.68	0.39	0.39	-
	CI	18.02	12.37	7.77	0.06	5.29	5.26	0.35	0.60	0.35	0.35	-
Te Toro Road Ramp	1	236	112	124	23.1	94.75	71.65	93.2	4.87	3.93	-1.60	50
	2	268	135	133	23.04	99.82	76.78	93.1	5.30	3.98	-1.55	50
	3	225	120	105	22.97	100.45	77.48	93.9	4.73	4.50	-1.03	50
	4	227	128	99	23.02	104.25	81.23	93.9	4.96	5.01	-0.53	50
	5	251	122	129	23.06	102.56	79.5	94.5	4.37	3.39	-2.14	50
	Mean	241.40	123.40	118.00	23.04	100.37	77.33	93.72	4.84	4.16	-1.37	-
	SD	18.06	8.65	15.10	0.05	3.60	3.62	0.58	0.34	0.61	0.61	-
	CI	15.83	7.58	13.24	0.04	3.15	3.18	0.51	0.30	0.54	0.54	-
Te Toro Road Settlement	1	270	134	136	23.04	120.25	97.21	93.4	6.42	4.72	-0.82	50
	2	247	122	125	23.01	117.44	94.43	93.8	5.85	4.68	-0.85	50
	3	259	128	131	23.04	111.39	88.35	92.9	6.27	4.79	-0.74	50
	4	237	122	115	23.11	111.5	88.39	93.8	5.48	4.77	-0.77	50
	5	237	121	116	23.08	110.58	87.5	92	7.00	6.03	0.50	50
	Mean	250.00	125.40	124.60	23.06	114.23	91.18	93.18	6.20	5.00	-0.54	-
	SD	14.39	5.55	9.18	0.04	4.34	4.37	0.76	0.58	0.58	0.58	-
	CI	12.61	4.86	8.05	0.03	3.81	3.83	0.66	0.51	0.51	0.51	-
Gordons Landing	1	229	113	116	23.05	87.36	64.31	93.3	4.31	3.71	-1.82	50
	2	236	122	114	23.11	86.7	63.59	92.8	4.58	4.02	-1.52	50
	3	220	108	112	23.06	91.4	68.34	93.2	4.65	4.15	-1.38	50
	4	220	112	108	23.04	85.45	62.41	92.8	4.49	4.16	-1.37	50
	5	237	117	120	23.03	87.78	64.75	92.8	4.66	3.89	-1.65	50
	Mean	228.40	114.40	114.00	23.06	87.74	64.68	92.98	4.54	3.99	-1.55	-
	SD	8.26	5.32	4.47	0.03	2.23	2.23	0.25	0.14	0.19	0.19	-
	CI	7.24	4.66	3.92	0.03	1.95	1.95	0.22	0.13	0.17	0.17	-

Table A 2.13 Condition Index of Farmed Oysters - March 2026

Site	Replicate	Entire Oyster (ml)	Empty Shells (ml)	Shell volume (ml)	Jar Weight (g)	Combined Weight (g)	Flesh Wet Weight (g)	Moisture (%)	Dry Weight (g)	Condition Index (CI)	Change in CI	Days in Environment
Control	1	393	187	206	23.03	153.25	130.22	93.1	8.99	4.36	-	0
	2	372	177	195	23	145.6	122.6	93.3	8.21	4.21	-	0
	3	414	210	204	23.07	151.12	128.05	92.7	9.35	4.58	-	0
	4	369	179	190	23.06	138.39	115.33	92.9	8.19	4.31	-	0
	5	379	185	194	23.01	135.85	112.84	93.2	7.67	3.96	-	0
	Mean	385.40	187.60	197.80	23.03	144.84	121.81	93.04	8.48	4.28	-	-
	SD	18.47	13.18	6.87	0.03	7.63	7.63	0.24	0.67	0.23	-	-
	CI	16.19	11.56	6.02	0.03	6.69	6.69	0.21	0.59	0.20	-	-
Matakawau Headland	1	305	150	155	23.07	125.06	101.99	93.5	6.63	4.28	-0.01	43
	2	297	150	147	22.96	121.32	98.36	93.6	6.30	4.28	0.00	43
	3	295	149	146	23.06	115.42	92.36	92.9	6.56	4.49	0.21	43
	4	285	140	145	23.03	107.77	84.74	93.1	5.85	4.03	-0.25	43
	5	330	152	178	23.04	146.89	123.85	93.1	8.55	4.80	0.52	43
	Mean	302.40	148.20	154.20	23.03	123.29	100.26	93.24	6.77	4.38	0.09	-
	SD	16.99	4.71	13.88	0.04	14.72	14.72	0.30	1.04	0.29	0.29	-
	CI	14.90	4.13	12.17	0.04	12.90	12.90	0.26	0.91	0.25	0.25	-
Karaka Point	1	342	166	176	23.09	138.7	115.61	92.1	9.13	5.19	0.91	43
	2	324	158	166	23.05	131.63	108.58	91.9	8.79	5.30	1.01	43
	3	306	147	159	23.11	124.99	101.88	92.2	7.95	5.00	0.71	43
	4	300	148	152	23.03	123.57	100.54	91.9	8.14	5.36	1.07	43
	5	280	134	146	23.09	125.24	102.15	90.2	10.01	6.86	2.57	43
	Mean	310.40	150.60	159.80	23.07	128.83	105.75	91.66	8.81	5.54	1.26	-
	SD	23.64	12.12	11.76	0.03	6.34	6.33	0.83	0.83	0.75	0.75	-
	CI	20.72	10.62	10.30	0.03	5.55	5.55	0.72	0.72	0.66	0.66	-
Te Toro Road Ramp	1	300	150	150	23.14	121.65	98.51	93.9	6.01	4.01	-0.28	43
	2	308	154	154	22.99	120.55	97.56	93.8	6.05	3.93	-0.36	43
	3	312	152	160	23.06	121.67	98.61	93.3	6.61	4.13	-0.15	43
	4	317	148	169	23.03	108.69	85.66	93.1	5.91	3.50	-0.79	43
	5	302	142	160	23.06	143.34	120.28	94.8	6.25	3.91	-0.38	43
	Mean	307.80	149.20	158.60	23.06	123.18	100.12	93.78	6.17	3.89	-0.39	-
	SD	7.01	4.60	7.20	0.06	12.53	12.52	0.66	0.28	0.24	0.24	-
	CI	6.15	4.04	6.31	0.05	10.98	10.97	0.58	0.24	0.21	0.21	-
Te Toro Road Settlement	1	292	151	141	22.96	90.29	67.33	91.2	5.93	4.20	-0.08	43
	2	332	168	164	22.98	135.25	112.27	93.1	7.75	4.72	0.44	43
	3	299	156	143	23.1	118.62	95.52	92.4	7.26	5.08	0.79	43
	4	310	144	166	23.05	141.08	118.03	93.7	7.44	4.48	0.20	43
	5	303	150	153	23.05	136.75	113.7	93.7	7.16	4.68	0.40	43
	Mean	307.20	153.80	153.40	23.03	124.40	101.37	92.82	7.11	4.63	0.35	-
	SD	15.32	9.01	11.55	0.06	20.89	20.86	1.05	0.70	0.32	0.32	-
	CI	13.43	7.90	10.12	0.05	18.31	18.29	0.92	0.61	0.28	0.28	-
Gordons Landing	1	260	130	130	22.98	118.49	95.51	94.6	5.16	3.97	-0.32	43
	2	304	150	154	23.04	124.52	101.48	93.9	6.19	4.02	-0.26	43
	3	312	161	151	23	124.08	101.08	94.4	5.66	3.75	-0.54	43
	4	290	154	136	23.04	120.17	97.13	94.3	5.54	4.07	-0.21	43
	5	287	149	138	23.03	109.25	86.22	93.3	5.78	4.19	-0.10	43
	Mean	290.60	148.80	141.80	23.02	119.30	96.28	94.10	5.66	4.00	-0.29	-
	SD	19.92	11.52	10.26	0.03	6.17	6.18	0.51	0.37	0.16	0.16	-
	CI	17.46	10.10	8.99	0.02	5.41	5.41	0.45	0.33	0.14	0.14	-

Table A 2.14 Condition Index of Farmed Oysters - April 2026

Site	Replicate	Entire Oyster (ml)	Empty Shells (ml)	Shell volume	Jar Weight (g)	Combined Weight (g)	Flesh Wet Weight (g)	Moisture (%)	Dry Weight	Condition Index (CI)	Change in CI	Days in Environment
Control	1	410	193	217	23.01	141.41	118.4	91.1	10.54	4.86	-	0
	2	418	222	196	22.89	149.76	126.87	91.2	11.16	5.70	-	0
	3	368	167	201	23	149.95	126.95	90.6	11.93	5.94	-	0
	4	346	170	176	22.98	142.99	120.01	92.2	9.36	5.32	-	0
	5	403	188	215	23.02	145.73	122.71	91.6	10.31	4.79	-	0
	Mean	389.00	188.00	201.00	22.98	145.97	122.99	91.34	10.66	5.32	-	-
	SD	30.69	22.06	16.60	0.05	3.87	3.90	0.60	0.96	0.50	-	-
	CI	26.90	19.33	14.55	0.05	3.39	3.42	0.52	0.84	0.44	-	-
Matakawau Headland	1	303	140	163	22.97	102.77	79.8	90.8	7.34	4.50	-0.82	32
	2	362	180	182	22.98	113.3	90.32	92.3	6.95	3.82	-1.50	32
	3	292	132	160	23	106.2	83.2	90.9	7.57	4.73	-0.59	32
	4	302	144	158	22.98	103.28	80.3	90.9	7.31	4.62	-0.70	32
	5	308	148	160	22.8	106.27	83.47	91.8	6.84	4.28	-1.04	32
	Mean	313.40	148.80	164.60	22.95	106.36	83.42	91.34	7.20	4.39	-0.93	-
	SD	27.78	18.42	9.89	0.08	4.20	4.20	0.67	0.30	0.36	0.36	-
	CI	24.35	16.14	8.67	0.07	3.68	3.68	0.59	0.26	0.32	0.32	-
Karaka Point	1	318	149	169	22.85	118.69	95.84	90.9	8.72	5.16	-0.16	32
	2	321	146	175	23.02	124.78	101.76	90.2	9.97	5.70	0.38	32
	3	290	142	148	23.05	108.94	85.89	91.1	7.64	5.17	-0.16	32
	4	298	145	153	22.97	100.88	77.91	89.7	8.02	5.24	-0.08	32
	5	295	156	139	22.98	116.99	94.01	90.9	8.55	6.15	0.83	32
	Mean	304.40	147.60	156.80	22.97	114.06	91.08	90.56	8.58	5.48	0.16	-
	SD	14.12	5.32	14.91	0.08	9.29	9.30	0.59	0.89	0.44	0.44	-
	CI	12.37	4.66	13.07	0.07	8.14	8.15	0.52	0.78	0.38	0.38	-
Te Toro Road Ramp	1	311	146	165	23.14	102.54	79.4	92.1	6.27	3.80	-1.52	32
	2	319	160	159	22.95	106.27	83.32	93.1	5.75	3.62	-1.70	32
	3	325	152	173	22.81	118.97	96.16	93.6	6.15	3.56	-1.76	32
	4	288	139	149	22.95	103.34	80.39	92.4	6.11	4.10	-1.22	32
	5	314	150	164	23.02	122.64	99.62	93.9	6.08	3.71	-1.62	32
	Mean	311.40	149.40	162.00	22.97	110.75	87.78	93.02	6.07	3.76	-1.56	-
	SD	14.12	7.73	8.83	0.12	9.37	9.42	0.77	0.20	0.21	0.21	-
	CI	12.37	6.78	7.74	0.11	8.21	8.26	0.67	0.17	0.19	0.19	-
Te Toro Road Settlement	1	309	148	161	22.88	117.06	94.18	90.6	8.85	5.50	0.18	32
	2	316	156	160	23.05	117.91	94.86	89.6	9.87	6.17	0.85	32
	3	306	156	150	23.03	118.37	95.34	88.9	10.58	7.06	1.73	32
	4	330	167	163	22.96	105.83	82.87	90.1	8.20	5.03	-0.29	32
	5	302	155	147	22.89	111.95	89.06	91.9	7.21	4.91	-0.41	32
	Mean	312.60	156.40	156.20	22.96	114.22	91.26	90.22	8.94	5.73	0.41	-
	SD	10.99	6.80	7.19	0.08	5.35	5.32	1.13	1.33	0.89	0.89	-
	CI	9.63	5.96	6.30	0.07	4.69	4.67	0.99	1.17	0.78	0.78	-
Gordons Landing	1	309	147	162	23.08	104.69	81.61	94	4.90	3.02	-2.30	32
	2	312	153	159	22.89	104.11	81.22	93.5	5.28	3.32	-2.00	32
	3	335	169	166	22.97	117.27	94.3	93.4	6.22	3.75	-1.57	32
	4	318	154	164	22.97	107.4	84.43	93.6	5.40	3.29	-2.03	32
	5	358	176	182	23.04	109.75	86.71	93	6.07	3.34	-1.99	32
	Mean	326.40	159.80	166.60	22.99	108.64	85.65	93.50	5.57	3.34	-1.98	-
	SD	20.33	12.15	8.99	0.07	5.32	5.32	0.36	0.56	0.26	0.26	-
	CI	17.82	10.65	7.88	0.06	4.67	4.67	0.32	0.49	0.23	0.23	-

Table A 2.15 Condition Index of Farmed Oysters - May 2026

Site	Replicate	Entire Oyster (ml)	Empty Shells (ml)	Shell volume	Jar Weight (g)	Combined Weight (g)	Flesh Wet Weight (g)	% Moisture	Dry Weight	Condition Index (CI)	Change in CI	Days in Environment
Control	1	324	161	163	22.95	134.6	111.65	93.2	7.59	4.66	-	0
	2	300	152	148	22.96	122.65	99.69	92.6	7.38	4.98	-	0
	3	332	149	183	22.99	146.63	123.64	92.7	9.03	4.93	-	0
	4	318	156	162	22.82	141.63	118.81	93.6	7.60	4.69	-	0
	5	308	147	161	23.01	141.04	118.03	93.6	7.55	4.69	-	0
	Mean	316.40	153.00	163.40	22.95	137.31	114.36	93.14	7.83	4.79	-	-
	SD	12.68	5.61	12.54	0.07	9.24	9.25	0.48	0.67	0.15	-	-
	CI	11.12	4.92	10.99	0.07	8.10	8.10	0.42	0.59	0.13	-	-
Matakawau Headland	1	312	142	170	23.01	138.77	115.76	92.1	9.15	5.38	0.59	28
	2	292	140	152	22.79	132.96	110.17	91.9	8.92	5.87	1.08	28
	3	344	167	177	23.06	126.24	103.18	91.8	8.46	4.78	-0.01	28
	4	288	145	143	22.98	134.51	111.53	91	10.04	7.02	2.23	28
	5	316	146	170	22.98	138.35	115.37	91.8	9.46	5.56	0.77	28
	Mean	310.40	148.00	162.40	22.96	134.17	111.20	91.72	9.21	5.72	0.93	-
	SD	22.38	10.89	14.26	0.10	5.08	5.09	0.42	0.59	0.83	0.83	-
	CI	19.62	9.54	12.50	0.09	4.45	4.46	0.37	0.52	0.72	0.72	-
Karaka Point	1	294	156	138	22.91	110.67	87.76	91.4	7.55	5.47	0.68	28
	2	298	155	143	22.99	118.72	95.73	91.1	8.52	5.96	1.17	28
	3	284	152	132	22.97	120.27	97.3	90.6	9.15	6.93	2.14	28
	4	284	146	138	22.87	114.29	91.42	91.2	8.04	5.83	1.04	28
	5	304	150	154	22.94	125.77	102.83	90.4	9.87	6.41	1.62	28
	Mean	292.80	151.80	141.00	22.94	117.94	95.01	90.94	8.63	6.12	1.33	-
	SD	8.79	4.02	8.25	0.05	5.78	5.75	0.42	0.91	0.56	0.56	-
	CI	7.70	3.53	7.23	0.04	5.06	5.04	0.37	0.80	0.49	0.49	-
Te Toro Road Ramp	1	296	155	141	22.95	108.63	85.68	92.3	6.60	4.68	-0.11	28
	2	308	146	162	22.91	124.38	101.47	92.5	7.61	4.70	-0.09	28
	3	323	142	181	22.81	132.61	109.8	92.6	8.13	4.49	-0.30	28
	4	267	149	118	22.96	111.88	88.92	91.9	7.20	6.10	1.31	28
	5	295	170	125	22.97	109.58	86.61	93.1	5.98	4.78	-0.01	28
	Mean	297.80	152.40	145.40	22.92	117.42	94.50	92.48	7.10	4.95	0.16	-
	SD	20.61	10.92	26.12	0.07	10.59	10.65	0.44	0.84	0.65	0.65	-
	CI	18.06	9.57	22.90	0.06	9.28	9.34	0.38	0.74	0.57	0.57	-
Te Toro Road Settlement	1	331	170	161	23.01	135.86	112.85	92.4	8.58	5.33	0.54	28
	2	330	176	154	22.95	128.76	105.81	90.6	9.95	6.46	1.67	28
	3	325	159	166	22.81	125.31	102.5	91.1	9.12	5.50	0.70	28
	4	305	160	145	22.78	118.02	95.24	90.3	9.24	6.37	1.58	28
	5	322	159	163	22.95	129.63	106.68	91.7	8.85	5.43	0.64	28
	Mean	322.60	164.80	157.80	22.90	127.52	104.62	91.22	9.15	5.82	1.02	-
	SD	10.50	7.79	8.41	0.10	6.53	6.44	0.85	0.51	0.55	0.55	-
	CI	9.21	6.83	7.37	0.09	5.73	5.64	0.74	0.45	0.48	0.48	-
Gordons Landing	1	306	142	164	22.88	141.67	118.79	93	8.32	5.07	0.28	28
	2	320	172	148	22.95	137.64	114.69	93.2	7.80	5.27	0.48	28
	3	282	138	144	22.9	127.02	104.12	93	7.29	5.06	0.27	28
	4	302	157	145	22.98	135.52	112.54	92.1	8.89	6.13	1.34	28
	5	312	151	161	22.95	133.31	110.36	93.4	7.28	4.52	-0.27	28
	Mean	304.40	152.00	152.40	22.93	135.03	112.10	92.94	7.92	5.21	0.42	-
	SD	14.24	13.44	9.40	0.04	5.44	5.44	0.50	0.69	0.58	0.58	-
	CI	12.48	11.78	8.24	0.04	4.77	4.77	0.44	0.61	0.51	0.51	-

APPENDIX 3 CONTAMINANT DATA IN FARMED OYSTERS

Table A 3.16 Raw Data Metals (mg/kg dry weight) - August 2024

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	14	370	0.30	1200
	2	14	360	0.32	1300
	3	14	440	0.34	1600
	4	14	440	0.34	1600
	5	13	330	0.30	1200
	Mean	**13.80**	**388.00**	**0.32**	**1380**
	SD	**0.45**	**49.70**	**0.02**	**204.94**
	CI	**0.39**	**43.56**	**0.02**	**179.64**
Karaka Point	1	12	310	0.34	1000
	2	14	270	0.53	1100
	3	14	320	0.50	1200
	4	13	350	0.32	1200
	5	14	340	0.55	1200
	Mean	**13.40**	**318.00**	**0.45**	**1140**
	SD	**0.89**	**31.14**	**0.11**	**89.44**
	CI	**0.78**	**27.30**	**0.10**	**78.40**
Te Toro Boat Ramp	1	13	300	0.24	1200
	2	12	340	0.28	1100
	3	13	400	0.30	1500
	4	13	400	0.32	1300
	5	13	350	0.27	1200
	Mean	**12.80**	**358.00**	**0.28**	**1260**
	SD	**0.45**	**42.66**	**0.03**	**151.66**
	CI	**0.39**	**37.39**	**0.03**	**132.93**
Te Toro Road Settlement	1	14	330	0.31	1200
	2	13	320	0.34	1100
	3	13	370	0.28	1300
	4	13	320	0.23	1200
	5	12	370	0.29	1200
	Mean	**13.00**	**342.00**	**0.29**	**1200**
	SD	**0.71**	**25.88**	**0.04**	**70.71**
	CI	**0.62**	**22.69**	**0.04**	**61.98**
Gordons Landing	1	13	470	0.24	1600
	2	13	320	0.20	1100
	3	12	410	0.20	1400
	4	12	330	0.21	1200
	5	11	330	0.20	1100
	Mean	**12.20**	**372.00**	**0.21**	**1280**
	SD	**0.84**	**65.73**	**0.02**	**216.79**
	CI	**0.73**	**57.61**	**0.02**	**190.03**

Table A 3.17 Raw Data Metals (mg/kg dry weight) - October 2024

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	13	150	0.17	1700
	2	15	120	0.21	1400
	3	13	340	0.26	1200
	4	14	360	0.39	1500
	5	14	130	0.21	1600
	Mean	**13.80**	**220**	**0.25**	**1480**
	SD	**0.84**	**119.37**	**0.09**	**192.35**
	CI	**0.73**	**104.64**	**0.07**	**168.61**
Karaka Point	1	14	310	0.38	1300
	2	11	290	0.30	1400
	3	11	420	0.33	1900
	4	11	280	0.35	1400
	5	13	330	0.32	1600
	Mean	**12**	**326**	**0.34**	**1520**
	SD	**1.41**	**55.95**	**0.03**	**238.75**
	CI	**1.24**	**49.04**	**0.03**	**209.27**
Te Toro Boat Ramp	1	13	310	0.22	1200
	2	12	350	0.23	1400
	3	11	250	0.25	1100
	4	14	350	0.24	1600
	5	13	370	0.22	1700
	Mean	**12.60**	**326**	**0.23**	**1400**
	SD	**1.14**	**47.75**	**0.01**	**254.95**
	CI	**1.00**	**41.85**	**0.01**	**223.47**
Te Toro Road Settlement	1	11	360	0.22	1200
	2	12	250	0.22	1400
	3	11	360	0.24	1600
	4	13	240	0.22	1300
	5	12	400	0.22	1600
	Mean	**11.80**	**322**	**0.22**	**1420**
	SD	**0.84**	**72.25**	**0.01**	**178.89**
	CI	**0.73**	**63.33**	**0.01**	**156.80**
Gordons Landing	1	13	470	0.27	1500
	2	13	480	0.28	1800
	3	12	520	0.27	1800
	4	11	610	0.28	1900
	5	12	500	0.24	1800
	Mean	**12.20**	**516.00**	**0.27**	**1760**
	SD	**0.84**	**55.95**	**0.02**	**151.66**
	CI	**0.73**	**49.04**	**0.01**	**132.93**

Table A 3.18 Raw Data Metals (mg/kg dry weight) - January 2025

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	9	290	0.23	1400
	2	12	320	0.36	1400
	3	13	330	0.31	1600
	4	13	380	0.33	1600
	5	14	410	0.30	1900
	Mean	**12.20**	**346**	**0.31**	**1580**
	SD	**1.92**	**48.27**	**0.05**	**204.94**
	CI	**1.69**	**42.31**	**0.04**	**179.64**
Karaka Point	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	Mean	-	-	-	-
	SD	-	-	-	-
	CI	-	-	-	-
Te Toro Boat Ramp	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	Mean	-	-	-	-
	SD	-	-	-	-
	CI	-	-	-	-
Te Toro Road Settlement	1	15	220	0.19	940
	2	11	370	0.21	1600
	3	14	350	0.24	1500
	4	14	440	0.25	1900
	5	15	280	0.19	1100
	Mean	**13.80**	**332**	**0.22**	**1408**
	SD	**1.64**	**84.68**	**0.03**	**387.71**
	CI	**1.44**	**74.22**	**0.02**	**339.84**
Gordons Landing	1	12	410	0.22	2000
	2	12	360	0.21	1500
	3	12	510	0.21	2000
	4	11	540	0.26	2300
	5	12	500	0.19	2000
	Mean	**11.80**	**464**	**0.22**	**1960**
	SD	**0.45**	**75.70**	**0.03**	**288.10**
	CI	**0.39**	**66.35**	**0.02**	**252.53**

Table A 3.19 Raw Data Metals (mg/kg dry weight) – March 2025

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	11	280	0.24	1500
	2	12	290	0.29	1800
	3	11	300	0.28	1600
	4	11	240	0.32	1300
	5	14	320	0.32	1800
	Mean	**11.80**	**286**	**0.29**	**1600**
	SD	**1.30**	**29.66**	**0.03**	**212.13**
	CI	**1.14**	**26.00**	**0.03**	**185.94**
Karaka Point	1	11	490	0.20	1800
	2	11	640	0.35	2200
	3	10	540	0.32	1900
	4	12	520	0.25	1700
	5	10	430	0.24	1700
	Mean	**10.80**	**524**	**0.27**	**1860**
	SD	**0.84**	**77.01**	**0.06**	**207.36**
	CI	**0.73**	**67.50**	**0.05**	**181.76**
Te Toro Boat Ramp	1	11	500	0.34	1700
	2	11	540	0.38	1800
	3	12	500	0.35	1700
	4	11	460	0.4	1600
	5	11	680	0.43	2600
	Mean	**11.20**	**536**	**0.38**	**1880**
	SD	**0.45**	**85.32**	**0.04**	**408.66**
	CI	**0.39**	**74.79**	**0.03**	**358.20**
Te Toro Road Settlement	1	9.8	430	0.23	2200
	2	11	630	0.19	2900
	3	10	430	0.18	2000
	4	9.9	360	0.19	1900
	5	11	590	0.19	2600
	Mean	**10.34**	**488**	**0.20**	**2320**
	SD	**0.61**	**115.84**	**0.02**	**420.71**
	CI	**0.53**	**101.54**	**0.02**	**368.77**
Gordons Landing	1	10	740	0.21	2800
	2	14	410	0.25	1900
	3	11	490	0.29	2500
	4	13	420	0.22	2200
	5	12	450	0.24	2400
	Mean	**12.00**	**502**	**0.24**	**2360**
	SD	**1.58**	**136.64**	**0.03**	**336.15**
	CI	**1.39**	**119.77**	**0.03**	**294.65**

Table A 3.20 Raw Data Metals (mg/kg dry weight) – May 2025

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	16	280	0.33	1100
	2	13	340	0.31	1200
	3	15	450	0.34	1800
	4	16	410	0.34	1400
	5	16	390	0.37	1600
	Mean	15.20	374	0.34	1420
	SD	1.30	65.80	0.02	286.36
	CI	1.14	57.68	0.02	251.00
Karaka Point	1	15	510	0.27	2000
	2	14	560	0.29	2400
	3	15	310	0.27	1800
	4	14	400	0.27	1700
	5	14	580	0.28	2300
	Mean	14.40	472	0.28	2040
	SD	0.55	114.32	0.01	304.96
	CI	0.48	100.21	0.01	267.31
Te Toro Boat Ramp	1	14	410	0.28	1900
	2	14	350	0.27	1400
	3	14	310	0.25	1300
	4	15	320	0.25	1500
	5	15	420	0.27	1900
	Mean	14.40	362	0.26	1600
	SD	0.55	50.70	0.01	282.84
	CI	0.48	44.44	0.01	247.92
Te Toro Road Settlement	1	16	410	0.29	1600
	2	16	410	0.26	1500
	3	16	470	0.32	1600
	4	14	540	0.25	2100
	5	15	520	0.28	1700
	Mean	15.40	470	0.28	1700
	SD	0.89	60.42	0.03	234.52
	CI	0.78	52.96	0.02	205.57
Gordons Landing	1	16	770	0.31	2700
	2	18	1000	0.36	3100
	3	16	950	0.35	2700
	4	17	900	0.32	2800
	5	17	1100	0.35	3300
	Mean	16.80	944	0.34	2920
	SD	0.84	122.19	0.02	268.33
	CI	0.73	107.10	0.02	235.20

Table A 3.21 Raw Data Metals (mg/kg dry weight) - August 2025

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	12	670	0.24	1900
	2	13	570	0.28	1700
	3	14	270	0.28	900
	4	13	650	0.30	1900
	5	13	900	0.25	2500
	Mean	13.00	612	0.27	1780
	SD	0.71	227.20	0.02	576.19
	CI	0.62	199.15	0.02	505.06
Karaka Point	1	14	460	0.18	1300
	2	14	430	0.20	1300
	3	15	290	0.20	940
	4	13	350	0.21	980
	5	14	460	0.21	1400
	Mean	14.00	398	0.20	1184
	SD	0.71	75.30	0.01	209.00
	CI	0.62	66.00	0.01	183.19
Te Toro Road Ramp	1	14	330	0.22	1000
	2	14	300	0.18	760
	3	15	290	0.18	860
	4	15	280	0.28	850
	5	14	330	0.21	960
	Mean	14.40	306	0.21	886
	SD	0.55	23.02	0.04	95.29
	CI	0.48	20.18	0.04	83.52
Te Toro Road Settlement	1	14	330	0.21	960
	2	14	620	0.26	1800
	3	14	470	0.25	1300
	4	14	460	0.22	1500
	5	12	590	0.28	2000
	Mean	13.60	494	0.24	1512
	SD	0.89	115.89	0.03	409.54
	CI	0.78	101.58	0.03	358.97
Gordons Landing	1	10	510	0.17	1700
	2	14	760	0.22	2200
	3	13	620	0.20	1600
	4	14	890	0.24	2500
	5	12	890	0.20	2600
	Mean	12.60	734	0.21	2120
	SD	1.67	167.72	0.03	454.97
	CI	1.47	147.01	0.02	398.80

Table A 3.22 Raw Data Metals (mg/kg dry weight) - October 2025

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	14	340	0.21	1100
	2	14	340	0.21	1200
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	Mean	**14**	**340**	**0.21**	**1150**
	SD	**0**	**0**	**0**	**71**
	CI	**0**	**0**	**0**	**98**
Karaka Point	1	16	330	0.21	1200
	2	14	210	0.18	940
	3	14	320	0.20	1300
	4	14	190	0.19	950
	5	15	340	0.20	1200
	Mean	**14.60**	**278**	**0.20**	**1118**
	SD	**0.89**	**72**	**0.01**	**163**
	CI	**0.78**	**63**	**0.01**	**143**
Te Toro Road Ramp	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	Mean	-	-	-	-
	SD	-	-	-	-
	CI	-	-	-	-
Te Toro Road Settlement	1	14	250	0.35	1000
	2	13	280	0.23	1100
	3	14	440	0.20	1700
	4	14	330	0.19	1100
	5	14	420	0.28	1400
	Mean	**13.80**	**344.00**	**0.25**	**1260**
	SD	**0.45**	**83.85**	**0.07**	**288.10**
	CI	**0.39**	**73.49**	**0.06**	**252.53**
Gordons Landing	1	15	340	0.20	1400
	2	13	280	0.20	1100
	3	14	340	0.62	1200
	4	14	390	0.19	1200
	5	13	240	0.16	770
	Mean	**13.80**	**318.00**	**0.27**	**1134**
	SD	**0.84**	**58.48**	**0.19**	**230.82**
	CI	**0.73**	**51.26**	**0.17**	**202.33**

Table A 3.23 Raw Data Metals (mg/kg dry weight) - December 2025

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	15	490	0.21	2100
	2	18	410	0.22	1600
	3	18	360	0.23	1500
	4	18	350	0.19	1300
	5	17	350	0.19	1500
	Mean	**17.20**	**392**	**0.21**	**1600**
	SD	**1.30**	**60.17**	**0.02**	**300**
	CI	**1.14**	**52.74**	**0.02**	**262.96**
Karaka Point	1	19	320	0.15	1400
	2	20	320	0.14	1300
	3	20	300	0.17	1200
	4	18	280	0.15	1300
	5	18	310	0.15	1200
	Mean	**19.00**	**306.00**	**0.15**	**1280.00**
	SD	**1.00**	**16.73**	**0.01**	**83.67**
	CI	**0.88**	**14.67**	**0.01**	**73.34**
Te Toro Road Ramp	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	-
	4	-	-	-	-
	5	-	-	-	-
	Mean	-	-	-	-
	SD	-	-	-	-
	CI	-	-	-	-
Te Toro Road Settlement	1	16	490	0.37	2100
	2	15	510	0.28	2300
	3	17	400	0.31	1900
	4	14	480	0.38	1900
	5	17	390	0.27	1800
	Mean	**15.80**	**454.00**	**0.32**	**2000.00**
	SD	**1.30**	**55.05**	**0.05**	**200.00**
	CI	**1.14**	**48.25**	**0.04**	**175.31**
Gordons Landing	1	15	430	0.25	1700
	2	15	390	0.19	1500
	3	15	430	0.21	1700
	4	15	410	0.22	1700
	5	14	410	0.22	1500
	Mean	**14.80**	**414.00**	**0.22**	**1620.00**
	SD	**0.45**	**16.73**	**0.02**	**109.54**
	CI	**0.39**	**14.67**	**0.02**	**96.02**

Table A 3.24 Raw Data Metals (mg/kg dry weight) – January 2026

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	15	370	0.30	1200
	2	15	560	0.27	1600
	3	15	650	0.31	2000
	4	16	550	0.33	1800
	5	17	610	0.28	2100
	Mean	**15.60**	**548.00**	**0.30**	**1740.00**
	SD	**0.89**	**107.33**	**0.02**	**357.77**
	CI	**0.78**	**94.08**	**0.02**	**313.60**
Karaka Point	1	18	460	0.26	1500
	2	16	490	0.29	1500
	3	17	440	0.27	1600
	4	14	330	0.25	1600
	5	15	300	0.29	1200
	Mean	**16.00**	**404.00**	**0.27**	**1480.00**
	SD	**1.58**	**83.85**	**0.02**	**164.32**
	CI	**1.39**	**73.49**	**0.02**	**144.03**
Te Toro Road Ramp	1	13	650	0.26	2100
	2	14	520	0.19	2000
	3	13	470	0.27	1600
	4	12	460	0.15	1500
	5	11	400	0.13	1400
	Mean	**12.60**	**500.00**	**0.20**	**1720.00**
	SD	**1.14**	**94.07**	**0.06**	**311.45**
	CI	**1.00**	**82.46**	**0.06**	**273.00**
Te Toro Road Settlement	1	12	410	0.22	1500
	2	11	390	0.19	1500
	3	13	370	0.21	1400
	4	12	310	0.26	1200
	5	13	330	0.22	1200
	Mean	**12.20**	**362.00**	**0.22**	**1360.00**
	SD	**0.84**	**41.47**	**0.03**	**151.66**
	CI	**0.73**	**36.35**	**0.02**	**132.93**
Gordons Landing	1	13	470	0.23	1700
	2	14	710	0.23	2300
	3	15	660	0.31	2300
	4	15	490	0.26	1600
	5	15	670	0.33	2300
	Mean	**14.40**	**600.00**	**0.27**	**2040.00**
	SD	**0.89**	**111.36**	**0.05**	**357.77**
	CI	**0.78**	**97.61**	**0.04**	**313.60**

Table A 3.25 Raw Data Metals (mg/kg dry weight) – March 2026

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	11	600	0.21	2100
	2	12	530	0.25	1800
	3	13	510	0.21	2000
	4	14	670	0.21	2000
	5	13	540	0.22	1900
	Mean	**12.60**	**570.00**	**0.22**	**1960.00**
	SD	**1.14**	**65.19**	**0.02**	**114.02**
	CI	**1.00**	**57.14**	**0.02**	**99.94**
Karaka Point	1	14	410	0.22	1300
	2	16	520	0.26	1800
	3	14	500	0.24	1800
	4	14	530	0.26	1900
	5	14	320	0.19	1200
	Mean	**14.40**	**456.00**	**0.23**	**1600.00**
	SD	**0.89**	**89.61**	**0.03**	**324.04**
	CI	**0.78**	**78.55**	**0.03**	**284.03**
Te Toro Road Ramp	1	14	730	0.21	2000
	2	12	560	0.21	1700
	3	13	560	0.18	1900
	4	12	600	0.27	2100
	5	11	620	0.23	2100
	Mean	**12.40**	**614.00**	**0.22**	**1960.00**
	SD	**1.14**	**69.86**	**0.03**	**167.33**
	CI	**1.00**	**61.23**	**0.03**	**146.67**
Te Toro Road Settlement	1	13	660	0.32	2500
	2	12	530	0.29	1800
	3	14	500	0.26	1700
	4	12	660	0.2	2100
	5	12	600	0.25	2400
	Mean	**12.60**	**590.00**	**0.26**	**2100.00**
	SD	**0.89**	**73.48**	**0.05**	**353.55**
	CI	**0.78**	**64.41**	**0.04**	**309.90**
Gordons Landing	1	12	520	0.25	1700
	2	13	630	0.23	2000
	3	13	610	0.26	1900
	4	13	760	0.25	2500
	5	14	390	0.6	1000
	Mean	**13.00**	**582.00**	**0.32**	**1820.00**
	SD	**0.71**	**137.37**	**0.16**	**544.98**
	CI	**0.62**	**120.41**	**0.14**	**477.69**

Table A 3.26 Raw Data Metals (mg/kg dry weight) – April 2026

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	15	820	0.35	2800
	2	13	580	0.31	1800
	3	14	650	0.34	2300
	4	15	480	0.28	1700
	5	15	740	0.29	2400
	Mean	**14.40**	**654**	**0.31**	**2200**
	SD	**0.89**	**132.97**	**0.03**	**452.77**
	CI	**0.78**	**116.55**	**0.03**	**396.87**
Karaka Point	1	13	580	0	1800
	2	12	560	0	1900
	3	16	660	0	2300
	4	14	590	0	1900
	5	13	530	0	1800
	Mean	**13.60**	**584**	**0.29**	**1940**
	SD	**1.52**	**48.27**	**0.05**	**207.36**
	CI	**1.33**	**42.31**	**0.05**	**181.76**
Te Toro Road Ramp	1	16	470	0	1700
	2	15	640	0	2100
	3	14	920	0	3100
	4	14	460	0	1500
	5	16	810	0	2600
	Mean	**15.00**	**660**	**0.29**	**2200**
	SD	**1.00**	**204.08**	**0.04**	**655.74**
	CI	**0.88**	**178.89**	**0.04**	**574.78**
Te Toro Road Settlement	1	14	480	0.24	1700
	2	14	550	0.23	1800
	3	13	440	0.25	1500
	4	14	430	0.23	1500
	5	13	530	0.32	2000
	Mean	**13.60**	**486**	**0.25**	**1700**
	SD	**0.55**	**53.20**	**0.04**	**212.13**
	CI	**0.48**	**46.63**	**0.03**	**185.94**
Gordons Landing	1	13	580	0.27	2000
	2	15	580	0.34	2600
	3	14	740	0.25	2500
	4	14	680	0.25	2400
	5	16	870	0.24	2700
	Mean	**14.40**	**690**	**0.27**	**2440**
	SD	**1.14**	**121.66**	**0.04**	**270.19**
	CI	**1.00**	**106.64**	**0.04**	**236.83**

Table A 3.27 Raw Data Metals (mg/kg dry weight) – May 2026

Site	Replicate	Arsenic	Copper	Lead	Zinc
Matakawau Headland	1	12	430	0.21	1400
	2	13	480	0.31	1800
	3	15	610	0.26	1700
	4	14	460	0.23	1400
	5	12	390	0.25	1500
	Mean	**13.20**	**474.00**	**0.25**	**1560.00**
	SD	**1.30**	**83.25**	**0.04**	**181.66**
	CI	**1.14**	**72.97**	**0.03**	**159.23**
Karaka Point	1	14	480	0.26	1700
	2	15	410	0.26	1400
	3	12	220	0.22	780
	4	13	520	0.32	1500
	5	14	440	0.24	1500
	Mean	**13.60**	**414.00**	**0.26**	**1376.00**
	SD	**1.14**	**116.10**	**0.04**	**350.54**
	CI	**1.00**	**101.77**	**0.03**	**307.26**
Te Toro Road Ramp	1	13	400	0.21	1500
	2	14	530	0.24	2000
	3	12	360	0.21	1300
	4	13	590	0.23	1800
	5	12	690	0.22	2500
	Mean	**12.80**	**514.00**	**0..22**	**1820.00**
	SD	**0.84**	**135.76**	**0.01**	**465.83**
	CI	**0.73**	**119.00**	**0.01**	**408.32**
Te Toro Road Settlement	1	12	320	0.20	1100
	2	13	430	0.20	1400
	3	13	500	0.26	1700
	4	13	420	0.27	1400
	5	12	510	0.25	1500
	Mean	**12.60**	**436.00**	**0.24**	**1420.00**
	SD	**0.55**	**76.35**	**0.03**	**216.79**
	CI	**0.48**	**66.93**	**0.03**	**190.03**
Gordons Landing	1	11	420	0.16	1400
	2	13	530	0.26	1800
	3	12	490	0.20	1500
	4	12	520	0.18	1700
	5	11	600	0.24	2000
	Mean	**11.80**	**512.00**	**0.21**	**1680.00**
	SD	**0.84**	**65.35**	**0.04**	**238.75**
	CI	**0.73**	**57.28**	**0.04**	**209.27**

Table A 3.28 Raw Data PAH (ng/g dry weight) - August 2024

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	<1.0	<1.0	<1.0	1.3	<2.0	<2.0	<4.0	<1.0	<4.0	2.2	2.2	<4.0	7.4	8.5	1.5
	2	1	<1.0	1	<1.0	<2.0	<2.0	<4.0	<1.0	<4.0	2.3	2.2	<4.0	9.1	8.2	1.6
	3	<1.0	<1.0	1.9	1.8	<2.0	<2.0	<4.0	<1.0	<4.0	2.9	3.1	<4.0	8.6	12.6	1.9
	4	<1.0	<1.0	1.3	1.7	<2.0	<2.0	<4.0	1	<4.0	2.5	2.5	<4.0	8.4	10.7	1.8
	5	<1.0	<1.0	1	1.8	<2.0	<2.0	<4.0	1.2	<4.0	2.2	2.3	<4.0	8.8	8.9	1.6
	Mean	**0.20**	**0.00**	**1.04**	**1.32**	**0.00**	**0.00**	**0.00**	**0.44**	**0.00**	**2.42**	**2.46**	**0.00**	**8.46**	**9.78**	**1.68**
	SD	**0.45**	**0.00**	**0.69**	**0.77**	**0.00**	**0.00**	**0.00**	**0.61**	**0.00**	**0.29**	**0.38**	**0.00**	**0.65**	**1.85**	**0.16**
	CI	**0.39**	**0.00**	**0.60**	**0.67**	**0.00**	**0.00**	**0.00**	**0.53**	**0.00**	**0.26**	**0.33**	**0.00**	**0.57**	**1.62**	**0.14**
Karaka Point	1	1.4	<1.0	1.2	1.5	<2.0	<2.0	<4.0	<1.0	<4.0	2	2.7	<4.0	9.6	10.7	1.4
	2	1	<1.0	1.3	<1.0	<2.0	<2.0	<4.0	<1.0	<4.0	2.5	2.3	<4.0	8.3	9.5	1.6
	3	<1.0	<1.0	1.1	1.8	<2.0	<2.0	<4.0	<1.0	<4.0	2.4	2	<4.0	10.1	7.2	1.3
	4	1	<1.0	1.4	1.7	<2.0	<2.0	<4.0	1	<4.0	2.9	2.5	<4.0	9.5	11.8	1.9
	5	2	<1.0	1.4	1.6	<2.0	<2.0	<4.0	<1.0	<4.0	2.6	2.4	<4.0	9	10.2	2
	Mean	**1.08**	**0.00**	**1.28**	**1.32**	**0.00**	**0.00**	**0.00**	**0.20**	**0.00**	**2.48**	**2.38**	**0.00**	**9.30**	**9.88**	**1.64**
	SD	**0.73**	**0.00**	**0.13**	**0.75**	**0.00**	**0.00**	**0.00**	**0.45**	**0.00**	**0.33**	**0.26**	**0.00**	**0.68**	**1.72**	**0.30**
	CI	**0.64**	**0.00**	**0.11**	**0.65**	**0.00**	**0.00**	**0.00**	**0.39**	**0.00**	**0.29**	**0.23**	**0.00**	**0.60**	**1.50**	**0.27**
Te Toro Boat Ramp	1	1.5	<1.0	1.3	1.9	<2.0	<2.0	<4.0	<1.0	<4.0	2.9	2.2	<4.0	9	11.3	2.2
	2	1.8	<1.0	1	2.2	<2.0	<2.0	<4.0	<1.0	<4.0	2.2	2.2	<4.0	10.1	9	1.7
	3	1.4	<1.0	1.7	2	<2.0	<2.0	<4.0	<1.0	<4.0	2.9	2.7	<4.0	9.3	13.3	2.4
	4	1.3	<1.0	<1.0	1.6	<2.0	<2.0	<4.0	<1.0	<4.0	2.5	1.9	<4.0	8.5	8.7	1.9
	5	<1.0	<1.0	1.4	1.6	<2.0	<2.0	<4.0	1	<4.0	3.2	2.5	<4.0	9.9	12.1	2.3
	Mean	**1.20**	**0.00**	**1.08**	**1.86**	**0.00**	**0.00**	**0.00**	**0.20**	**0.00**	**2.74**	**2.30**	**0.00**	**9.36**	**10.88**	**2.10**
	SD	**0.70**	**0.00**	**0.65**	**0.26**	**0.00**	**0.00**	**0.00**	**0.45**	**0.00**	**0.39**	**0.31**	**0.00**	**0.65**	**1.99**	**0.29**
	CI	**0.61**	**0.00**	**0.57**	**0.23**	**0.00**	**0.00**	**0.00**	**0.39**	**0.00**	**0.34**	**0.27**	**0.00**	**0.57**	**1.74**	**0.26**
Te Toro Road Settlement	1	1.3	<1.0	1.6	1.7	<2.0	<2.0	<4.0	1	<4.0	2.8	2.9	<4.0	9.6	14	2.1
	2	1.1	<1.0	<1.0	1.4	<2.0	<2.0	<4.0	<1.0	<4.0	2.1	1.7	<4.0	8.9	7.1	1.5
	3	1.2	<1.0	<1.0	1.6	<2.0	<2.0	<4.0	<1.0	<4.0	2.1	1.5	<4.0	9.6	5.7	1.4
	4	<1.0	<1.0	<1.0	1.3	<2.0	<2.0	<4.0	<1.0	<4.0	2.5	1.7	<4.0	10.2	6.2	1.5
	5	1.2	<1.0	1.1	1.6	<2.0	<2.0	<4.0	<1.0	<4.0	2.2	2.2	<4.0	9.4	10.1	1.5
	Mean	**0.96**	**0.00**	**0.54**	**1.52**	**0.00**	**0.00**	**0.00**	**0.20**	**0.00**	**2.34**	**2.00**	**0.00**	**9.54**	**8.62**	**1.60**
	SD	**0.54**	**0.00**	**0.76**	**0.16**	**0.00**	**0.00**	**0.00**	**0.45**	**0.00**	**0.30**	**0.57**	**0.00**	**0.47**	**3.46**	**0.28**
	CI	**0.47**	**0.00**	**0.67**	**0.14**	**0.00**	**0.00**	**0.00**	**0.39**	**0.00**	**0.27**	**0.50**	**0.00**	**0.41**	**3.03**	**0.25**
Gordons Landing	1	<1.0	<1.0	<1.0	1.5	<2.0	<2.0	<4.0	1.2	<4.0	3.3	1.9	<4.0	10.1	8.1	2.1
	2	1.3	<1.0	<1.0	<1.0	<2.0	<2.0	<4.0	<1.0	<4.0	2.3	1.7	<4.0	9.4	7.6	1.6
	3	1.3	<1.0	<1.0	1.4	<2.0	<2.0	<4.0	<1.0	<4.0	2.5	1.8	<4.0	10	8.2	1.9
	4	1.1	<1.0	1.6	2.4	<2.0	3.6	<4.0	3.6	<4.0	3	2.4	<4.0	9.1	11.6	2.9
	5	<1.0	<1.0	1.1	1.4	<2.0	<2.0	<4.0	<1.0	<4.0	2.2	1.8	<4.0	9.4	7.7	1.9
	Mean	**0.74**	**0.00**	**0.54**	**1.34**	**0.00**	**0.72**	**0.00**	**0.96**	**0.00**	**2.66**	**1.92**	**0.00**	**9.60**	**8.64**	**2.08**
	SD	**0.68**	**0.00**	**0.76**	**0.86**	**0.00**	**1.61**	**0.00**	**1.56**	**0.00**	**0.47**	**0.28**	**0.00**	**0.43**	**1.67**	**0.49**
	CI	**0.60**	**0.00**	**0.67**	**0.75**	**0.00**	**1.41**	**0.00**	**1.37**	**0.00**	**0.41**	**0.24**	**0.00**	**0.38**	**1.47**	**0.43**

Table A 3.29 Raw Data PAH (ng/g dry weight) - October 2024

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	0.33	0.49	1.82	0.46	0.32	0.4	<1	0.74	<1	2.58	1.45	<1	2.23	6.8	2.87
	2	0.45	0.35	1.2	0.43	0.32	0.47	<1	0.82	<1	2.96	1.72	<1	2.68	8.16	3.42
	3	0.36	0.31	1.24	0.84	0.33	0.23	<1	0.64	<1	1.58	1.25	<1	2.58	4.79	1.55
	4	0.28	0.14	0.28	0.27	<1	0.19	<1	0.46	<1	0.8	0.74	<1	2.66	1.59	0.43
	5	0.26	0.14	0.44	0.29	<1	0.42	<1	0.49	<1	0.79	0.98	<1	4.23	1.55	0.55
	Mean	**0.34**	**0.29**	**1.00**	**0.46**	**0.19**	**0.34**	**0.00**	**0.63**	**0.00**	**1.74**	**1.23**	**0.00**	**2.88**	**4.58**	**1.76**
	SD	**0.08**	**0.15**	**0.63**	**0.23**	**0.18**	**0.12**	**0.00**	**0.16**	**0.00**	**1.00**	**0.38**	**0.00**	**0.78**	**3.00**	**1.35**
	CI	**0.07**	**0.13**	**0.55**	**0.20**	**0.16**	**0.11**	**0.00**	**0.14**	**0.00**	**0.88**	**0.34**	**0.00**	**0.68**	**2.63**	**1.18**
Karaka Point	1	0.36	0.47	0.75	0.7	0.38	0.47	<1	0.68	<1	1.8	1.39	<1	2.74	5.74	1.81
	2	0.48	0.28	0.88	0.92	0.36	0.39	<1	0.63	<1	2.44	1.51	<1	3.38	7.47	2.81
	3	0.41	0.44	0.89	0.98	0.23	0.49	<1	0.6	<1	2.25	1.26	<1	2.37	5.94	2.67
	4	0.33	0.35	0.52	0.92	0.43	0.54	<1	0.67	<1	1.55	1.03	<1	2.28	4.44	1.5
	5	0.54	0.69	0.66	1.03	0.37	0.38	<1	0.5	<1	1.69	1.67	<1	2.73	6.4	1.69
	Mean	**0.42**	**0.45**	**0.74**	**0.91**	**0.35**	**0.45**	**0.00**	**0.62**	**0.00**	**1.95**	**1.37**	**0.00**	**2.70**	**6.00**	**2.10**
	SD	**0.09**	**0.16**	**0.16**	**0.13**	**0.07**	**0.07**	**0.00**	**0.07**	**0.00**	**0.38**	**0.24**	**0.00**	**0.43**	**1.10**	**0.60**
	CI	**0.08**	**0.14**	**0.14**	**0.11**	**0.07**	**0.06**	**0.00**	**0.06**	**0.00**	**0.33**	**0.21**	**0.00**	**0.38**	**0.96**	**0.53**
Te Toro Boat Ramp	1	0.44	0.37	1.06	0.43	0.38	0.48	<1	0.58	<1	2.74	1.56	<1	3.25	8.18	3.22
	2	0.43	0.54	0.87	0.88	0.38	0.46	<1	0.72	<1	2.14	1.4	<1	3.88	6.59	2.09
	3	0.32	0.29	0.69	0.82	0.31	0.35	<1	0.48	<1	1.47	1.02	<1	2.9	4.88	1.58
	4	0.42	0.42	0.81	0.48	0.42	0.49	<1	0.58	<1	1.79	1.39	<1	3.5	6.11	1.84
	5	0.4	0.54	0.66	1.04	0.33	0.45	<1	0.71	<1	2.73	1.32	<1	3.51	7.05	2.9
	Mean	**0.40**	**0.43**	**0.82**	**0.73**	**0.36**	**0.45**	**0.00**	**0.61**	**0.00**	**2.17**	**1.34**	**0.00**	**3.41**	**6.56**	**2.33**
	SD	**0.05**	**0.11**	**0.16**	**0.26**	**0.04**	**0.06**	**0.00**	**0.10**	**0.00**	**0.56**	**0.20**	**0.00**	**0.36**	**1.21**	**0.70**
	CI	**0.04**	**0.10**	**0.14**	**0.23**	**0.04**	**0.05**	**0.00**	**0.09**	**0.00**	**0.49**	**0.17**	**0.00**	**0.32**	**1.06**	**0.62**
Te Toro Road Settlement	1	0.43	0.33	1.49	0.9	0.4	0.38	<1	0.64	<1	2.78	1.59	<1	3.87	8.91	3.32
	2	0.42	0.34	1	1.19	0.39	0.37	<1	0.51	<1	2.08	1.24	<1	3.34	5.98	2.34
	3	0.36	0.28	1.32	1.01	0.37	0.39	<1	0.7	<1	2.92	1.83	<1	4.18	9.82	3.31
	4	0.54	0.65	1.32	1.02	0.4	0.46	<1	0.68	<1	3.25	2.04	<1	4.47	11.32	3.29
	5	1.16	0.4	1.64	1.06	0.2	0.36	<1	0.68	<1	3.21	2.23	<1	4.64	12.18	4.01
	Mean	**0.58**	**0.40**	**1.35**	**1.04**	**0.35**	**0.39**	**0.00**	**0.64**	**0.00**	**2.85**	**1.79**	**0.00**	**4.10**	**9.64**	**3.25**
	SD	**0.33**	**0.15**	**0.24**	**0.10**	**0.09**	**0.04**	**0.00**	**0.08**	**0.00**	**0.47**	**0.39**	**0.00**	**0.52**	**2.41**	**0.59**
	CI	**0.29**	**0.13**	**0.21**	**0.09**	**0.08**	**0.03**	**0.00**	**0.07**	**0.00**	**0.41**	**0.34**	**0.00**	**0.45**	**2.11**	**0.52**
Gordons Landing	1	0.65	0.45	0.78	0.86	0.44	0.64	<1	0.75	<1	2.42	1.96	<1	3.38	9.26	2.72
	2	0.64	0.86	1.67	1.61	0.68	0.92	<1	1.01	<1	4.19	2.44	<1	3.73	13.37	4.66
	3	0.53	0.63	1.22	0.92	0.56	1.54	<1	0.93	<1	3.7	2.05	<1	3.99	12.91	4.5
	4	0.46	0.42	1.42	0.64	0.31	1	<1	0.64	<1	2.78	1.75	<1	3.31	9.43	2.86
	5	0.6	0.98	1.65	1.76	0.52	0.58	<1	0.86	<1	3.31	1.97	<1	3.33	10.7	4.21
	Mean	**0.58**	**0.67**	**1.35**	**1.16**	**0.50**	**0.94**	**0.00**	**0.84**	**0.00**	**3.28**	**2.03**	**0.00**	**3.55**	**11.13**	**3.79**
	SD	**0.08**	**0.25**	**0.37**	**0.50**	**0.14**	**0.38**	**0.00**	**0.15**	**0.00**	**0.71**	**0.25**	**0.00**	**0.30**	**1.92**	**0.93**
	CI	**0.07**	**0.22**	**0.32**	**0.43**	**0.12**	**0.33**	**0.00**	**0.13**	**0.00**	**0.62**	**0.22**	**0.00**	**0.26**	**1.68**	**0.81**

Table A 3.30 Raw Data PAH (ng/g dry weight) - January 2025

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	<0.2	<0.2	<0.2	0.67	0.39	0.81	<1	<0.2	<1	1.73	1.27	<1	2.78	1.38	2.24
	2	<0.2	0.56	0.89	0.7	< 0.2	0.58	<1	1.16	<1	2.12	1.48	<1	5.53	1.4	2.04
	3	0.62	0.44	0.84	0.62	0.55	0.65	<1	0.63	<1	2.96	1.81	<1	13.96	1.93	2.65
	4	0.68	0.51	0.6	0.64	0.6	0.74	<1	0.73	<1	2.81	1.81	<1	9.21	2.18	2.38
	5	<0.2	<0.2	0.33	0.8	0.53	0.78	<1	0.55	<1	2.44	1.38	<1	6.22	1.02	2.15
	Mean	**0.26**	**0.30**	**0.53**	**0.69**	**0.41**	**0.71**	**0.00**	**0.61**	**0.00**	**2.41**	**1.55**	**0.00**	**7.54**	**1.58**	**2.29**
	SD	**0.36**	**0.28**	**0.37**	**0.07**	**0.24**	**0.10**	**0.00**	**0.42**	**0.00**	**0.50**	**0.25**	**0.00**	**4.26**	**0.47**	**0.24**
	CI	**0.31**	**0.24**	**0.33**	**0.06**	**0.21**	**0.08**	**0.00**	**0.36**	**0.00**	**0.44**	**0.22**	**0.00**	**3.73**	**0.41**	**0.21**
Karaka Point	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Te Toro Boat Ramp	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Te Toro Road Settlement	1	<0.2	0.5	0.48	0.7	0.5	0.46	<1	0.69	<1	2.72	1.26	<1	3.71	1.31	2.3
	2	0.59	0.23	0.59	0.57	0.48	0.22	<1	0.49	<1	2.88	1.71	<1	6.53	1.86	2.34
	3	<0.2	0.38	1.03	<0.2	<0.2	0.37	<1	0.6	<1	3.61	2.17	<1	17.5	2.98	2.65
	4	<0.2	0.49	0.75	0.61	0.65	0.43	<1	0.87	<1	3.22	1.71	<1	9.97	2.1	2.83
	5	<0.2	< 0.2	0.91	0.67	< 0.2	0.37	<1	0.74	<1	2.5	1.91	<1	7.96	3.42	1.89
	Mean	**0.12**	**0.32**	**0.75**	**0.51**	**0.33**	**0.37**	**0.00**	**0.68**	**0.00**	**2.99**	**1.75**	**0.00**	**9.13**	**2.33**	**2.40**
	SD	**0.26**	**0.21**	**0.22**	**0.29**	**0.30**	**0.09**	**0.00**	**0.14**	**0.00**	**0.44**	**0.33**	**0.00**	**5.20**	**0.86**	**0.36**
	CI	**0.23**	**0.18**	**0.20**	**0.25**	**0.27**	**0.08**	**0.00**	**0.13**	**0.00**	**0.38**	**0.29**	**0.00**	**4.56**	**0.75**	**0.32**
Gordons Landing	1	<0.2	0.32	0.93	0.46	1.15	0.89	<1	1.54	<1	3.77	1.47	<1	4.96	2.1	2.8
	2	<0.2	0.37	0.67	0.67	0.59	0.43	<1	0.89	<1	2.44	1.77	<1	6.29	1.41	2.01
	3	<0.2	0.22	0.68	0.63	0.65	0.64	<1	0.69	<1	2.66	1.66	<1	4.48	1.74	2.25
	4	<0.2	0.55	1.11	<0.2	0.88	0.58	<1	1.45	<1	3.39	2.12	<1	11.08	1.54	2.55
	5	0.59	0.53	0.63	<0.2	0.89	0.47	<1	0.94	<1	2.97	1.96	<1	4.02	2.25	2.24
	Mean	**0.12**	**0.40**	**0.80**	**0.35**	**0.83**	**0.60**	**0.00**	**1.10**	**0.00**	**3.05**	**1.80**	**0.00**	**6.17**	**1.81**	**2.37**
	SD	**0.26**	**0.14**	**0.21**	**0.33**	**0.22**	**0.18**	**0.00**	**0.37**	**0.00**	**0.54**	**0.25**	**0.00**	**2.88**	**0.36**	**0.31**
	CI	**0.23**	**0.12**	**0.18**	**0.29**	**0.20**	**0.16**	**0.00**	**0.33**	**0.00**	**0.47**	**0.22**	**0.00**	**2.52**	**0.31**	**0.27**

Table A 3.31 Raw Data PAH (ng/g dry weight) - March 2025

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	<0.2	<0.2	<0.2	< 0.2	< 0.2	< 0.2	<1	<1	<0.2	2.89	1.38	<1	8.95	4.28	2.28
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	6.14	2.12	<1	18.74	7.07	5.43
	3	<0.2	<0.2	< 0.2	< 0.2	< 0.2	< 0.2	<1	<1	< 0.2	2.09	1.14	<1	10.81	4.63	1.65
	4	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	<0.2	<1	<1	<0.2	2.14	<0.2	<1	10.81	4.63	1.65
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	2.3	1.4	<1	11.79	4.53	1.8
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.11**	**1.21**	**0.00**	**12.22**	**5.03**	**2.56**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.72**	**0.77**	**0.00**	**3.79**	**1.15**	**1.62**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.51**	**0.67**	**0.00**	**3.32**	**1.01**	**1.42**
Karaka Point	1	<0.2	<0.2	<0.2	< 0.2	<0.2	< 0.2	<1	<1	< 0.2	2.81	2.14	<1	15.42	5.74	2.41
	2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	<1	<1	<0.2	2.19	1.87	<1	12.26	5.28	2.38
	3	< 0.2	< 0.2	< 0.2	< 0.2	<0.2	< 0.2	<1	<1	< 0.2	3.01	1.47	<1	14.94	4.9	2.61
	4	< 0.2	< 0.2	<0.2	< 0.2	< 0.2	< 0.2	<1	<1	<0.2	3.25	1.78	<1	14.36	5.98	2.93
	5	< 0.2	<0.2	< 0.2	< 0.2	< 0.2	<0.2	<1	<1	<0.2	2.7	1.78	<1	13.73	5.77	2.24
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.79**	**1.81**	**0.00**	**14.14**	**5.53**	**2.51**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.40**	**0.24**	**0.00**	**1.23**	**0.44**	**0.27**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.35**	**0.21**	**0.00**	**1.08**	**0.38**	**0.23**
Te Toro Boat Ramp	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	2.95	2.19	<1	19.32	5.32	2.28
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	2.48	1.68	<1	16.54	4.35	2.17
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	3.79	1.56	<1	16.91	3.79	3.36
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	3.71	0.21	<1	17.27	2.41	2.08
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	3.25	4.48	<1	8.61	9.77	1.86
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.24**	**2.02**	**0.00**	**15.73**	**5.13**	**2.35**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.54**	**1.56**	**0.00**	**4.12**	**2.80**	**0.59**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.48**	**1.36**	**0.00**	**3.61**	**2.45**	**0.51**
Te Toro Road Settlement	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	4.18	<0.2	<1	0.24	3.62	2.43
	2	4.66	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	3.01	8.09	<1	12.38	12.44	1.66
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	3.8	<0.2	<1	7.1	2.23	1.85
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	2.5	<0.2	<1	3.95	0.97	1.27
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	2.64	<0.2	<1	2.1	2.45	1.28
	Mean	**0.93**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.23**	**1.62**	**0.00**	**5.15**	**4.34**	**1.70**
	SD	**2.08**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.73**	**3.62**	**0.00**	**4.77**	**4.62**	**0.48**
	CI	**1.83**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.64**	**3.17**	**0.00**	**4.18**	**4.05**	**0.42**
Gordons Landing	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	3.32	<0.2	<1	1.11	2.09	1.51
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	2.88	<0.2	<1	2.31	1.97	1.55
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	2.41	<0.2	<1	2.43	2.14	1.51
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<1	<0.2	2.65	<0.2	<1	2.99	1.98	1.62
	5	2.39	<0.2	<0.2	2.058	<0.2	<0.2	<1	<1	<0.2	1.52	3.83	<1	4.51	4.8	0.66
	Mean	**0.48**	**0.00**	**0.00**	**0.41**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.56**	**0.77**	**0.00**	**2.67**	**2.60**	**1.37**
	SD	**1.07**	**0.00**	**0.00**	**0.92**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.67**	**1.71**	**0.00**	**1.24**	**1.23**	**0.40**
	CI	**0.94**	**0.00**	**0.00**	**0.81**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.59**	**1.50**	**0.00**	**1.08**	**1.08**	**0.35**

Table A 3.32 Raw Data PAH (ng/g dry weight) - May 2025

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	<0.2	0.4	<0.2	0.9	<0.2	1.3	2.4	1.7	1.7	3.4	1.1	<1.0	8.7	3.9	2.1
	2	<0.2	<0.2	<0.2	0.6	<0.2	0.8	1.9	1.2	1.2	2.4	1	<1.0	6.7	3.4	1.5
	3	<0.2	0.5	<0.2	1.3	<0.2	1.8	2.3	2.9	2.1	4.9	1.8	1.3	17	7.4	3.1
	4	<0.2	<0.2	<0.2	0.8	<0.2	1.2	1.8	1.3	1.4	3.5	1	<1.0	11	4.7	1.9
	5	<0.2	<0.2	<0.2	0.6	<0.2	0.5	<1.0	0.6	<1.0	2	0.9	<1.0	7	2.9	1.1
	Mean	**0.00**	**0.18**	**0.00**	**0.84**	**0.00**	**1.12**	**1.68**	**1.54**	**1.28**	**3.24**	**1.16**	**0.26**	**10.08**	**4.46**	**1.94**
	SD	**0.00**	**0.25**	**0.00**	**0.29**	**0.00**	**0.50**	**0.97**	**0.86**	**0.79**	**1.13**	**0.36**	**0.58**	**4.23**	**1.77**	**0.75**
	CI	**0.00**	**0.22**	**0.00**	**0.25**	**0.00**	**0.44**	**0.85**	**0.75**	**0.69**	**0.99**	**0.32**	**0.51**	**3.71**	**1.55**	**0.66**
Karaka Point	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Te Toro Boat Ramp	1	<0.2	0.7	<0.2	0.8	0.8	1	1	1.8	<1.0	7.7	1.5	<1.0	9.9	8.6	4.3
	2	<0.2	0.4	<0.2	0.7	0.5	0.7	<1.0	1.2	<1.0	5.5	1.2	<1.0	8.6	6	3.1
	3	<0.2	0.4	<0.2	0.6	0.9	0.9	<1.0	1.3	<1.0	8	1.3	<1.0	10	7.9	4
	4	<0.2	0.5	<0.2	1.9	1.9	1.9	1.4	2.6	1	13	2.3	<1.0	16	13	6
	5	<0.2	<0.2	<0.2	0.4	0.4	0.6	<1.0	0.7	<1.0	3.2	1.1	<1.0	10	3.9	1.9
	Mean	**0.00**	**0.40**	**0.00**	**0.88**	**0.90**	**1.02**	**0.48**	**1.52**	**0.20**	**7.48**	**1.48**	**0.00**	**10.90**	**7.88**	**3.86**
	SD	**0.00**	**0.25**	**0.00**	**0.59**	**0.60**	**0.52**	**0.67**	**0.72**	**0.45**	**3.64**	**0.48**	**0.00**	**2.91**	**3.40**	**1.52**
	CI	**0.00**	**0.22**	**0.00**	**0.52**	**0.52**	**0.45**	**0.59**	**0.63**	**0.39**	**3.19**	**0.42**	**0.00**	**2.55**	**2.98**	**1.33**
Te Toro Road Settlement	1	<0.2	<0.2	<0.2	0.7	0.8	1	<1.0	1.7	<1.0	9.1	2.7	<1.0	15	10	4.6
	2	<0.2	0.4	<0.2	0.5	<0.2	0.6	<1.0	0.9	<1.0	4.5	1.4	<1.0	10	5.7	2.5
	3	<0.2	<0.2	<0.2	0.8	0.5	0.6	<1.0	1.1	<1.0	7.2	1.1	<1.0	14	7.2	3.4
	4	<0.2	0.2	<0.2	0.6	<0.2	0.4	<1.0	0.5	<1.0	3.2	0.8	<1.0	5.9	3.4	1.7
	5	<0.2	<0.2	<0.2	2.4	<0.2	1.8	<1.0	2.9	1.6	10	2.8	<1.0	18	12	5.3
	Mean	**0.00**	**0.12**	**0.00**	**1.00**	**0.26**	**0.88**	**0.00**	**1.42**	**0.32**	**6.80**	**1.76**	**0.00**	**12.58**	**7.66**	**3.50**
	SD	**0.00**	**0.18**	**0.00**	**0.79**	**0.37**	**0.56**	**0.00**	**0.93**	**0.72**	**2.91**	**0.93**	**0.00**	**4.70**	**3.41**	**1.47**
	CI	**0.00**	**0.16**	**0.00**	**0.69**	**0.33**	**0.49**	**0.00**	**0.82**	**0.63**	**2.55**	**0.81**	**0.00**	**4.12**	**2.99**	**1.29**
Gordons Landing	1	<0.2	<0.2	<0.2	0.5	<0.2	0.9	<1.0	0.7	<1.0	3.5	1.4	<1.0	8.5	5.1	2.2
	2	<0.2	<0.2	<0.2	1.1	<0.2	1.2	<1.0	1.2	<1.0	4.6	1.7	<1.0	9.7	5.3	2.9
	3	<0.2	<0.2	<0.2	1.2	<0.2	0.7	<1.0	0.5	<1.0	2.9	1	<1.0	6.9	3	1.7
	4	<0.2	<0.2	<0.2	0.8	<0.2	1.3	<1.0	1.3	<1.0	5.2	1.2	<1.0	8.7	5.2	3.4
	5	<0.2	<0.2	<0.2	0.6	<0.2	0.7	<1.0	0.6	<1.0	3.3	1.1	<1.0	7.4	4.2	2.2
	Mean	**0.00**	**0.00**	**0.00**	**0.84**	**0.00**	**0.96**	**0.00**	**0.86**	**0.00**	**3.90**	**1.28**	**0.00**	**8.24**	**4.56**	**2.48**
	SD	**0.00**	**0.00**	**0.00**	**0.30**	**0.00**	**0.28**	**0.00**	**0.36**	**0.00**	**0.96**	**0.28**	**0.00**	**1.11**	**0.98**	**0.67**
	CI	**0.00**	**0.00**	**0.00**	**0.27**	**0.00**	**0.24**	**0.00**	**0.32**	**0.00**	**0.84**	**0.24**	**0.00**	**0.97**	**0.86**	**0.59**

Table A 3.33 Raw Data PAH (ng/g dry weight) - August 2025

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	9.4	2.4	<1.0	10	14	5
	2	<0.2	1.7	2.6	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	9.8	3.2	<1.0	11	15	6.3
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	7.3	1.7	<1.1	8	11	4.4
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	6.8	2.3	<1.1	8.4	11	3.8
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	7.3	2	<1.0	13	12	4.3
	Mean	0.00	0.34	0.52	0.00	0.00	0.00	0.00	0.00	0.00	8.12	2.32	0.00	10.08	12.60	4.76
	SD	0.00	0.76	1.16	0.00	0.00	0.00	0.00	0.00	0.00	1.37	0.56	0.00	2.03	1.82	0.96
	CI	0.00	0.67	1.02	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.49	0.00	1.78	1.59	0.84
Karaka Point	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	16	2.8	<1.0	13	26	8.9
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	17	3.1	<1.0	16	30	8.6
	3	<0.2	1	<0.2	<0.2	1.5	<0.4	<1.0	<0.2	<1.0	19	3.3	<1.0	22	34	10
	4	<0.2	1.6	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	16	3.3	<1.0	22	27	8.5
	5	<0.2	<0.2	<0.2	<0.2	1.3	<0.4	<1.0	<0.2	<1.0	16	3	<1.0	18	28	9.6
	Mean	0.00	0.52	0.00	0.00	0.56	0.00	0.00	0.00	0.00	16.80	3.10	0.00	18.20	29.00	9.12
	SD	0.00	0.74	0.00	0.00	0.77	0.00	0.00	0.00	0.00	1.30	0.21	0.00	3.90	3.16	0.65
	CI	0.00	0.65	0.00	0.00	0.67	0.00	0.00	0.00	0.00	1.14	0.19	0.00	3.42	2.77	0.57
Te Toro Road Ramp	1	<0.2	1.1	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	23	3.9	<1.0	21	42	15
	2	<0.2	<0.2	<0.2	<0.2	1.7	<0.4	<1.0	<0.2	<1.0	24	3.9	<1.0	28	42	14
	3	<0.2	2	<0.2	<0.2	1.9	<0.4	<1.0	<0.2	<1.0	26	4.2	<1.0	29	49	16
	4	<0.2	2	<0.2	<0.2	2.5	<0.4	<1.0	<0.2	<1.0	27	3.8	<1.0	26	47	16
	5	<0.2	1.3	<0.2	<0.2	2.9	<0.4	<1.0	<0.2	<1.0	26	4.2	<1.0	32	45	16
	Mean	0.00	1.28	0.00	0.00	1.80	0.00	0.00	0.00	0.00	25.20	4.00	0.00	27.20	45.00	15.40
	SD	0.00	0.82	0.00	0.00	1.11	0.00	0.00	0.00	0.00	1.64	0.19	0.00	4.09	3.08	0.89
	CI	0.00	0.72	0.00	0.00	0.98	0.00	0.00	0.00	0.00	1.44	0.16	0.00	3.58	2.70	0.78
Te Toro Road Settlement	1	<0.2	<0.2	<0.2	<0.2	1.6	<0.4	<1.0	<0.2	<1.0	18	3.4	<1.0	26	34	12
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	18	3.6	<1.0	29	31	10
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	18	3	<1.0	22	32	12
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	21	3.4	<1.0	27	33	12
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	16	3	<1.1	27	24	9.4
	Mean	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	18.20	3.28	0.00	26.20	30.80	11.08
	SD	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.00	1.79	0.27	0.00	2.59	3.96	1.28
	CI	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.00	1.57	0.24	0.00	2.27	3.47	1.12
Gordons Landing	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	16	2.5	<1.0	12	27	11
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	18	3.5	<1.0	17	33	11
	3	<0.2	<0.2	<0.2	<0.2	1.9	<0.4	<1.0	<0.2	<1.0	25	4.1	<1.0	21	48	15
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	19	3.2	<1.1	18	32	12
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	20	2.1	<1.0	16	29	12
	Mean	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	19.60	3.08	0.00	16.80	33.80	12.20
	SD	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.00	3.36	0.79	0.00	3.27	8.29	1.64
	CI	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.00	2.95	0.70	0.00	2.87	7.27	1.44

Table A 3.34 Raw Data PAH (ng/g dry weight) - October 2025

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	<0.2	<0.2	<0.2	3.1	<0.2	<0.4	<1.0	2.4	<1.0	<0.2	1.3	<1.0	6.6	5	<0.2
	2	<0.2	<0.2	<0.2	4.3	<0.2	<0.4	<1.0	1.9	<1.0	<0.2	1.5	<1.0	8.8	3.8	<0.2
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	0.00	0.00	0.00	1.48	0.00	0.00	0.00	0.86	0.00	0.00	0.56	0.00	3.08	1.76	0.00
	SD	0.00	0.00	0.00	2.07	0.00	0.00	0.00	1.19	0.00	0.00	0.77	0.00	4.29	2.45	0.00
	CI	0.00	0.00	0.00	1.81	0.00	0.00	0.00	1.04	0.00	0.00	0.67	0.00	3.76	2.14	0.00
Karaka Point	1	<0.2	<0.2	<0.2	3.4	<0.2	<0.4	<1.0	2.3	<1.0	2.5	1.5	<1.0	11	7.9	<0.2
	2	<0.2	<0.2	<0.2	5.7	<0.2	<0.4	<1.0	2	<1.0	3	1.5	<1.0	8.6	8	<0.2
	3	<0.2	<0.2	<0.2	8.6	<0.2	<0.4	<1.0	2.5	<1.0	4.2	2.1	<1.0	14	11	5.2
	4	<0.2	<0.2	<0.2	6.2	<0.2	<0.4	<1.0	1.7	<1.0	3.8	1.8	<1.0	15	9.5	3.7
	5	<0.2	<0.2	<0.2	5.3	<0.2	<0.4	<1.0	1.5	<1.0	<0.2	1.7	<1.0	11	8.9	4.4
	Mean	0.00	0.00	0.00	5.84	0.00	0.00	0.00	2.00	0.00	2.70	1.72	0.00	11.92	9.06	2.66
	SD	0.00	0.00	0.00	1.87	0.00	0.00	0.00	0.41	0.00	1.65	0.25	0.00	2.58	1.27	2.49
	CI	0.00	0.00	0.00	1.64	0.00	0.00	0.00	0.36	0.00	1.45	0.22	0.00	2.26	1.11	2.18
Te Toro Road Ramp	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Te Toro Road Settlement	1	<0.2	<0.2	<0.2	4.4	<0.2	<0.4	<1.0	2.2	<1.0	<0.2	2.1	<1.0	15	13	7.3
	2	<0.2	<0.2	<0.2	6.2	<0.2	<0.4	<1.0	1.8	<1.0	<0.2	1.6	<1.0	9.9	10	6.4
	3	<0.2	<0.2	<0.2	4.4	<0.2	<0.4	<1.0	1.3	<1.0	3.8	1.5	<1.0	11	9.1	5.1
	4	<0.2	<0.2	<0.2	5.1	<0.2	<0.4	<1.0	2	<1.0	4.6	1.7	<1.0	10	10	4.1
	5	<0.2	<0.2	<0.2	4.9	<0.2	<0.4	<1.0	1.9	<1.0	3.5	2.2	<1.0	15	11	<0.2
	Mean	0.00	0.00	0.00	5.00	0.00	0.00	0.00	1.84	0.00	2.38	1.82	0.00	12.18	10.62	4.58
	SD	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.34	0.00	2.21	0.31	0.00	2.61	1.49	2.84
	CI	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.29	0.00	1.94	0.27	0.00	2.29	1.31	2.49
Gordons Landing	1	<0.2	<0.2	<0.2	4.5	<0.2	<0.4	<1.0	1.3	<1.0	6.9	2.7	<1.0	15	15	7.2
	2	<0.2	<0.2	<0.2	8.5	<0.2	<0.4	<1.0	1.4	<1.0	8.3	3.1	<1.0	18	18	9.9
	3	<0.2	<0.2	<0.2	5.4	<0.2	<0.4	<1.0	1.5	<1.0	9	2.8	<1.0	20	16	1.5
	4	<0.2	<0.2	<0.2	5.3	<0.2	<0.4	<1.0	2.3	<1.0	7.4	2.4	<1.0	17	15	7
	5	<0.2	<0.2	<0.2	3.4	<0.2	<0.4	<1.0	2.2	<1.0	8.3	2.6	<1.0	20	16	7.5
	Mean	0.00	0.00	0.00	5.42	0.00	0.00	0.00	1.74	0.00	7.98	2.72	0.00	18.00	16.00	6.62
	SD	0.00	0.00	0.00	1.90	0.00	0.00	0.00	0.47	0.00	0.83	0.26	0.00	2.12	1.22	3.09
	CI	0.00	0.00	0.00	1.66	0.00	0.00	0.00	0.41	0.00	0.73	0.23	0.00	1.86	1.07	2.71

Table A 3.35 Raw Data PAH (ng/g dry weight) - December 2025

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)-perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	0.8	0.7	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.6	2.4	<1.0	26	4.4	<0.2
	2	0.8	0.5	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.5	2.3	<1.0	44	2.8	<0.2
	3	0.9	0.6	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.8	1.9	<1.0	26	4.2	<0.2
	4	0.7	0.7	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.4	2.8	<1.0	57	3.2	<0.2
	5	0.8	0.8	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.8	2.4	<1.0	39	4.3	<0.2
	Mean	**0.80**	**0.66**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.62**	**2.36**	**0.00**	**38.40**	**3.78**	**0.00**
	SD	**0.07**	**0.11**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.18**	**0.32**	**0.00**	**13.09**	**0.73**	**0.00**
	CI	**0.06**	**0.10**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.16**	**0.28**	**0.00**	**11.47**	**0.64**	**0.00**
Karaka Point	1	2.1	1.9	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	2.4	4.6	<1.0	160	4.3	<0.2
	2	0.9	0.6	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	2.6	1.3	<1.0	19	3.5	<0.2
	3	1	0.8	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.7	2.5	<1.0	49	2.5	<0.2
	4	1.1	0.6	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	2.6	2.6	<1.0	49	4.2	<0.2
	5	1.4	0.7	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.4	2.5	<1.0	6.9	3.9	<0.2
	Mean	**1.30**	**0.92**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.14**	**2.70**	**0.00**	**56.78**	**3.68**	**0.00**
	SD	**0.48**	**0.55**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.55**	**1.19**	**0.00**	**60.60**	**0.73**	**0.00**
	CI	**0.42**	**0.49**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.49**	**1.04**	**0.00**	**53.12**	**0.64**	**0.00**
Te Toro Road Ramp	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	SD	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	CI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Te Toro Road Settlement	1	0.9	0.7	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.9	2.3	<1.0	13	5	<0.2
	2	0.8	0.7	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	2.3	1.6	<1.0	19	5.5	<0.2
	3	0.7	0.7	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.7	2	<1.0	12	4.3	<0.2
	4	0.8	0.5	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.8	1.4	<1.0	17	3.5	<0.2
	5	0.8	0.5	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.8	1.5	<1.0	6.6	4.7	<0.2
	Mean	**0.80**	**0.62**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.90**	**1.76**	**0.00**	**13.52**	**4.60**	**0.00**
	SD	**0.07**	**0.11**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.23**	**0.38**	**0.00**	**4.81**	**0.75**	**0.00**
	CI	**0.06**	**0.10**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.21**	**0.33**	**0.00**	**4.22**	**0.66**	**0.00**
Gordons Landing	1	0.9	0.6	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	3.6	1.2	<1.0	8.4	5.5	<0.2
	2	0.6	0.6	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	3.8	1.2	<1.0	8.8	6.3	<0.2
	3	0.9	0.8	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	3.8	1.5	<1.0	17	6.8	<0.2
	4	0.8	0.8	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	4.3	1.2	<1.0	15	6.2	<0.2
	5	0.8	0.8	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	3.3	1.5	<1.0	21	5.5	<0.2
	Mean	**0.80**	**0.72**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.76**	**1.32**	**0.00**	**14.04**	**6.06**	**0.00**
	SD	**0.12**	**0.11**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.36**	**0.16**	**0.00**	**5.42**	**0.56**	**0.00**
	CI	**0.11**	**0.10**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.32**	**0.14**	**0.00**	**4.75**	**0.49**	**0.00**

Table A 3.36 Raw Data PAH (ng/g dry weight) - January 2026

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	0.6	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.1	4	<1.0	27	3.2	0.3
	2	0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	0.7	3.8	<1.2	18	3.1	0.2
	3	0.3	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	0.7	1.7	<1.0	10	2.9	0.3
	4	0.7	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	0.7	3.5	<1.0	20	2.7	0.3
	5	0.6	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	0.7	2	<1.0	18	2.8	0.3
	Mean	**0.54**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.78**	**3.00**	**0.00**	**18.60**	**2.94**	**0.28**
	SD	**0.15**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.18**	**1.07**	**0.00**	**6.07**	**0.21**	**0.04**
	CI	**0.13**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.16**	**0.94**	**0.00**	**5.32**	**0.18**	**0.04**
Karaka Point	1	0.9	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	2.1	4.2	<1.0	42	4.5	0.8
	2	0.7	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.7	3.5	<1.0	30	3.2	0.7
	3	0.5	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.3	3	<1.0	18	2.8	0.5
	4	0.7	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.2	3.4	<1.0	23	2.9	0.6
	5	0.4	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.3	1.7	<1.0	15	2.6	0.5
	Mean	**0.64**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.52**	**3.16**	**0.00**	**25.60**	**3.20**	**0.62**
	SD	**0.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.38**	**0.92**	**0.00**	**10.78**	**0.76**	**0.13**
	CI	**0.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.33**	**0.81**	**0.00**	**9.45**	**0.66**	**0.11**
Te Toro Road Ramp	1	0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<1.1	<0.2	<1.1	0.9	2	<1.1	11	3.2	0.4
	2	0.5	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	1.1	1.7	<1.1	10	2.9	0.5
	3	0.6	<0.3	<0.3	<0.3	<0.3	<0.6	<1.5	<0.3	<1.5	1.1	3	<1.5	12	3.6	0.5
	4	0.6	<0.3	<0.3	<0.3	<0.3	<0.6	<1.5	<0.3	<1.5	1.1	4.1	<1.5	16	3.6	0.7
	5	0.5	<0.3	<0.3	<0.3	<0.3	<0.6	<1.6	<0.3	<1.6	0.9	2.7	<1.6	13	3.7	0.6
	Mean	**0.54**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.02**	**2.70**	**0.00**	**12.40**	**3.40**	**0.54**
	SD	**0.05**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.11**	**0.94**	**0.00**	**2.30**	**0.34**	**0.11**
	CI	**0.05**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**0.82**	**0.00**	**2.02**	**0.30**	**0.10**
Te Toro Road Settlement	1	0.8	<0.3	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	0.8	3.9	<1.4	18	3.6	0.5
	2	1.1	<0.3	<0.3	<0.3	<0.3	<0.6	<1.6	<0.3	<1.6	1	3.7	<1.6	21	3.5	0.8
	3	0.8	<0.3	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	1	3.8	<1.4	22	3.2	0.6
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	1	4.7	<1.2	35	2.9	0.6
	5	0.9	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	1.4	3.3	<1.2	28	3.6	0.5
	Mean	**0.72**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.04**	**3.88**	**0.00**	**24.80**	**3.36**	**0.60**
	SD	**0.42**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.22**	**0.51**	**0.00**	**6.76**	**0.30**	**0.12**
	CI	**0.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.19**	**0.45**	**0.00**	**5.93**	**0.27**	**0.11**
Gordons Landing	1	0.6	<0.2	<0.2	<0.2	<0.2	<0.5	<1.1	<0.2	<1.1	1.1	2.6	<1.1	13	2.8	0.6
	2	0.8	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	1.1	3.5	<1.3	12	3.5	0.5
	3	0.4	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	1.3	1.9	<1.2	9.6	2.9	0.6
	4	0.9	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	1.7	4.3	<1.3	22	3.6	0.8
	5	0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	1.1	2.1	<1.2	13	3.1	0.6
	Mean	**0.64**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.26**	**2.88**	**0.00**	**13.92**	**3.18**	**0.62**
	SD	**0.21**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.26**	**1.01**	**0.00**	**4.73**	**0.36**	**0.11**
	CI	**0.18**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.23**	**0.88**	**0.00**	**4.14**	**0.31**	**0.10**

Table A 3.37 Raw Data PAH (ng/g dry weight) - March 2026

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	1.8	<0.3	<1.4	13	2.4	1.7
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	0.8	2.4	<1.2	16	0.7	<0.2
	3	<2.2	<2.2	<2.2	25	<2.2	18	<11	23	<11	55	14	<11	130	28	20
	4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	0.7	<0.3	<1.4	8.8	<0.3	<0.3
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	0.9	1.4	<1.1	8.2	1.1	<0.2
	Mean	**0.00**	**0.00**	**0.00**	**5.00**	**0.00**	**3.60**	**0.00**	**4.60**	**0.00**	**11.84**	**3.56**	**0.00**	**35.20**	**6.44**	**4.34**
	SD	**0.00**	**0.00**	**0.00**	**11.18**	**0.00**	**8.05**	**0.00**	**10.29**	**0.00**	**24.13**	**5.92**	**0.00**	**53.09**	**12.08**	**8.79**
	CI	**0.00**	**0.00**	**0.00**	**9.80**	**0.00**	**7.06**	**0.00**	**9.02**	**0.00**	**21.15**	**5.19**	**0.00**	**46.54**	**10.59**	**7.70**
Karaka Point	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	1.2	0.9	<1.1	20	0.9	0.3
	2	0.8	<0.2	<0.2	<0.2	<0.2	0.6	<1.0	<0.2	<1.0	2.1	1.9	<1.0	28	2	0.8
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	0.8	0.7	<1.0	9.8	0.4	0.2
	4	<0.2	<0.2	<0.2	<0.2	<0.2	1.2	<1.2	<0.2	<1.2	0.9	0.4	<1.2	13	1.3	<0.2
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.8	2	<1.0	7.9	2.4	0.8
	Mean	**0.16**	**0.00**	**0.00**	**0.00**	**0.00**	**0.36**	**0.00**	**0.00**	**0.00**	**1.36**	**1.18**	**0.00**	**15.74**	**1.40**	**0.42**
	SD	**0.36**	**0.00**	**0.00**	**0.00**	**0.00**	**0.54**	**0.00**	**0.00**	**0.00**	**0.57**	**0.73**	**0.00**	**8.26**	**0.81**	**0.36**
	CI	**0.31**	**0.00**	**0.00**	**0.00**	**0.00**	**0.47**	**0.00**	**0.00**	**0.00**	**0.50**	**0.64**	**0.00**	**7.24**	**0.71**	**0.32**
Te Toro Road Ramp	1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	0.6	<0.3	<1.3	2.1	0.5	<0.3
	2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	0.6	<0.3	<1.3	5.8	<0.3	<0.3
	3	0.8	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	1.3	2	<1.2	4.3	0.3	0.5
	4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	1	1.4	<1.3	3.9	1.4	<0.3
	5	<0.4	<0.4	<0.4	<0.4	<0.4	<0.7	<1.9	<0.4	<1.9	<0.4	<0.4	<1.9	1.2	<0.4	<0.4
	Mean	**0.16**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.70**	**0.68**	**0.00**	**3.46**	**0.44**	**0.10**
	SD	**0.36**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.49**	**0.95**	**0.00**	**1.83**	**0.58**	**0.22**
	CI	**0.31**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.43**	**0.84**	**0.00**	**1.60**	**0.51**	**0.20**
Te Toro Road Settlement	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	0.9	1.9	<1.0	10	1	0.4
	2	<0.3	1.1	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	1.6	2.1	<1.4	4.8	0.6	0.7
	3	<0.2	1	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1	3.2	<1.0	8.9	2.2	0.4
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	0.6	1.8	<1.2	7.1	0.3	0.3
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	0.7	2.1	<1.2	3.6	<0.2	<0.2
	Mean	**0.00**	**0.42**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.96**	**2.22**	**0.00**	**6.88**	**0.82**	**0.36**
	SD	**0.00**	**0.58**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.39**	**0.56**	**0.00**	**2.69**	**0.86**	**0.25**
	CI	**0.00**	**0.51**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.34**	**0.49**	**0.00**	**2.36**	**0.75**	**0.22**
Gordons Landing	1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.6	<1.6	<0.3	<1.6	0.5	<0.3	<1.6	2.7	0.8	<0.3
	2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.4	<0.3	<1.4	1	<0.3	<1.4	8.2	0.4	0.4
	3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	2	0.6	<1.3	12	1.2	1.2
	4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	1.9	0.3	<1.3	1.7	1.4	1.3
	5	<0.2	<0.2	<0.2	<0.2	<0.2	0.5	<1.1	<0.2	<1.1	1.7	2.7	<1.1	16	2.3	0.6
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**0.00**	**0.00**	**0.00**	**1.42**	**0.72**	**0.00**	**8.12**	**1.22**	**0.70**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.22**	**0.00**	**0.00**	**0.00**	**0.65**	**1.13**	**0.00**	**6.08**	**0.72**	**0.55**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.20**	**0.00**	**0.00**	**0.00**	**0.57**	**0.99**	**0.00**	**5.33**	**0.63**	**0.48**

Table A 3.38 Raw Data PAH (ng/g dry weight) - April 2026

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.3	4.3	<1.0	22	4.4	1
	2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	1.5	<0.3	<1.4	10	5.2	1
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.1	<0.2	<1.1	1.3	<0.2	<1.1	7	<0.2	0.9
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	1.6	1	<0.2	<1.2	9.6	3.7	0.7
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	1.1	<0.2	<1.2	23	3.7	0.8
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.32**	**1.24**	**0.86**	**0.00**	**14.32**	**3.40**	**0.88**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.72**	**0.19**	**1.92**	**0.00**	**7.56**	**2.00**	**0.13**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.63**	**0.17**	**1.69**	**0.00**	**6.63**	**1.75**	**0.11**
Karaka Point	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	1.4	<0.2	<1.2	20	4.7	1.1
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.1	<0.2	<1.0	9.4	2.9	0.7
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	1.6	<0.2	<1.1	14	4.5	1.2
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.3	<0.2	<1.0	32	3.7	1.2
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	<0.2	<0.2	<1.1	<0.2	<0.2	<0.2
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.08**	**0.00**	**0.00**	**15.08**	**3.16**	**0.84**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.63**	**0.00**	**0.00**	**11.95**	**1.90**	**0.51**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.55**	**0.00**	**0.00**	**10.48**	**1.67**	**0.45**
Te Toro Road Ramp	1	<0.2	1.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	1.1	<0.2	<1.2	23	4	0.8
	2	<0.3	0.9	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	1.3	<0.3	<1.4	17	5.5	0.9
	3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	<0.3	<0.3	<1.3	15	4.5	0.6
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	0.9	<0.2	<1.1	17	3	0.6
	5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.7	<1.7	<0.3	<1.7	1.5	<0.3	<1.7	27	5.1	1.2
	Mean	**0.00**	**0.42**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.96**	**0.00**	**0.00**	**19.80**	**4.42**	**0.82**
	SD	**0.00**	**0.58**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.58**	**0.00**	**0.00**	**5.02**	**0.98**	**0.25**
	CI	**0.00**	**0.51**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.51**	**0.00**	**0.00**	**4.40**	**0.86**	**0.22**
Te Toro Road Settlement	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	1.4	4.6	<1.0	31	3.7	1
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	1.7	<0.2	<1.2	44	5.2	1.5
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	1.6	4.5	<1.1	18	4.2	1.1
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	1.3	5.1	<1.1	30	4	1.2
	5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	1.7	<0.3	<1.3	11	6.1	1.3
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.54**	**2.84**	**0.00**	**26.80**	**4.64**	**1.22**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.18**	**2.60**	**0.00**	**12.76**	**0.99**	**0.19**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.16**	**2.28**	**0.00**	**11.18**	**0.87**	**0.17**
Gordons Landing	1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.7	<1.6	<0.3	<1.6	<0.3	<0.3	<1.6	26	<0.3	<0.3
	2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.7	<1.7	<0.3	<1.7	1.8	<0.3	<1.7	35	<0.3	1.5
	3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	1.7	<0.3	<1.3	28	5.9	1.3
	4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.7	<1.6	<0.3	<1.6	1.5	<0.3	<1.6	28	7.4	1.1
	5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.6	<1.6	<0.3	<1.6	2	<0.3	<1.6	32	<0.3	1.6
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.40**	**0.00**	**0.00**	**29.80**	**2.66**	**1.10**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.80**	**0.00**	**0.00**	**3.63**	**3.68**	**0.64**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.70**	**0.00**	**0.00**	**3.18**	**3.23**	**0.56**

Table A 3.39 Raw Data PAH (ng/g dry weight) - May 2026

Site	Replicate	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b+k)fluoranthene	Benzo(ghi)perylene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1-2-3-c-d)pyrene	Naphthalene	Phenanthrene	Pyrene
Matakawau Headland	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	2	7.8	<1.0	33	1.3	1.7
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	3.8	9.9	<1.0	45	2.8	3.2
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	2.4	7	<1.1	21	1.4	1.8
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.1	<0.2	<1.1	3.5	11	<1.1	33	1.9	2.4
	5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	2	11	<1.3	34	<0.3	1.7
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.74**	**9.34**	**0.00**	**33.20**	**1.48**	**2.16**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.85**	**1.85**	**0.00**	**8.50**	**1.02**	**0.65**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.75**	**1.62**	**0.00**	**7.45**	**0.89**	**0.57**
Karaka Point	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	2.7	7.6	<1.0	38	0.7	1.9
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	4.6	9.5	<1.0	36	3	3.1
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	3	3.3	<1.0	3.2	0.6	1.9
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	2.6	3.9	<1.2	1.6	0.3	1.9
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	3	3.4	<1.0	4.5	1.1	1.9
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.18**	**5.54**	**0.00**	**16.66**	**1.14**	**2.14**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.81**	**2.84**	**0.00**	**18.61**	**1.08**	**0.54**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.71**	**2.49**	**0.00**	**16.31**	**0.95**	**0.47**
Te Toro Road Ramp	1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	3.8	9.6	<1.4	28	2.7	2.5
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	3.8	4.7	<1.0	7.5	3.5	3
	3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.2	<0.2	<1.2	4.1	6.1	<1.2	7.5	3	2.5
	4	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.4	<0.3	<1.4	4	8	<1.4	14	3.4	2.7
	5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	3.4	8.5	<1.4	14	2.6	2.4
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.82**	**7.38**	**0.00**	**14.20**	**3.04**	**2.62**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.27**	**1.96**	**0.00**	**8.37**	**0.40**	**0.24**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.24**	**1.72**	**0.00**	**7.34**	**0.35**	**0.21**
Te Toro Road Settlement	1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	4.4	6.6	<1.0	18	2.9	2.9
	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.0	<0.2	<1.0	5.9	9.5	<1.0	41	3.8	3.9
	3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	4.1	7.4	<1.3	12	3.7	2.6
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<1.1	<0.2	<1.1	4.6	6.7	<1.1	30	3.6	3
	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.1	<0.2	<1.1	3.7	6.5	<1.1	11	2.9	2.3
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.54**	**7.34**	**0.00**	**22.40**	**3.38**	**2.94**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.83**	**1.26**	**0.00**	**12.86**	**0.44**	**0.60**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.73**	**1.10**	**0.00**	**11.27**	**0.39**	**0.53**
Gordons Landing	1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	5.3	7.1	<1.4	12	2.7	3.2
	2	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.4	<0.3	<1.4	5	14	<1.4	29	3.3	2.9
	3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	<1.3	<0.3	<1.3	5.1	11	<1.3	17	2.9	3.2
	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<1.1	<0.2	<1.1	5.1	8.6	<1.1	11	3.6	2.9
	5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.6	<1.4	<0.3	<1.4	5.1	16	<1.4	27	5.8	3.3
	Mean	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**5.12**	**11.34**	**0.00**	**19.20**	**3.66**	**3.10**
	SD	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.11**	**3.69**	**0.00**	**8.38**	**1.25**	**0.19**
	CI	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.10**	**3.23**	**0.00**	**7.34**	**1.09**	**0.16**

Table A 3.40 Raw Data for Faecal Coliforms (MPN/100g) from August 2024 to May 2026

Sites	Month	Year	Weather	Replicates					Median	>230		>330	
				1	2	3	4	5		Number exceeding	Compliant	Number exceeding	Compliant
Matakawau Headland	August	2024	Dry	170	490	490	220	330	330	3/5	No	2/5	No
	October	2024	Dry	490	330	490	790	790	490	5/5	No	4/5	No
	January	2025	Dry	1300	490	790	1300	490	790	5/5	No	5/5	No
	March	2025	Wet	45	78	220	-	-	78	0/5	Yes	0/5	Yes
	May	2025	Dry	20	45	40	230	270	45	1/5	Yes	0/5	Yes
	August	2025	Wet	330	270	220	700	490	330	4/5	No	2/5	No
	October	2025	Wet	-	-	-	-	-	-	-	-	-	-
	December	2025	Dry	<18	330	<18	78	<18	0	1/5	Yes	0/5	Yes
	January	2026	Neutral	330	20	130	45	<18	45	1/5	Yes	0/5	Yes
	March	2026	Dry	<18	20	68	20	20	20	0/5	Yes	0/5	Yes
	April	2026	Wet	790	490	1300	1100	230	790	4/5	No	4/5	No
	May	2026	Dry	1700	220	330	790	220	330	3/5	No	2/5	No
Karaka Point	August	2024	Dry	78	130	20	45	330	78	1/5	Yes	0/5	Yes
	October	2024	Dry	45	130	18	<18	45	45	0/5	Yes	0/5	Yes
	January	2025	Dry	-	-	-	-	-	-	-	-	-	-
	March	2025	Wet	45	78	78	-	-	78	0/3	Yes	0/3	Yes
	May	2025	Dry	45	230	45	45	130	45	0/5	Yes	0/5	Yes
	August	2025	Wet	78	220	110	230	330	220	1/5	Yes	0/5	Yes
	October	2025	Wet	20	78	20	78	<18	20	0/5	Yes	0/5	Yes
	December	2025	Dry	<18	<18	<18	490	<18	0	1/5	No	1/5	No
	January	2026	Neutral	68	45	130	20	110	68	0/5	Yes	0/5	Yes
	March	2026	Dry	20	20	45	110	<18	20	0/5	Yes	0/5	Yes
	April	2026	Wet	330	130	700	330	220	330	3/5	No	1/5	No
	May	2026	Dry	45	0	78	45	18	45	0/5	Yes	0/5	Yes
Te Toro Boat Ramp	August	2024	Dry	110	45	330	120	140	120	1/5	Yes	0/5	Yes
	October	2024	Dry	78	230	<18	68	170	78	0/5	Yes	0/5	Yes
	January	2025	Dry	-	-	-	-	-	-	-	-	-	-
	March	2025	Wet	45	45	<18	-	-	45	0/3	Yes	0/3	Yes
	May	2025	Dry	230	170	330	78	790	230	2/5	No	1/5	No
	August	2025	Wet	230	61	490	78	230	230	1/5	No	1/5	No
	October	2025	Wet	-	-	-	-	-	-	-	-	-	-
	December	2025	Dry	-	-	-	-	-	-	-	-	-	-
	January	2026	Neutral	20	20	<18	110	20	20	0/5	Yes	0/5	Yes
	March	2026	Dry	<18	210	<18	<18	<18	0	0/5	Yes	0/5	Yes
	April	2026	Wet	1300	1300	2300	2300	1100	1300	5/5	No	5/5	No
	May	2026	Dry	230	700	790	36	940	700	3/5	No	3/5	No
Te Toro Road Settlement	August	2024	Dry	<18	110	<18	<18	18	0	0/5	Yes	0/5	Yes
	October	2024	Dry	<18	<18	<18	20	<18	0	0/5	Yes	0/5	Yes
	January	2025	Dry	<18	<18	<18	<18	<18	0	0/5	Yes	0/5	Yes
	March	2025	Wet	-	20	<18	<18	20	10	0/4	Yes	0/4	Yes
	May	2025	Dry	170	20	20	20	230	20	0/5	Yes	0/5	Yes
	August	2025	Wet	170	110	170	230	330	170	1/5	Yes	0/5	Yes
	October	2025	Wet	45	20	170	68	45	45	0/5	Yes	0/5	Yes
	December	2025	Dry	<18	45	<18	<18	<18	0	0/5	Yes	0/5	Yes
	January	2026	Neutral	<18	<18	<18	<18	<18	0	0/5	Yes	0/5	Yes
	March	2026	Dry	<18	45	170	20	45	45	0/5	Yes	0/5	Yes
	April	2026	Wet	490	790	790	130	170	490	3/5	No	3/5	No
	May	2026	Dry	170	330	40	78	130	130	1/5	Yes	0/5	Yes
Gordons Landing	August	2024	Dry	45	45	110	78	110	78	0/5	Yes	0/5	Yes
	October	2024	Dry	45	20	<18	<18	45	20	0/5	Yes	0/5	Yes
	January	2025	Dry	<18	93	78	170	<18	78	0/5	Yes	0/5	Yes
	March	2025	Wet	20	<18	<18	20	<18	0	0/5	Yes	0/5	Yes
	May	2025	Dry	310	130	<18	20	78	78	1/5	Yes	0/5	Yes
	August	2025	Wet	78	790	310	<18	130	130	2/5	No	1/5	No
	October	2025	Wet	20	20	45	45	45	45	0/5	Yes	0/5	Yes
	December	2025	Dry	210	130	130	490	920	210	2/5	No	2/5	No
	January	2026	Neutral	<18	<18	20	<18	<18	0	0/5	Yes	0/5	Yes
	March	2026	Dry	40	45	<18	78	230	45	0/5	Yes	0/5	Yes
	April	2026	Wet	790	3300	2300	3100	1300	2300	5/5	No	5/5	No
	May	2026	Dry	330	330	790	330	790	330	5/5	No	2/5	No

Table A 3.41 Raw Data for Enterococci (MPN/100g) and Enterovirus (pfu/100g) from August 2024 to May 2025.

Sites	Month	Year	Weather	Enterococci						Enterovirus			
				1	2	3	4	5	Median	1	2	3	Median
Matakawau Headland	August	2024	Dry	45	78	78	20	230	78	<4.0	<4.0	<4.0	<4.0
	October	2024	Dry	78	170	2300	330	45	170	<4.0	<4.0	<4.0	<4.0
	January	2025	Dry	460	790	2300	3300	2300	2300	<4.0	<4.0	<4.0	<4.0
	March	2025	Wet	230	490	110	45	130	130	<4.0	<4.0	<4.0	<4.0
	May	2025	Dry	170	140	78	170	130	140	<4.0	<4.0	<4.0	<4.0
	August	2025	Wet	40	20	330	45	78	45	<4.0	<4.0	<4.0	<4.0
	October	2025	Wet	-	-	-	-	-	-	-	-	-	-
	December	2025	Dry	<18	45	<18	40	<18	0	<4.0	<4.0	<4.0	<4.0
	January	2026	Neutral	45	130	20	<18	45	45	<4.0	<4.0	<4.0	<4.0
	March	2026	Dry	45	700	140	78	78	78	<4.0	<4.0	<4.0	<4.0
	April	2026	Wet	1300	4900	1700	13000	3300	3300	<4.0	<4.0	<4.0	<4.0
	May	2026	Dry	330	130	170	330	1400	330	<4.0	<4.0	<4.0	<4.0
Karaka Point	August	2024	Dry	78	20	45	40	20	40	<4.0	<4.0	<4.0	<4.0
	October	2024	Dry	<18	20	20	45	45	20	<4.0	<4.0	<4.0	<4.0
	January	2025	Dry	-	-	-	-	-	-	-	-	-	-
	March	2025	Wet	<18	78	45	78	45	45	<4.0	<4.0	<4.0	<4.0
	May	2025	Dry	130	330	700	130	45	130	<4.0	<4.0	-	<4.0
	August	2025	Wet	45	170	45	45	130	45	<4.0	<4.0	<4.0	<4.0
	October	2025	Wet	<18	<18	<18	<18	78	0	<4.0	<4.0	<4.0	<4.0
	December	2025	Dry	45	20	<18	<18	<18	0	<4.0	<4.0	<4.0	<4.0
	January	2026	Neutral	<18	20	<18	20	<18	0	<4.0	<4.0	<4.0	<4.0
	March	2026	Dry	130	11000	450	220	330	330	<4.0	<4.0	<4.0	<4.0
	April	2026	Wet	220	220	920	170	1100	220	<4.0	<4.0	<4.0	<4.0
	May	2026	Dry	78	<18	<18	<18	20	0	<4.0	<4.0	<4.0	<4.0
Te Toro Boat Ramp	August	2024	Dry	78	130	61	20	18	61	<4.0	<4.0	<4.0	<4.0
	October	2024	Dry	790	130	<18	<18	20	20	<4.0	<4.0	<4.0	<4.0
	January	2025	Dry	-	-	-	-	-	-	-	-	-	-
	March	2025	Wet	490	78	790	170	78	170	<4.0	<4.0	<4.0	<4.0
	May	2025	Dry	230	330	140	230	330	230	<4.0	<4.0	<4.0	<4.0
	August	2025	Wet	170	490	330	170	110	120	<4.0	<4.0	<4.0	<4.0
	October	2025	Wet	-	-	-	-	-	-	-	-	-	-
	December	2025	Dry	-	-	-	-	-	-	-	-	-	-
	January	2026	Neutral	<18	20	<18	20	<18	0	<4.0	<4.0	<4.0	<4.0
	March	2026	Dry	140	110	330	130	130	130	<4.0	<4.0	<4.0	<4.0
	April	2026	Wet	790	490	490	1400	200	490	<4.0	<4.0	<4.0	<4.0
	May	2026	Dry	110	170	1700	110	1100	170	<4.0	<4.0	<4.0	<4.0
Te Toro Road Settlement	August	2024	Dry	20	<18	20	20	<18	20	<4.0	<4.0	<4.0	<4.0
	October	2024	Dry	<18	<18	<18	20	<18	0	<4.0	<4.0	<4.0	<4.0
	January	2025	Dry	<18	<18	45	78	<18	0	<4.0	<4.0	<4.0	<4.0
	March	2025	Wet	230	45	45	78	170	78	<4.0	<4.0	<4.0	<4.0
	May	2025	Dry	78	790	110	78	110	110	<4.0	<4.0	<4.0	<4.0
	August	2025	Wet	120	110	130	78	230	170	<4.0	<4.0	<4.0	<4.0
	October	2025	Wet	<18	<18	<18	<18	20	0	<4.0	<4.0	<4.0	<4.0
	December	2025	Dry	<18	<18	20	330	<18	0	<4.0	<4.0	<4.0	<4.0
	January	2026	Neutral	<18	<18	20	<18	<18	0	<4.0	<4.0	<4.0	<4.0
	March	2026	Dry	45	40	<18	110	45	45	<4.0	<4.0	<4.0	<4.0
	April	2026	Wet	790	330	40	790	93	330	<4.0	<4.0	<4.0	<4.0
	May	2026	Dry	45	<18	330	<18	78	45	<4.0	<4.0	<4.0	<4.0
Gordons Landing	August	2024	Dry	170	78	490	140	110	140	<4.0	<4.0	<4.0	<4.0
	October	2024	Dry	<18	<18	<18	40	45	0	<4.0	<4.0	<4.0	<4.0
	January	2025	Dry	170	68	68	45	18	68	<4.0	<4.0	<4.0	<4.0
	March	2025	Wet	170	68	110	170	20	110	<4.0	<4.0	<4.0	<4.0
	May	2025	Dry	78	68	1300	1300	220	220	<4.0	<4.0	<4.0	<4.0
	August	2025	Wet	230	130	170	170	20	170	<4.0	<4.0	<4.0	<4.0
	October	2025	Wet	<18	20	20	40	68	20	<4.0	<4.0	<4.0	<4.0
	December	2025	Dry	2300	78	20	230	230	230	<4.0	<4.0	<4.0	<4.0
	January	2026	Neutral	20	<18	20	<18	45	20	<4.0	<4.0	<4.0	<4.0
	March	2026	Dry	<18	20	<18	<18	20	0	<4.0	<4.0	<4.0	<4.0
	April	2026	Wet	3300	4900	390	2300	2300	2300	<4.0	<4.0	<4.0	<4.0
	May	2026	Dry	1100	700	490	140	400	490	<4.0	<4.0	<4.0	<4.0

Certificate of Analysis Metals & PAH - August 2024

Watercare
Laboratory Services

Watercare Services Limited
52 Aintree Ave, Māngere, Auckland, 2022
PO Box 107028, Auckland, 2150
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clientsupport@water.co.nz
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Certificate of Analysis
Laboratory Reference:240827-106

Attention:	Laureline Meynier	*Final Report:*	**562485-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**11-Sep-2024**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**27-Aug-2024**
Client Reference:	**SW Clark WWTP Monitoring - Contaminants**	*Laboratory Activity Dates:*	**28-Aug-2024 - 11-Sep-2024**
Purchase Order:	**Y-3310-LB-002**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**240827-106-1**	**240827-106-2**	**240827-106-3**	**240827-106-4**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Matakawau MET24WI 1 Wet	Matakawau MET24WI 2 Wet	Matakawau MET24WI 3 Wet	Matakawau MET24WI 4 Wet
General Testing					
Percentage Moisture	%	88.8	88.3	87.3	88.8
Percentage Solids	%	11.2	11.7	12.7	11.2
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	14	14	14
Copper (Recoverable Dry Wt.)	mg/kg	370	360	290	440
Lead (Recoverable Dry Wt.)	mg/kg	0.3	0.32	0.34	0.34
Zinc (Recoverable Dry Wt.)	mg/kg	1200	1300	890	1600

Sample Details					
Lab Sample ID:		**240827-106-5**	**240827-106-6**	**240827-106-7**	**240827-106-8**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Matakawau MET24WI 5 Wet	Matakawau PAH24WI 1 Wet	Matakawau PAH24WI 2 Wet	Matakawau PAH24WI 3 Wet
General Testing					
Percentage Moisture	%	87.9	-	-	-
Percentage Solids	%	12.1	-	-	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	330	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.3	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1200	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	<1.0 *	1.0 *	<1.0 *
Acenaphthylene	ng/g	-	<1.0 *	<1.0 *	<1.0 *
Anthracene	ng/g	-	<1.0 *	1.0 *	1.9 *
Benzo(a)anthracene	ng/g	-	1.3 *	<1.0 *	1.8 *
Benzo(a)pyrene	ng/g	-	<2.0 *	<2.0 *	<2.0 *
Benzo(b+k)fluoranthene	ng/g	-	<2.0 *	<2.0 *	<2.0 *
Benzo(ghi)perylene	ng/g	-	<4.0 *	<4.0 *	<4.0 *
Chrysene	ng/g	-	<1.0 *	<1.0 *	<1.0 *
Comments		-	Sample tested using GCMS *	Sample tested using GCMS *	Sample tested using GCMS *
Dibenzo(ah)anthracene	ng/g	-	<4.0 *	<4.0 *	<4.0 *
Fluoranthene	ng/g	-	2.2 *	2.3 *	2.9 *
Fluorene	ng/g	-	2.2 *	2.2 *	3.1 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	<4.0 *	<4.0 *	<4.0 *
Naphthalene	ng/g	-	7.4 *	9.1 *	8.6 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240827-106-5**	**240827-106-6**	**240827-106-7**	**240827-106-8**
Client Sample ID:					
Sample Date/Time:		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Matakawau MET24WI 5 Wet	Matakawau PAH24WI 1 Wet	Matakawau PAH24WI 2 Wet	Matakawau PAH24WI 3 Wet
Organics					
Adhoc investigation					
Phenanthrene	ng/g	-	8.5 *	8.2 *	12.6 *
Pyrene	ng/g	-	1.5 *	1.6 *	1.9 *

Sample Details					
Lab Sample ID:		**240827-106-9**	**240827-106-10**	**240827-106-11**	**240827-106-12**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Matakawau PAH24WI 4 Wet	Matakawau PAH24WI 5 Wet	Karaka MET24WI1 Wet	Karaka MET24WI2 Wet
General Testing					
Percentage Moisture	%	-	-	88.4	89.3
Percentage Solids	%	-	-	11.6	10.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	-	12	14
Copper (Recoverable Dry Wt.)	mg/kg	-	-	310	270
Lead (Recoverable Dry Wt.)	mg/kg	-	-	0.34	0.53
Zinc (Recoverable Dry Wt.)	mg/kg	-	-	1000	1100
Organics					
Adhoc investigation					
Acenaphthene	ng/g	<1.0 *	<1.0 *	-	-
Acenaphthylene	ng/g	<1.0 *	<1.0 *	-	-
Anthracene	ng/g	1.3 *	1.0 *	-	-
Benzo(a)anthracene	ng/g	1.7 *	1.8 *	-	-
Benzo(a)pyrene	ng/g	<2.0 *	<2.0 *	-	-
Benzo(b+k)fluoranthene	ng/g	<2.0 *	<2.0 *	-	-
Benzo(ghi)perylene	ng/g	<4.0 *	<4.0 *	-	-
Chrysene	ng/g	1.0 *	1.2 *	-	-
Comments		Sample tested using GCMS *	Sample tested using GCMS *	-	-
Dibenzo(ah)anthracene	ng/g	<4.0 *	<4.0 *	-	-
Fluoranthene	ng/g	2.5 *	2.2 *	-	-
Fluorene	ng/g	2.5 *	2.3 *	-	-
Indeno(1-2-3-c-d)pyrene	ng/g	<4.0 *	<4.0 *	-	-
Naphthalene	ng/g	8.4 *	8.8 *	-	-
Phenanthrene	ng/g	10.7 *	8.9 *	-	-
Pyrene	ng/g	1.8 *	1.6 *	-	-

Sample Details					
Lab Sample ID:		**240827-106-13**	**240827-106-14**	**240827-106-15**	**240827-106-16**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Karaka MET24WI3 Wet	Karaka MET24WI4 Wet	Karaka MET24WI5 Wet	Karaka PAH24WI1 Wet
General Testing					
Percentage Moisture	%	87.8	88.5	89.0	-
Percentage Solids	%	12.2	11.5	11.0	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	13	14	-
Copper (Recoverable Dry Wt.)	mg/kg	320	350	340	-
Lead (Recoverable Dry Wt.)	mg/kg	0.5	0.32	0.55	-
Zinc (Recoverable Dry Wt.)	mg/kg	1200	1200	1200	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	-	-	1.4 *
Acenaphthylene	ng/g	-	-	-	<1.0 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240827-106-13**	**240827-106-14**	**240827-106-15**	**240827-106-16**
Client Sample ID:					
Sample Date/Time:		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Karaka MET24WI3 Wet	Karaka MET24WI4 Wet	Karaka MET24WI5 Wet	Karaka PAH24WI1 Wet
Organics					
Adhoc investigation					
Anthracene	ng/g	-	-	-	1.2 *
Benzo(a)anthracene	ng/g	-	-	-	1.5 *
Benzo(a)pyrene	ng/g	-	-	-	<2.0 *
Benzo(b+k)fluoranthene	ng/g	-	-	-	<2.0 *
Benzo(ghi)perylene	ng/g	-	-	-	<4.0 *
Chrysene	ng/g	-	-	-	<1.0 *
Comments		-	-	-	Sample tested using GCMS *
Dibenzo(ah)anthracene	ng/g	-	-	-	<4.0 *
Fluoranthene	ng/g	-	-	-	2.0 *
Fluorene	ng/g	-	-	-	2.7 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	-	-	<4.0 *
Naphthalene	ng/g	-	-	-	9.6 *
Phenanthrene	ng/g	-	-	-	10.7 *
Pyrene	ng/g	-	-	-	1.4 *

Sample Details					
Lab Sample ID:		**240827-106-17**	**240827-106-18**	**240827-106-19**	**240827-106-20**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Karaka PAH24WI2 Wet	Karaka PAH24WI3 Wet	Karaka PAH24WI4 Wet	Karaka PAH24WI5 Wet
Organics					
Adhoc investigation					
Acenaphthene	ng/g	1.0 *	<1.0 *	1.0 *	2.0 *
Acenaphthylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Anthracene	ng/g	1.3 *	1.1 *	1.4 *	1.4 *
Benzo(a)anthracene	ng/g	<1.0 *	1.8 *	1.7 *	1.6 *
Benzo(a)pyrene	ng/g	<2.0 *	<2.0 *	<2.0 *	<2.0 *
Benzo(b+k)fluoranthene	ng/g	<2.0 *	<2.0 *	<2.0 *	<2.0 *
Benzo(ghi)perylene	ng/g	<4.0 *	<4.0 *	<4.0 *	<4.0 *
Chrysene	ng/g	<1.0 *	<1.0 *	1.0 *	<1.0 *
Comments		Sample tested using GCMS *	Sample tested using GCMS *	Sample tested using GCMS *	Sample tested using GCMS *
Dibenzo(ah)anthracene	ng/g	<4.0 *	<4.0 *	<4.0 *	<4.0 *
Fluoranthene	ng/g	2.5 *	2.4 *	2.9 *	2.6 *
Fluorene	ng/g	2.3 *	2.0 *	2.5 *	2.4 *
Indeno(1-2-3-c-d)pyrene	ng/g	<4.0 *	<4.0 *	<4.0 *	<4.0 *
Naphthalene	ng/g	8.3 *	10.1 *	9.5 *	9.0 *
Phenanthrene	ng/g	9.5 *	7.2 *	11.8 *	10.2 *
Pyrene	ng/g	1.6 *	1.3 *	1.9 *	2.0 *

Sample Details					
Lab Sample ID:		**240827-106-21**	**240827-106-22**	**240827-106-23**	**240827-106-24**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Toro Ramp MET24WI 1 Wet	Toro Ramp MET24WI 2 Wet	Toro Ramp MET24WI 3 Wet	Toro Ramp MET24WI 4 Wet
General Testing					
Percentage Moisture	%	88.7	90.0	89.7	90.0
Percentage Solids	%	11.3	10.0	10.3	10.0
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	12	13	13
Copper (Recoverable Dry Wt.)	mg/kg	300	340	400	400
Lead (Recoverable Dry Wt.)	mg/kg	0.24	0.28	0.3	0.32
Zinc (Recoverable Dry Wt.)	mg/kg	1200	1100	1500	1300

Sample Details					
Lab Sample ID:		**240827-106-25**	**240827-106-26**	**240827-106-27**	**240827-106-28**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Toro Ramp MET24WI 5 Wet	Toro Ramp PAH24WI 1 Wet	Toro Ramp PAH24WI 2 Wet	Toro Ramp PAH24WI3 Wet
General Testing					
Percentage Moisture	%	88.9	-	-	-
Percentage Solids	%	11.1	-	-	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	350	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.27	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1200	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	1.5 *	1.8 *	1.4 *
Acenaphthylene	ng/g	-	<1.0 *	<1.0 *	<1.0 *
Anthracene	ng/g	-	1.3 *	1.0 *	1.7 *
Benzo(a)anthracene	ng/g	-	1.9 *	2.2 *	2.0 *
Benzo(a)pyrene	ng/g	-	<2.0 *	<2.0 *	<2.0 *
Benzo(b+k)fluoranthene	ng/g	-	<2.0 *	<2.0 *	<2.0 *
Benzo(ghi)perylene	ng/g	-	<4.0 *	<4.0 *	<4.0 *
Chrysene	ng/g	-	<1.0 *	<1.0 *	<1.0 *
Comments		-	Sample tested using GCMS *	Sample tested using GCMS *	Sample tested using GCMS *
Dibenzo(ah)anthracene	ng/g	-	<4.0 *	<4.0 *	<4.0 *
Fluoranthene	ng/g	-	2.9 *	2.2 *	2.9 *
Fluorene	ng/g	-	2.2 *	2.2 *	2.7 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	<4.0 *	<4.0 *	<4.0 *
Naphthalene	ng/g	-	9.0 *	10.1 *	9.3 *
Phenanthrene	ng/g	-	11.3 *	9.0 *	13.3 *
Pyrene	ng/g	-	2.2 *	1.7 *	2.4 *

Sample Details					
Lab Sample ID:		**240827-106-29**	**240827-106-30**	**240827-106-31**	**240827-106-32**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Toro Ramp PAH24WI 4 Wet	Toro Ramp PAH24WI 5 Wet	Te Toro MET24WI1 Wet	Te Toro MET24WI2 Wet
General Testing					
Percentage Moisture	%	-	-	87.8	88.1
Percentage Solids	%	-	-	12.2	11.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	-	14	13
Copper (Recoverable Dry Wt.)	mg/kg	-	-	330	320
Lead (Recoverable Dry Wt.)	mg/kg	-	-	0.31	0.34
Zinc (Recoverable Dry Wt.)	mg/kg	-	-	1200	1100
Organics					
Adhoc investigation					
Acenaphthene	ng/g	1.3 *	<1.0 *	-	-
Acenaphthylene	ng/g	<1.0 *	<1.0 *	-	-
Anthracene	ng/g	<1.0 *	1.4 *	-	-
Benzo(a)anthracene	ng/g	1.6 *	1.6 *	-	-
Benzo(a)pyrene	ng/g	<2.0 *	<2.0 *	-	-
Benzo(b+k)fluoranthene	ng/g	<2.0 *	<2.0 *	-	-
Benzo(ghi)perylene	ng/g	<4.0 *	<4.0 *	-	-
Chrysene	ng/g	<1.0 *	1.0 *	-	-
Comments		Sample tested using GCMS *	Sample tested using GCMS *	-	-
Dibenzo(ah)anthracene	ng/g	<4.0 *	<4.0 *	-	-
Fluoranthene	ng/g	2.5 *	3.2 *	-	-
Fluorene	ng/g	1.9 *	2.5 *	-	-

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240827-106-29**	**240827-106-30**	**240827-106-31**	**240827-106-32**
Client Sample ID:					
Sample Date/Time:		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Toro Ramp PAH24WI 4 Wet	Toro Ramp PAH24WI 5 Wet	Te Toro MET24WI1 Wet	Te Toro MET24WI2 Wet
Organics					
Adhoc investigation					
Indeno(1-2-3-c-d)pyrene	ng/g	<4.0 *	<4.0 *	-	-
Naphthalene	ng/g	8.5 *	9.9 *	-	-
Phenanthrene	ng/g	8.7 *	12.1 *	-	-
Pyrene	ng/g	1.9 *	2.3 *	-	-

Sample Details		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240827-106-33**	**240827-106-34**	**240827-106-35**	**240827-106-36**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Te Toro MET24WI3 Wet	Te Toro MET24WI4 Wet	Te Toro MET24WI5 Wet	Te Toro PAH24WI1 Wet
General Testing					
Percentage Moisture	%	87.7	88.7	87.2	-
Percentage Solids	%	12.3	11.3	12.8	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	13	12	-
Copper (Recoverable Dry Wt.)	mg/kg	370	320	370	-
Lead (Recoverable Dry Wt.)	mg/kg	0.28	0.23	0.29	-
Zinc (Recoverable Dry Wt.)	mg/kg	1300	1200	1200	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	-	-	1.3 *
Acenaphthylene	ng/g	-	-	-	<1.0 *
Anthracene	ng/g	-	-	-	1.6 *
Benzo(a)anthracene	ng/g	-	-	-	1.7 *
Benzo(a)pyrene	ng/g	-	-	-	<2.0 *
Benzo(b+k)fluoranthene	ng/g	-	-	-	<2.0 *
Benzo(ghi)perylene	ng/g	-	-	-	<4.0 *
Chrysene	ng/g	-	-	-	1.0 *
Comments		-	-	-	Sample tested using GCMS *
Dibenzo(ah)anthracene	ng/g	-	-	-	<4.0 *
Fluoranthene	ng/g	-	-	-	2.8 *
Fluorene	ng/g	-	-	-	2.9 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	-	-	<4.0 *
Naphthalene	ng/g	-	-	-	9.6 *
Phenanthrene	ng/g	-	-	-	14.0 *
Pyrene	ng/g	-	-	-	2.1 *

Sample Details		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240827-106-37**	**240827-106-38**	**240827-106-39**	**240827-106-40**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Te Toro PAH24WI2 Wet	Te Toro PAH24WI3 Wet	Te Toro PAH24WI4 Wet	Te Toro PAH24WI5 Wet
Organics					
Adhoc investigation					
Acenaphthene	ng/g	1.1 *	1.2 *	<1.0 *	1.2 *
Acenaphthylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	1.1 *
Benzo(a)anthracene	ng/g	1.4 *	1.6 *	1.3 *	1.6 *
Benzo(a)pyrene	ng/g	<2.0 *	<2.0 *	<2.0 *	<2.0 *
Benzo(b+k)fluoranthene	ng/g	<2.0 *	<2.0 *	<2.0 *	<2.0 *
Benzo(ghi)perylene	ng/g	<4.0 *	<4.0 *	<4.0 *	<4.0 *
Chrysene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Comments		Sample tested using GCMS *	Sample tested using GCMS *	Sample tested using GCMS *	Sample tested using GCMS *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240827-106-37**	**240827-106-38**	**240827-106-39**	**240827-106-40**
Client Sample ID:					
Sample Date/Time:		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Te Toro PAH24WI2 Wet	Te Toro PAH24WI3 Wet	Te Toro PAH24WI4 Wet	Te Toro PAH24WI5 Wet
Organics					
Adhoc investigation					
Dibenzo(ah)anthracene	ng/g	<4.0 *	<4.0 *	<4.0 *	<4.0 *
Fluoranthene	ng/g	2.1 *	2.1 *	2.5 *	2.2 *
Fluorene	ng/g	1.7 *	1.5 *	1.7 *	2.2 *
Indeno(1-2-3-c-d)pyrene	ng/g	<4.0 *	<4.0 *	<4.0 *	<4.0 *
Naphthalene	ng/g	8.9 *	9.6 *	10.2 *	9.4 *
Phenanthrene	ng/g	7.1 *	5.7 *	6.2 *	10.1 *
Pyrene	ng/g	1.5 *	1.4 *	1.5 *	1.5 *

Sample Details		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240827-106-41**	**240827-106-42**	**240827-106-43**	**240827-106-44**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Gordons MET24WI1 Wet	Gordons MET24WI2 Wet	Gordons MET24WI3 Wet	Gordons MET24WI4 Wet
General Testing					
Percentage Moisture	%	91.1	90.9	90.2	90.7
Percentage Solids	%	8.9	9.1	9.8	9.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	13	12	12
Copper (Recoverable Dry Wt.)	mg/kg	470	320	410	330
Lead (Recoverable Dry Wt.)	mg/kg	0.24	0.2	0.2	0.21
Zinc (Recoverable Dry Wt.)	mg/kg	1600	1100	1400	1200

Sample Details		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240827-106-45**	**240827-106-46**	**240827-106-47**	**240827-106-48**
Client Sample ID:					
Sample Date/Time		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Gordons MET24WI5 Wet	Gordons PAH24WI1 Wet	Gordons PAH24WI2 Wet	Gordons PAH24WI3 Wet
General Testing					
Percentage Moisture	%	91.5	-	-	-
Percentage Solids	%	8.5	-	-	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	330	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.2	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1100	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	<1.0 *	1.3 *	1.3 *
Acenaphthylene	ng/g	-	<1.0 *	<1.0 *	<1.0 *
Anthracene	ng/g	-	<1.0 *	<1.0 *	<1.0 *
Benzo(a)anthracene	ng/g	-	1.5 *	<1.0 *	1.4 *
Benzo(a)pyrene	ng/g	-	<2.0 *	<2.0 *	<2.0 *
Benzo(b+k)fluoranthene	ng/g	-	<2.0 *	<2.0 *	<2.0 *
Benzo(ghi)perylene	ng/g	-	<4.0 *	<4.0 *	<4.0 *
Chrysene	ng/g	-	1.2 *	<1.0 *	<1.0 *
Comments		-	Sample tested using GCMS *	Sample tested using GCMS *	Sample tested using GCMS *
Dibenzo(ah)anthracene	ng/g	-	<4.0 *	<4.0 *	<4.0 *
Fluoranthene	ng/g	-	3.3 *	2.3 *	2.5 *
Fluorene	ng/g	-	1.9 *	1.7 *	1.8 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	<4.0 *	<4.0 *	<4.0 *
Naphthalene	ng/g	-	10.1 *	9.4 *	10.0 *
Phenanthrene	ng/g	-	8.1 *	7.6 *	8.2 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240827-106-45**	**240827-106-46**	**240827-106-47**	**240827-106-48**
Client Sample ID:					
Sample Date/Time:		15/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Gordons MET24WI5 Wet	Gordons PAH24WI1 Wet	Gordons PAH24WI2 Wet	Gordons PAH24WI3 Wet
Organics					
Adhoc investigation					
Pyrene	ng/g	-	2.1 *	1.6 *	1.9 *

Sample Details		240827-106-49	240827-106-50
Lab Sample ID:			
Client Sample ID:			
Sample Date/Time		15/08/2024	15/08/2024
Description:		Gordons PAH24WI4 Wet	Gordons PAH24WI5 Wet
Organics			
Adhoc investigation			
Acenaphthene	ng/g	1.1 *	<1.0 *
Acenaphthylene	ng/g	<1.0 *	<1.0 *
Anthracene	ng/g	1.6 *	1.1 *
Benzo(a)anthracene	ng/g	2.4 *	1.4 *
Benzo(a)pyrene	ng/g	<2.0 *	<2.0 *
Benzo(b+k)fluoranthene	ng/g	3.6 *	<2.0 *
Benzo(ghi)perylene	ng/g	<4.0 *	<4.0 *
Chrysene	ng/g	3.6 *	<1.0 *
Comments		Sample tested using GCMS *	Sample tested using GCMS *
Dibenzo(ah)anthracene	ng/g	<4.0 *	<4.0 *
Fluoranthene	ng/g	3.0 *	2.2 *
Fluorene	ng/g	2.4 *	1.8 *
Indeno(1-2-3-c-d)pyrene	ng/g	<4.0 *	<4.0 *
Naphthalene	ng/g	9.1 *	9.4 *
Phenanthrene	ng/g	11.6 *	7.7 *
Pyrene	ng/g	2.9 *	1.9 *

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.

The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Organics				
Adhoc investigation				
Comments	As specified above		6, 7, 8, 9, 10, 16, 17, 18, 19, 20, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Anel Du Preez
KTP Signatory

Peter Boniface
KTP Signatory

Certificate of Analysis Metals & PAH - October 2024

Watercare
Laboratory Services

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Certificate of Analysis
Laboratory Reference:241014-099

Attention:	Laureline Meynier	*Final Report:*	**572364-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**10-Dec-2024**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**19-Nov-2024**
Client Reference:	**SW Clark WWTP Monitoring - Contaminants**	*Laboratory Activity Dates:*	**20-Nov-2024 - 10-Dec-2024**
Purchase Order:	**Y-3310-LB-002**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**241014-099-1**	**241014-099-2**	**241014-099-3**	**241014-099-4**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Matakawau MET24WI 1 dry	Matakawau MET24WI 2 dry	Matakawau MET24WI 3 dry	Matakawau MET24WI 4 dry
General Testing					
Percentage Moisture	%	87.1	87.1	87.3	88.1
Percentage Solids	%	12.9	12.9	12.7	11.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	15	13	14
Copper (Recoverable Dry Wt.)	mg/kg	150	120	340	360
Lead (Recoverable Dry Wt.)	mg/kg	0.17	0.21	0.26	0.39
Zinc (Recoverable Dry Wt.)	mg/kg	1700	1400	1200	1500

Sample Details					
Lab Sample ID:		**241014-099-5**	**241014-099-6**	**241014-099-7**	**241014-099-8**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Matakawau MET24WI 5 dry	Matakawau PAH24WI 1 dry	Matakawau PAH24WI 2 dry	Matakawau PAH24WI 3 dry
General Testing					
Percentage Moisture	%	87.7	-	-	-
Percentage Solids	%	12.3	-	-	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	130	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.21	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1600	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	0.33 *	0.45 *	0.36 *
Acenaphthylene	ng/g	-	0.49 *	0.35 *	0.31 *
Anthracene	ng/g	-	1.82 *	1.20 *	1.24 *
Benzo(a)anthracene	ng/g	-	0.46 *	0.43 *	0.84 *
Benzo(a)pyrene	ng/g	-	0.32 *	0.32 *	0.33 *
Benzo(b+k)fluoranthene	ng/g	-	0.40 *	0.47 *	0.23 *
Benzo(ghi)perylene	ng/g	-	<1 *	<1 *	<1 *
Chrysene	ng/g	-	0.74 *	0.82 *	0.64 *
Comments		-	Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *
Dibenz(ah)anthracene	ng/g	-	<1 *	<1 *	<1 *
Fluoranthene	ng/g	-	2.58 *	2.96 *	1.58 *
Fluorene	ng/g	-	1.45 *	1.72 *	1.25 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	<1 *	<1 *	<1 *
Naphthalene	ng/g	-	2.23 *	2.68 *	2.58 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**241014-099-5**	**241014-099-6**	**241014-099-7**	**241014-099-8**
Client Sample ID:					
Sample Date/Time:		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Matakawau MET24WI 5 dry	Matakawau PAH24WI 1 dry	Matakawau PAH24WI 2 dry	Matakawau PAH24WI 3 dry
Organics					
Adhoc investigation					
Phenanthrene	ng/g	-	6.80 *	8.16 *	4.79 *
Pyrene	ng/g	-	2.87 *	3.42 *	1.55 *

Sample Details					
Lab Sample ID:		**241014-099-9**	**241014-099-10**	**241014-099-11**	**241014-099-12**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Matakawau PAH24WI 4 dry	Matakawau PAH24WI 5 dry	Karaka MET24WI1 dry	Karaka MET24WI2 dry
General Testing					
Percentage Moisture	%	-	-	86.8	88.3
Percentage Solids	%	-	-	13.2	11.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	-	14	11
Copper (Recoverable Dry Wt.)	mg/kg	-	-	310	290
Lead (Recoverable Dry Wt.)	mg/kg	-	-	0.38	0.3
Zinc (Recoverable Dry Wt.)	mg/kg	-	-	1300	1400
Organics					
Adhoc investigation					
Acenaphthene	ng/g	0.28 *	0.26 *	-	-
Acenaphthylene	ng/g	0.14 *	0.14 *	-	-
Anthracene	ng/g	0.28 *	0.44 *	-	-
Benzo(a)anthracene	ng/g	0.27 *	0.29 *	-	-
Benzo(a)pyrene	ng/g	<1 *	<1 *	-	-
Benzo(b+k)fluoranthene	ng/g	0.19 *	0.42 *	-	-
Benzo(ghi)perylene	ng/g	<1 *	<1 *	-	-
Chrysene	ng/g	0.46 *	0.49 *	-	-
Comments		Analysed by GCMS *	Analysed by GCMS *	-	-
Dibenz(ah)anthracene	ng/g	<1 *	<1 *	-	-
Fluoranthene	ng/g	0.80 *	0.79 *	-	-
Fluorene	ng/g	0.74 *	0.98 *	-	-
Indeno(1-2-3-c-d)pyrene	ng/g	<1 *	<1 *	-	-
Naphthalene	ng/g	2.66 *	4.23 *	-	-
Phenanthrene	ng/g	1.59 *	1.55 *	-	-
Pyrene	ng/g	0.43 *	0.55 *	-	-

Sample Details					
Lab Sample ID:		**241014-099-13**	**241014-099-14**	**241014-099-15**	**241014-099-16**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Karaka MET24WI3 dry	Karaka MET24WI4 dry	Karaka MET24WI5 dry	Karaka PAH24WI1 dry
General Testing					
Percentage Moisture	%	89.2	89.7	87.6	-
Percentage Solids	%	10.8	10.3	12.4	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	11	13	-
Copper (Recoverable Dry Wt.)	mg/kg	420	280	330	-
Lead (Recoverable Dry Wt.)	mg/kg	0.33	0.35	0.32	-
Zinc (Recoverable Dry Wt.)	mg/kg	1900	1400	1600	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	-	-	0.36 *
Acenaphthylene	ng/g	-	-	-	0.47 *
Anthracene	ng/g	-	-	-	0.75 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**241014-099-13**	**241014-099-14**	**241014-099-15**	**241014-099-16**
Client Sample ID:					
Sample Date/Time:		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Karaka MET24WI3 dry	Karaka MET24WI4 dry	Karaka MET24WI5 dry	Karaka PAH24WI1 dry
Organics					
Adhoc investigation					
Benzo(a)anthracene	ng/g	-	-	-	0.70 *
Benzo(a)pyrene	ng/g	-	-	-	0.38 *
Benzo(b+k)fluoranthene	ng/g	-	-	-	0.47 *
Benzo(ghi)perylene	ng/g	-	-	-	<1 *
Chrysene	ng/g	-	-	-	0.68 *
Comments		-	-	-	Analysed by GCMS *
Dibenz(ah)anthracene	ng/g	-	-	-	<1 *
Fluoranthene	ng/g	-	-	-	1.80 *
Fluorene	ng/g	-	-	-	1.39 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	-	-	<1 *
Naphthalene	ng/g	-	-	-	2.74 *
Phenanthrene	ng/g	-	-	-	5.74 *
Pyrene	ng/g	-	-	-	1.81 *

Sample Details					
Lab Sample ID:		**241014-099-17**	**241014-099-18**	**241014-099-19**	**241014-099-20**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Karaka PAH24WI2 dry	Karaka PAH24WI3 dry	Karaka PAH24WI4 dry	Karaka PAH24WI5 dry
Organics					
Adhoc investigation					
Acenaphthene	ng/g	0.48 *	0.41 *	0.33 *	0.54 *
Acenaphthylene	ng/g	0.28 *	0.44 *	0.35 *	0.69 *
Anthracene	ng/g	0.88 *	0.89 *	0.52 *	0.66 *
Benzo(a)anthracene	ng/g	0.92 *	0.98 *	0.92 *	1.03 *
Benzo(a)pyrene	ng/g	0.36 *	0.23 *	0.43 *	0.37 *
Benzo(b+k)fluoranthene	ng/g	0.39 *	0.49 *	0.54 *	0.38 *
Benzo(ghi)perylene	ng/g	<1 *	<1 *	<1 *	<1 *
Chrysene	ng/g	0.63 *	0.60 *	0.67 *	0.50 *
Comments		Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *
Dibenz(ah)anthracene	ng/g	<1 *	<1 *	<1 *	<1 *
Fluoranthene	ng/g	2.44 *	2.25 *	1.55 *	1.69 *
Fluorene	ng/g	1.51 *	1.26 *	1.03 *	1.67 *
Indeno(1-2-3-c-d)pyrene	ng/g	<1 *	<1 *	<1 *	<1 *
Naphthalene	ng/g	3.38 *	2.37 *	2.28 *	2.73 *
Phenanthrene	ng/g	7.47 *	5.94 *	4.44 *	6.40 *
Pyrene	ng/g	2.81 *	2.67 *	1.50 *	1.69 *

Sample Details					
Lab Sample ID:		**241014-099-21**	**241014-099-22**	**241014-099-23**	**241014-099-24**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Toro ramp MET24WI1 dry	Toro ramp MET24WI2 dry	Toro ramp MET24WI3 dry	Toro ramp MET24WI4 dry
General Testing					
Percentage Moisture	%	88.3	88.5	87.2	88.3
Percentage Solids	%	11.7	11.5	12.8	11.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	12	11	14
Copper (Recoverable Dry Wt.)	mg/kg	310	350	250	350
Lead (Recoverable Dry Wt.)	mg/kg	0.22	0.23	0.25	0.24
Zinc (Recoverable Dry Wt.)	mg/kg	1200	1400	1100	1600

Sample Details					
Lab Sample ID:		**241014-099-25**	**241014-099-26**	**241014-099-27**	**241014-099-28**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Toro ramp MET24WI5 dry	Toro ramp PAH24WI1 dry	Toro ramp PAH24WI2 dry	Toro ramp PAH24WI3 dry
General Testing					
Percentage Moisture	%	87.2	-	-	-
Percentage Solids	%	12.8	-	-	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	370	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.22	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1700	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	0.44 *	0.43 *	0.32 *
Acenaphthylene	ng/g	-	0.37 *	0.54 *	0.29 *
Anthracene	ng/g	-	1.06 *	0.87 *	0.69 *
Benzo(a)anthracene	ng/g	-	0.43 *	0.88 *	0.82 *
Benzo(a)pyrene	ng/g	-	0.38 *	0.38 *	0.31 *
Benzo(b+k)fluoranthene	ng/g	-	0.48 *	0.46 *	0.35 *
Benzo(ghi)perylene	ng/g	-	<1 *	<1 *	<1 *
Chrysene	ng/g	-	0.58 *	0.72 *	0.48 *
Comments		-	Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *
Dibenz(ah)anthracene	ng/g	-	<1 *	<1 *	<1 *
Fluoranthene	ng/g	-	2.74 *	2.14 *	1.47 *
Fluorene	ng/g	-	1.56 *	1.40 *	1.02 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	<1 *	<1 *	<1 *
Naphthalene	ng/g	-	3.25 *	3.88 *	2.90 *
Phenanthrene	ng/g	-	8.18 *	6.59 *	4.88 *
Pyrene	ng/g	-	3.22 *	2.09 *	1.58 *

Sample Details					
Lab Sample ID:		**241014-099-29**	**241014-099-30**	**241014-099-31**	**241014-099-32**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Toro ramp PAH24WI4 dry	Toro ramp PAH24WI5 dry	Te Toro MET24WI1 dry	Te Toro MET24WI2 dry
General Testing					
Percentage Moisture	%	-	-	89.4	89.7
Percentage Solids	%	-	-	10.6	10.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	-	11	12
Copper (Recoverable Dry Wt.)	mg/kg	-	-	360	250
Lead (Recoverable Dry Wt.)	mg/kg	-	-	0.22	0.22
Zinc (Recoverable Dry Wt.)	mg/kg	-	-	1200	1400
Organics					
Adhoc investigation					
Acenaphthene	ng/g	0.42 *	0.40 *	-	-
Acenaphthylene	ng/g	0.42 *	0.54 *	-	-
Anthracene	ng/g	0.81 *	0.66 *	-	-
Benzo(a)anthracene	ng/g	0.48 *	1.04 *	-	-
Benzo(a)pyrene	ng/g	0.42 *	0.33 *	-	-
Benzo(b+k)fluoranthene	ng/g	0.49 *	0.45 *	-	-
Benzo(ghi)perylene	ng/g	<1 *	<1 *	-	-
Chrysene	ng/g	0.58 *	0.71 *	-	-
Comments		Analysed by GCMS *	Analysed by GCMS *	-	-
Dibenz(ah)anthracene	ng/g	<1 *	<1 *	-	-
Fluoranthene	ng/g	1.79 *	2.73 *	-	-
Fluorene	ng/g	1.39 *	1.32 *	-	-
Indeno(1-2-3-c-d)pyrene	ng/g	<1 *	<1 *	-	-

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**241014-099-29**	**241014-099-30**	**241014-099-31**	**241014-099-32**
Client Sample ID:					
Sample Date/Time:		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Toro ramp PAH24WI4 dry	Toro ramp PAH24WI5 dry	Te Toro MET24WI1 dry	Te Toro MET24WI2 dry
Organics					
Adhoc investigation					
Naphthalene	ng/g	3.50 *	3.51 *	-	-
Phenanthrene	ng/g	6.11 *	7.05 *	-	-
Pyrene	ng/g	1.84 *	2.90 *	-	-

Sample Details					
Lab Sample ID:		**241014-099-33**	**241014-099-34**	**241014-099-35**	**241014-099-36**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Te Toro MET24WI3 dry	Te Toro MET24WI4 dry	Te Toro MET24WI5 dry	Te Toro PAH24WI1 dry
General Testing					
Percentage Moisture	%	89.7	88.1	89.4	-
Percentage Solids	%	10.3	11.9	10.6	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	13	12	-
Copper (Recoverable Dry Wt.)	mg/kg	360	240	400	-
Lead (Recoverable Dry Wt.)	mg/kg	0.24	0.22	0.22	-
Zinc (Recoverable Dry Wt.)	mg/kg	1600	1300	1600	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	-	-	0.43 *
Acenaphthylene	ng/g	-	-	-	0.33 *
Anthracene	ng/g	-	-	-	1.49 *
Benzo(a)anthracene	ng/g	-	-	-	0.90 *
Benzo(a)pyrene	ng/g	-	-	-	0.40 *
Benzo(b+k)fluoranthene	ng/g	-	-	-	0.38 *
Benzo(ghi)perylene	ng/g	-	-	-	<1 *
Chrysene	ng/g	-	-	-	0.64 *
Comments		-	-	-	Analysed by GCMS *
Dibenz(ah)anthracene	ng/g	-	-	-	<1 *
Fluoranthene	ng/g	-	-	-	2.78 *
Fluorene	ng/g	-	-	-	1.59 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	-	-	<1 *
Naphthalene	ng/g	-	-	-	3.87 *
Phenanthrene	ng/g	-	-	-	8.91 *
Pyrene	ng/g	-	-	-	3.32 *

Sample Details					
Lab Sample ID:		**241014-099-37**	**241014-099-38**	**241014-099-39**	**241014-099-40**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Te Toro PAH24WI2 dry	Te Toro PAH24WI3 dry	Te Toro PAH24WI4 dry	Te Toro PAH24WI5 dry
Organics					
Adhoc investigation					
Acenaphthene	ng/g	0.42 *	0.36 *	0.54 *	1.16 *
Acenaphthylene	ng/g	0.34 *	0.28 *	0.65 *	0.40 *
Anthracene	ng/g	1.00 *	1.32 *	1.32 *	1.64 *
Benzo(a)anthracene	ng/g	1.19 *	1.01 *	1.02 *	1.06 *
Benzo(a)pyrene	ng/g	0.39 *	0.37 *	0.40 *	0.20 *
Benzo(b+k)fluoranthene	ng/g	0.37 *	0.39 *	0.46 *	0.36 *
Benzo(ghi)perylene	ng/g	<1 *	<1 *	<1 *	<1 *
Chrysene	ng/g	0.51 *	0.70 *	0.68 *	0.68 *
Comments		Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *
Dibenz(ah)anthracene	ng/g	<1 *	<1 *	<1 *	<1 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**241014-099-37**	**241014-099-38**	**241014-099-39**	**241014-099-40**
Client Sample ID:					
Sample Date/Time:		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Te Toro PAH24WI2 dry	Te Toro PAH24WI3 dry	Te Toro PAH24WI4 dry	Te Toro PAH24WI5 dry
Organics					
Adhoc investigation					
Fluoranthene	ng/g	2.08 *	2.92 *	3.25 *	3.21 *
Fluorene	ng/g	1.24 *	1.83 *	2.04 *	2.23 *
Indeno(1-2-3-c-d)pyrene	ng/g	<1 *	<1 *	<1 *	<1 *
Naphthalene	ng/g	3.34 *	4.18 *	4.47 *	4.64 *
Phenanthrene	ng/g	5.98 *	9.82 *	11.32 *	12.18 *
Pyrene	ng/g	2.34 *	3.31 *	3.29 *	4.01 *

Sample Details					
Lab Sample ID:		**241014-099-41**	**241014-099-42**	**241014-099-43**	**241014-099-44**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Gordons MET24WI1 dry	Gordons MET24WI2 dry	Gordons MET24WI3 dry	Gordons MET24WI4 dry
General Testing					
Percentage Moisture	%	90.4	90.4	90.2	90.1
Percentage Solids	%	9.6	9.6	9.8	9.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	13	12	11
Copper (Recoverable Dry Wt.)	mg/kg	470	480	520	610
Lead (Recoverable Dry Wt.)	mg/kg	0.27	0.28	0.27	0.28
Zinc (Recoverable Dry Wt.)	mg/kg	1500	1800	1800	1900

Sample Details					
Lab Sample ID:		**241014-099-45**	**241014-099-46**	**241014-099-47**	**241014-099-48**
Client Sample ID:					
Sample Date/Time		30/10/2024	30/10/2024	30/10/2024	30/10/2024
Description:		Gordons MET24WI5 dry	Gordons PAH24WI1 dry	Gordons PAH24WI2 dry	Gordons PAH24WI3 dry
General Testing					
Percentage Moisture	%	90.2	-	-	-
Percentage Solids	%	9.8	-	-	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	500	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.24	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1800	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	0.65 *	0.64 *	0.53 *
Acenaphthylene	ng/g	-	0.45 *	0.86 *	0.63 *
Anthracene	ng/g	-	0.78 *	1.67 *	1.22 *
Benzo(a)anthracene	ng/g	-	0.86 *	1.61 *	0.92 *
Benzo(a)pyrene	ng/g	-	0.44 *	0.68 *	0.56 *
Benzo(b+k)fluoranthene	ng/g	-	0.64 *	0.92 *	1.54 *
Benzo(ghi)perylene	ng/g	-	<1 *	<1 *	<1 *
Chrysene	ng/g	-	0.75 *	1.01 *	0.93 *
Comments		-	Analysed by GCMS *	Analysed by GCMS *	Analysed by GCMS *
Dibenz(ah)anthracene	ng/g	-	<1 *	<1 *	<1 *
Fluoranthene	ng/g	-	2.42 *	4.19 *	3.70 *
Fluorene	ng/g	-	1.96 *	2.44 *	2.05 *
Indeno(1-2-3-c-d)pyrene	ng/g	-	<1 *	<1 *	<1 *
Naphthalene	ng/g	-	3.38 *	3.73 *	3.99 *
Phenanthrene	ng/g	-	9.26 *	13.37 *	12.91 *
Pyrene	ng/g	-	2.72 *	4.66 *	4.50 *

Sample Details			
Lab Sample ID:		**241014-099-49**	**241014-099-50**
Client Sample ID:			
Sample Date/Time		30/10/2024	30/10/2024
Description:		Gordons PAH24WI4 dry	Gordons PAH24WI5 dry
Organics			
Adhoc investigation			
Acenaphthene	ng/g	0.46 *	0.60 *
Acenaphthylene	ng/g	0.42 *	0.98 *
Anthracene	ng/g	1.42 *	1.65 *
Benzo(a)anthracene	ng/g	0.64 *	1.76 *
Benzo(a)pyrene	ng/g	0.31 *	0.52 *
Benzo(b+k)fluoranthene	ng/g	1.00 *	0.58 *
Benzo(ghi)perylene	ng/g	<1 *	<1 *
Chrysene	ng/g	0.64 *	0.86 *
Comments		Analysed by GCMS *	Analysed by GCMS *
Dibenz(ah)anthracene	ng/g	<1 *	<1 *
Fluoranthene	ng/g	2.78 *	3.31 *
Fluorene	ng/g	1.75 *	1.97 *
Indeno(1-2-3-c-d)pyrene	ng/g	<1 *	<1 *
Naphthalene	ng/g	3.31 *	3.33 *
Phenanthrene	ng/g	9.43 *	10.70 *
Pyrene	ng/g	2.86 *	4.21 *

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.

The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Organics				
Adhoc investigation				
Comments	As specified above		6, 7, 8, 9, 10, 16, 17, 18, 19, 20, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland

Preparations			
Biomatter Percentage Solids	APHA (online edition) 2540 B	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

Watercare Laboratory Services is a division of Watercare Services Limited .

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Anel Du Preez
KTP Signatory

Peter Boniface
KTP Signatory

Certificate of Analysis Metals & PAH - January 2025

Watercare
Laboratory Services

Watercare Services Limited
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PO Box 107028, Auckland, 2150
T: 0800 522 365
clientsupport@water.co.nz
www.watercarelabs.co.nz

Certificate of Analysis
Laboratory Reference: 250218-124

Attention:		*Final Report:*	**591842-0**	*Replaces Report*	**591389-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**05-Jun-2025**		
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**18-Feb-2025**		
Client Reference:	**SW Clark WWTP Monitoring - Contaminants**	*Laboratory Activity Dates:*	**18-Feb-2025** -	**29-May-2025**	
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16353**		

This is an amended report superseding 581967-0. The PAH results have been corrected for amount and the correct units are now applied. We apologise for this error on our part.

Sample Details					
Lab Sample ID:		**250218-124-1**	**250218-124-2**	**250218-124-3**	**250218-124-4**
Client Sample ID:					
Sample Date/Time		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Matakawau MET25WI 1 dry	Matakawau MET25WI 2 dry	Matakawau MET25WI 3 dry	Matakawau MET25WI 4 dry
General Testing					
Percentage Moisture	%	89.3	90.9	90.1	90.4
Percentage Solids	%	10.7	9.1	9.9	9.6
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	9.0	12	13	13
Copper (Recoverable Dry Wt.)	mg/kg	290	320	330	380
Lead (Recoverable Dry Wt.)	mg/kg	0.23	0.36	0.31	0.33
Zinc (Recoverable Dry Wt.)	mg/kg	1400	1400	1600	1600

Sample Details					
Lab Sample ID:		**250218-124-5**	**250218-124-6**	**250218-124-7**	**250218-124-8**
Client Sample ID:					
Sample Date/Time		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Matakawau MET25WI 5 dry	Matakawau PAH25WI 1 dry	Matakawau PAH25WI 2 dry	Matakawau PAH25WI 3 dry
General Testing					
Percentage Moisture	%	91.6	91.3	90.4	90.3
Percentage Solids	%	8.4	8.7	9.6	9.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	410	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.3	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1900	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	<0.2 *	<0.2 *	0.62 *
Acenaphthylene	ng/g	-	<0.2 *	0.56 *	0.44 *
Anthracene	ng/g	-	<0.2 *	0.89 *	0.84 *
Ben[a]anthracene	ng/g	-	0.67 *	0.70 *	0.62 *
Benzo[a]anthracene	ng/g	-	0.67 *	0.70 *	0.62 *
Benzo[a]pyrene	ng/g	-	0.39 *	< 0.2 *	0.55 *
Benzo[b+k]fluoranthene	ng/g	-	0.81 *	0.58 *	0.65 *
Benzo[g,h,i]perylene	ng/g	-	<1 *	<1 *	<1 *
Chrysene	ng/g	-	<0.2 *	1.16 *	0.63 *
Comments		-	GC-MSMS *	GC-MSMS *	GC-MSMS *
Dibenz[a,h]anthrancene	ng/g	-	<1 *	<1 *	<1 *
Fluoranthene	ng/g	-	1.73 *	2.12 *	2.96 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250218-124-5**	**250218-124-6**	**250218-124-7**	**250218-124-8**
Client Sample ID:					
Sample Date/Time:		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Matakawau MET25WI 5 dry	Matakawau PAH25WI 1 dry	Matakawau PAH25WI 2 dry	Matakawau PAH25WI 3 dry
Organics					
Adhoc investigation					
Fluorene	ng/g	-	1.27 *	1.48 *	1.81 *
Indeno[1,2,3-cd]pyrene	ng/g	-	<1 *	<1 *	<1 *
Naphthalene	ng/g	-	2.78 *	5.53 *	13.96 *
Phenanathrene	ng/g	-	1.38 *	1.40 *	1.93 *
Pyrene	ng/g	-	2.24 *	2.04 *	2.65 *

Sample Details					
Lab Sample ID:		**250218-124-9**	**250218-124-10**	**250218-124-11**	**250218-124-12**
Client Sample ID:					
Sample Date/Time		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Matakawau PAH25WI 4 dry	Matakawau PAH25WI 5 dry	Te Toro MET25WI1 dry	Te Toro MET25WI2 dry
General Testing					
Percentage Moisture	%	90.7	91.8	87.9	90.3
Percentage Solids	%	9.3	8.2	12.1	9.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	-	15	11
Copper (Recoverable Dry Wt.)	mg/kg	-	-	220	370
Lead (Recoverable Dry Wt.)	mg/kg	-	-	0.19	0.21
Zinc (Recoverable Dry Wt.)	mg/kg	-	-	940	1600
Organics					
Adhoc investigation					
Acenaphthene	ng/g	0.68 *	<0.2 *	-	-
Acenaphthylene	ng/g	0.51 *	<0.2 *	-	-
Anthracene	ng/g	0.60 *	0.33 *	-	-
Ben[a]anthracene	ng/g	0.64 *	-	-	-
Benzo[a]anthracene	ng/g	0.64 *	0.80 *	-	-
Benzo[a]pyrene	ng/g	0.60 *	0.53 *	-	-
Benzo[b+k]fluoranthene	ng/g	0.74 *	0.78 *	-	-
Benzo[g,h,i]perylene	ng/g	<1 *	<1 *	-	-
Chrysene	ng/g	0.73 *	0.55 *	-	-
Comments		GC-MSMS *	GC-MSMS *	-	-
Dibenz[a,h]anthrancene	ng/g	<1 *	<1 *	-	-
Fluoranthene	ng/g	2.81 *	2.44 *	-	-
Fluorene	ng/g	1.81 *	1.38 *	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1 *	<1 *	-	-
Naphthalene	ng/g	9.21 *	6.22 *	-	-
Phenanathrene	ng/g	2.18 *	1.02 *	-	-
Pyrene	ng/g	2.38 *	2.15 *	-	-

Sample Details					
Lab Sample ID:		**250218-124-13**	**250218-124-14**	**250218-124-15**	**250218-124-16**
Client Sample ID:					
Sample Date/Time		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Te Toro MET25WI3 dry	Te Toro MET25WI4 dry	Te Toro MET25WI5 dry	Te Toro PAH25WI1 dry
General Testing					
Percentage Moisture	%	89.4	89.3	87.0	88.5
Percentage Solids	%	10.6	10.7	13.0	11.5
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	14	15	-
Copper (Recoverable Dry Wt.)	mg/kg	350	440	280	-
Lead (Recoverable Dry Wt.)	mg/kg	0.24	0.25	0.19	-
Zinc (Recoverable Dry Wt.)	mg/kg	1500	1900	1100	-
Organics					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250218-124-13**	**250218-124-14**	**250218-124-15**	**250218-124-16**
Client Sample ID:					
Sample Date/Time:		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Te Toro MET25WI3 dry	Te Toro MET25WI4 dry	Te Toro MET25WI5 dry	Te Toro PAH25WI1 dry
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	-	-	<0.2 *
Acenaphthylene	ng/g	-	-	-	0.50 *
Anthracene	ng/g	-	-	-	0.48 *
Ben[a]anthracene	ng/g	-	-	-	0.70 *
Benzo[a]anthracene	ng/g	-	-	-	0.70 *
Benzo[a]pyrene	ng/g	-	-	-	0.50 *
Benzo[b+k]fluoranthene	ng/g	-	-	-	0.46 *
Benzo[g,h,i]perylene	ng/g	-	-	-	<1 *
Chrysene	ng/g	-	-	-	0.69 *
Comments		-	-	-	GC-MSMS *
Dibenz[a,h]anthrancene	ng/g	-	-	-	<1 *
Fluoranthene	ng/g	-	-	-	2.72 *
Fluorene	ng/g	-	-	-	1.26 *
Indeno[1,2,3-cd]pyrene	ng/g	-	-	-	<1 *
Naphthalene	ng/g	-	-	-	3.71 *
Phenanathrene	ng/g	-	-	-	1.31 *
Pyrene	ng/g	-	-	-	2.30 *

Sample Details					
Lab Sample ID:		**250218-124-17**	**250218-124-18**	**250218-124-19**	**250218-124-20**
Client Sample ID:					
Sample Date/Time		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Te Toro PAH25WI2 dry	Te Toro PAH25WI3 dry	Te Toro PAH25WI4 dry	Te Toro PAH25WI5 dry
General Testing					
Percentage Moisture	%	89.1	87.5	88.7	90.7
Percentage Solids	%	10.9	12.5	11.3	9.3
Organics					
Adhoc investigation					
Acenaphthene	ng/g	0.59 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	0.23 *	0.38 *	0.49 *	< 0.2 *
Anthracene	ng/g	0.59 *	1.03 *	0.75 *	0.91 *
Ben[a]anthracene	ng/g	0.57 *	<0.2 *	0.61 *	0.67 *
Benzo[a]anthracene	ng/g	0.57 *	<0.2 *	0.61 *	0.67 *
Benzo[a]pyrene	ng/g	0.48 *	<0.2 *	0.65 *	< 0.2 *
Benzo[b+k]fluoranthene	ng/g	0.22 *	0.37 *	0.43 *	0.37 *
Benzo[g,h,i]perylene	ng/g	<1 *	<1 *	<1 *	<1 *
Chrysene	ng/g	0.49 *	0.60 *	0.87 *	0.74 *
Comments		GC-MSMS *	GC-MSMS *	GC-MSMS *	GC-MSMS *
Dibenz[a,h]anthrancene	ng/g	<1 *	<1 *	<1 *	<1 *
Fluoranthene	ng/g	2.88 *	3.61 *	3.22 *	2.50 *
Fluorene	ng/g	1.71 *	2.17 *	1.71 *	1.91 *
Indeno[1,2,3-cd]pyrene	ng/g	<1 *	<1 *	<1 *	<1 *
Naphthalene	ng/g	6.53 *	17.50 *	9.97 *	7.96 *
Phenanathrene	ng/g	1.86 *	2.98 *	2.10 *	3.42 *
Pyrene	ng/g	2.34 *	2.65 *	2.83 *	1.89 *

Sample Details					
Lab Sample ID:		**250218-124-21**	**250218-124-22**	**250218-124-23**	**250218-124-24**
Client Sample ID:					
Sample Date/Time		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Gordons MET25WI1	Gordons MET25WI2	Gordons MET25WI3	Gordons MET25WI4
General Testing					
Percentage Moisture	%	90.3	90.6	91.2	93.0
Percentage Solids	%	9.7	9.4	8.8	7.0
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250218-124-21**	**250218-124-22**	**250218-124-23**	**250218-124-24**
Client Sample ID:					
Sample Date/Time:		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Gordons MET25WI1	Gordons MET25WI2	Gordons MET25WI3	Gordons MET25WI4
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	12	12	11
Copper (Recoverable Dry Wt.)	mg/kg	410	360	510	540
Lead (Recoverable Dry Wt.)	mg/kg	0.22	0.21	0.21	0.26
Zinc (Recoverable Dry Wt.)	mg/kg	2000	1500	2000	2300

Sample Details					
Lab Sample ID:		**250218-124-25**	**250218-124-26**	**250218-124-27**	**250218-124-28**
Client Sample ID:					
Sample Date/Time		22/01/2025	22/01/2025	22/01/2025	22/01/2025
Description:		Gordons MET25WI5	Gordons PAH25WI1	Gordons PAH25WI2	Gordons PAH25WI3
General Testing					
Percentage Moisture	%	91.1	90.3	91.2	92.0
Percentage Solids	%	8.9	9.7	8.8	8.0
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	500	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.19	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	2000	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	-	0.32 *	0.37 *	0.22 *
Anthracene	ng/g	-	0.93 *	0.67 *	0.68 *
Ben[a]anthracene	ng/g	-	0.46 *	0.67 *	0.63 *
Benzo[a]anthracene	ng/g	-	0.46 *	0.67 *	0.63 *
Benzo[a]pyrene	ng/g	-	1.15 *	0.59 *	0.65 *
Benzo[b+k]fluoranthene	ng/g	-	0.89 *	0.43 *	0.64 *
Benzo[g,h,i]perylene	ng/g	-	<1 *	<1 *	<1 *
Chrysene	ng/g	-	1.54 *	0.89 *	0.69 *
Comments		-	GC-MSMS *	GC-MSMS *	GC-MSMS *
Dibenz[a,h]anthrancene	ng/g	-	<1 *	<1 *	<1 *
Fluoranthene	ng/g	-	3.77 *	2.44 *	2.66 *
Fluorene	ng/g	-	1.47 *	1.77 *	1.66 *
Indeno[1,2,3-cd]pyrene	ng/g	-	<1 *	<1 *	<1 *
Naphthalene	ng/g	-	4.96 *	6.29 *	4.48 *
Phenanathrene	ng/g	-	2.10 *	1.41 *	1.74 *
Pyrene	ng/g	-	2.80 *	2.01 *	2.25 *

Sample Details			
Lab Sample ID:		**250218-124-29**	**250218-124-30**
Client Sample ID:			
Sample Date/Time		22/01/2025	22/01/2025
Description:		Gordons PAH25WI4	Gordons PAH25WI5
General Testing			
Percentage Moisture	%	90.3	90.6
Percentage Solids	%	9.7	9.4
Organics			
Adhoc investigation			
Acenaphthene	ng/g	<0.2 *	0.59 *
Acenaphthylene	ng/g	0.55 *	0.53 *
Anthracene	ng/g	1.11 *	0.63 *
Ben[a]anthracene	ng/g	< 0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	0.88 *	0.89 *
Benzo[b+k]fluoranthene	ng/g	0.58 *	0.47 *
Benzo[g,h,i]perylene	ng/g	<1 *	<1 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250218-124-29**	**250218-124-30**
Client Sample ID:			
Sample Date/Time:		22/01/2025	22/01/2025
Description:		Gordons PAH25WI4	Gordons PAH25WI5
Organics			
Adhoc investigation			
Chrysene	ng/g	1.45 *	0.94 *
Comments		GC-MSMS *	GC-MSMS *
Dibenz[a,h]anthrancene	ng/g	<1 *	<1 *
Fluoranthene	ng/g	3.39 *	2.97 *
Fluorene	ng/g	2.12 *	1.96 *
Indeno[1,2,3-cd]pyrene	ng/g	<1 *	<1 *
Naphthalene	ng/g	11.08 *	4.02 *
Phenanathrene	ng/g	1.54 *	2.25 *
Pyrene	ng/g	2.55 *	2.24 *

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.

The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25	Auckland
Organics				
Adhoc investigation				
Comments	As specified above		6, 7, 8, 9, 10, 16, 17, 18, 19, 20, 26, 27, 28, 29, 30	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		All	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B		All	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Report Number: **591842-0** Watercare Laboratory Services **Page 5 of 5**

Certificate of Analysis Metals & PAH - March 2025

Watercare
Laboratory Services

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Certificate of Analysis
Laboratory Reference: 250325-145

Attention:	Laureline Meynier	*Final Report:*	**586605-0**	*Replaces Report*	**585913-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**17-Apr-2025**		
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**25-Mar-2025**		
Client Reference:	**SW Clark WWTP Monitoring - Contaminants**	*Laboratory Activity Dates:*	**26-Mar-2025** -	**11-Apr-2025**	
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16353**		

Amended COA generated with corrected accreditation status.

Sample Details					
Lab Sample ID:		**250325-145-1**	**250325-145-2**	**250325-145-3**	**250325-145-4**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Matakawau MET25MA RCH1	Matakawau MET25MA RCH2	Matakawau MET25MA RCH3	Matakawau MET25MA RCH4
General Testing					
Percentage Moisture	%	91.2	90.6	90.5	89.1
Percentage Solids	%	8.8	9.4	9.5	10.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	12	11	11
Copper (Recoverable Dry Wt.)	mg/kg	280	290	300	240
Lead (Recoverable Dry Wt.)	mg/kg	0.24	0.29	0.28	0.32
Zinc (Recoverable Dry Wt.)	mg/kg	1500	1800	1600	1300

Sample Details					
Lab Sample ID:		**250325-145-5**	**250325-145-6**	**250325-145-7**	**250325-145-8**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Matakawau MET25MA RCH5	Matakawau PAH25MA RCH1	Matakawau PAH25MA RCH2	Matakawau PAH25MA RCH3
General Testing					
Percentage Moisture	%	90.5	-	-	-
Percentage Solids	%	9.5	-	-	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	320	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.32	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1800	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	-	<0.2 *	<0.2 *	< 0.2 *
Ben[a]anthracene	ng/g	-	< 0.2 *	<0.2 *	< 0.2 *
Benzo[a]pyrene	ng/g	-	< 0.2 *	<0.2 *	< 0.2 *
Benzo[b+k]fluoranthene	ng/g	-	< 0.2 *	<0.2 *	< 0.2 *
Benzo[g,h,i]perylene	ng/g	-	<1 *	<1 *	<1 *
Chrysene	ng/g	-	<1 *	<1 *	<1 *
Comments		-	Analyze by GC-MS *	Analyze by GC-MS *	Analyze by GC-MS *
Dibenz[a,h]anthrancene	ng/g	-	<0.2 *	<0.2 *	< 0.2 *
Fluoranthene	ng/g	-	2.89 *	6.14 *	2.09 *
Fluorene	ng/g	-	1.38 *	2.12 *	1.14 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250325-145-5**	**250325-145-6**	**250325-145-7**	**250325-145-8**
Client Sample ID:					
Sample Date/Time:		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Matakawau MET25M ARCH5	Matakawau PAH25MA RCH1	Matakawau PAH25MA RCH2	Matakawau PAH25MA RCH3
Organics					
Adhoc investigation					
Indeno[1,2,3-cd]pyrene	ng/g	-	<1 *	<1 *	<1 *
Naphthalene	ng/g	-	8.95 *	18.74 *	10.81 *
Phenanathrene	ng/g	-	4.28 *	7.07 *	4.63 *
Pyrene	ng/g	-	2.28 *	5.43 *	1.65 *

Sample Details					
Lab Sample ID:		**250325-145-9**	**250325-145-10**	**250325-145-11**	**250325-145-12**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Matakawau PAH25MA RCH4	Matakawau PAH25MA RCH5	Karaka MET25MARC H1	Karaka MET25MARC H2
General Testing					
Percentage Moisture	%	-	-	92.7	92.3
Percentage Solids	%	-	-	7.3	7.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	-	11	11
Copper (Recoverable Dry Wt.)	mg/kg	-	-	490	640
Lead (Recoverable Dry Wt.)	mg/kg	-	-	0.2	0.35
Zinc (Recoverable Dry Wt.)	mg/kg	-	-	1800	2200
Organics					
Adhoc investigation					
Acenaphthene	ng/g	< 0.2 *	<0.2 *	-	-
Acenaphthylene	ng/g	< 0.2 *	<0.2 *	-	-
Anthracene	ng/g	< 0.2 *	<0.2 *	-	-
Ben[a]anthracene	ng/g	< 0.2 *	<0.2 *	-	-
Benzo[a]pyrene	ng/g	< 0.2 *	<0.2 *	-	-
Benzo[b+k]fluoranthene	ng/g	<0.2 *	<0.2 *	-	-
Benzo[g,h,i]perylene	ng/g	<1 *	<1 *	-	-
Chrysene	ng/g	<1 *	<1 *	-	-
Comments		Analyze by GC-MS *	Analyze by GC-MS *	-	-
Dibenz[a,h]anthrancene	ng/g	<0.2 *	<0.2 *	-	-
Fluoranthene	ng/g	2.14 *	2.3 *	-	-
Fluorene	ng/g	<0.2 *	1.40 *	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1 *	<1 *	-	-
Naphthalene	ng/g	10.81 *	11.79 *	-	-
Phenanathrene	ng/g	4.63 *	4.53 *	-	-
Pyrene	ng/g	1.65 *	1.80 *	-	-

Sample Details					
Lab Sample ID:		**250325-145-13**	**250325-145-14**	**250325-145-15**	**250325-145-16**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Karaka MET25MARC H3	Karaka MET25MARC H4	Karaka MET25MARC H5	Karaka PAH25MARC H1
General Testing					
Percentage Moisture	%	92.4	92.1	92.2	-
Percentage Solids	%	7.6	7.9	7.8	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	10	12	10	-
Copper (Recoverable Dry Wt.)	mg/kg	540	520	430	-
Lead (Recoverable Dry Wt.)	mg/kg	0.32	0.25	0.24	-
Zinc (Recoverable Dry Wt.)	mg/kg	1900	1700	1700	-
Organics					
Adhoc investigation					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		250325-145-13	250325-145-14	250325-145-15	250325-145-16
Client Sample ID:					
Sample Date/Time:		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Karaka MET25MARC H3	Karaka MET25MARC H4	Karaka MET25MARC H5	Karaka PAH25MARC H1
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	-	-	<0.2 *
Acenaphthylene	ng/g	-	-	-	<0.2 *
Anthracene	ng/g	-	-	-	<0.2 *
Ben[a]anthracene	ng/g	-	-	-	< 0.2 *
Benzo[a]pyrene	ng/g	-	-	-	<0.2 *
Benzo[b+k]fluoranthene	ng/g	-	-	-	< 0.2 *
Benzo[g,h,i]perylene	ng/g	-	-	-	<1 *
Chrysene	ng/g	-	-	-	<1 *
Comments		-	-	-	Analyze by GC-MS *
Dibenz[a,h]anthrancene	ng/g	-	-	-	< 0.2 *
Fluoranthene	ng/g	-	-	-	2.81 *
Fluorene	ng/g	-	-	-	2.14 *
Indeno[1,2,3-cd]pyrene	ng/g	-	-	-	<1 *
Naphthalene	ng/g	-	-	-	15.42 *
Phenanathrene	ng/g	-	-	-	5.74 *
Pyrene	ng/g	-	-	-	2.41 *

Sample Details					
Lab Sample ID:		250325-145-17	250325-145-18	250325-145-19	250325-145-20
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Karaka PAH25MARC H2	Karaka PAH25MARC H3	Karaka PAH25MARC H4	Karaka PAH25MARC H5
Organics					
Adhoc investigation					
Acenaphthene	ng/g	< 0.2 *	< 0.2 *	< 0.2 *	< 0.2 *
Acenaphthylene	ng/g	< 0.2 *	< 0.2 *	< 0.2 *	<0.2 *
Anthracene	ng/g	< 0.2 *	< 0.2 *	<0.2 *	< 0.2 *
Ben[a]anthracene	ng/g	< 0.2 *	< 0.2 *	< 0.2 *	< 0.2 *
Benzo[a]pyrene	ng/g	< 0.2 *	<0.2 *	< 0.2 *	< 0.2 *
Benzo[b+k]fluoranthene	ng/g	< 0.2 *	< 0.2 *	< 0.2 *	<0.2 *
Benzo[g,h,i]perylene	ng/g	<1 *	<1 *	<1 *	<1 *
Chrysene	ng/g	<1 *	<1 *	<1 *	<1 *
Comments		Analyze by GC-MS *	Analyze by GC-MS *	Analyze by GC-MS *	Analyze by GC-MS *
Dibenz[a,h]anthrancene	ng/g	<0.2 *	< 0.2 *	<0.2 *	<0.2 *
Fluoranthene	ng/g	2.19 *	3.01 *	3.25 *	2.70 *
Fluorene	ng/g	1.87 *	1.47 *	1.78 *	1.78 *
Indeno[1,2,3-cd]pyrene	ng/g	<1 *	<1 *	<1 *	<1 *
Naphthalene	ng/g	12.26 *	14.94 *	14.36 *	13.73 *
Phenanathrene	ng/g	5.28 *	4.90 *	5.98 *	5.77 *
Pyrene	ng/g	2.38 *	2.61 *	2.93 *	2.24 *

Sample Details					
Lab Sample ID:		250325-145-21	250325-145-22	250325-145-23	250325-145-24
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Toro ramp MET25MA RCH1	Toro ramp MET25MA RCH2	Toro ramp MET25MA RCH3	Toro ramp MET25MA RCH4
General Testing					
Percentage Moisture	%	91.8	91.9	91.7	91.1
Percentage Solids	%	8.2	8.1	8.3	8.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	11	12	11
Copper (Recoverable Dry Wt.)	mg/kg	500	540	500	460
Lead (Recoverable Dry Wt.)	mg/kg	0.34	0.38	0.35	0.4
Zinc (Recoverable Dry Wt.)	mg/kg	1700	1800	1700	1600

Sample Details					
Lab Sample ID:		250325-145-25	250325-145-26	250325-145-27	250325-145-28
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Toro ramp MET25MA RCH5	Toro ramp PAH25MAR CH1	Toro ramp PAH25MAR CH2	Toro ramp PAH25MAR CH3
General Testing					
Percentage Moisture	%	90.4	-	-	-
Percentage Solids	%	9.6	-	-	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	680	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.43	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	2600	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Ben[a]anthracene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Benzo[g,h,i]perylene	ng/g	-	<1 *	<1 *	<1 *
Chrysene	ng/g	-	<1 *	<1 *	<1 *
Comments		-	Analyze by GC-MS *	Analyze by GC-MS *	Analyze by GC-MS *
Dibenz[a,h]anthrancene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Fluoranthene	ng/g	-	2.95 *	2.48 *	3.79 *
Fluorene	ng/g	-	2.19 *	1.68 *	1.56 *
Indeno[1,2,3-cd]pyrene	ng/g	-	<1 *	<1 *	<1 *
Naphthalene	ng/g	-	19.32 *	16.54 *	16.91 *
Phenanathrene	ng/g	-	5.32 *	4.35 *	3.79 *
Pyrene	ng/g	-	2.28 *	2.17 *	3.36 *

Sample Details					
Lab Sample ID:		250325-145-29	250325-145-30	250325-145-31	250325-145-32
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Toro ramp PAH25MAR CH4	Toro ramp PAH25MAR CH5	Te Toro MET25MARC H1	Te Toro MET25MARC H2
General Testing					
Percentage Moisture	%	-	-	92.9	93.7
Percentage Solids	%	-	-	7.1	6.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	-	9.8	11
Copper (Recoverable Dry Wt.)	mg/kg	-	-	430	630
Lead (Recoverable Dry Wt.)	mg/kg	-	-	0.23	0.19
Zinc (Recoverable Dry Wt.)	mg/kg	-	-	2200	2900
Organics					
Adhoc investigation					
Acenaphthene	ng/g	<0.2 *	<0.2 *	-	-
Acenaphthylene	ng/g	<0.2 *	<0.2 *	-	-
Anthracene	ng/g	<0.2 *	<0.2 *	-	-
Ben[a]anthracene	ng/g	<0.2 *	<0.2 *	-	-
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	-	-
Benzo[b+k]fluoranthene	ng/g	<0.2 *	<0.2 *	-	-
Benzo[g,h,i]perylene	ng/g	<1 *	<1 *	-	-
Chrysene	ng/g	<1 *	<1 *	-	-
Comments		Analyze by GC-MS *	Analyze by GC-MS *	-	-
Dibenz[a,h]anthrancene	ng/g	<0.2 *	<0.2 *	-	-
Fluoranthene	ng/g	3.71 *	3.25 *	-	-
Fluorene	ng/g	0.21 *	4.48 *	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1 *	<1 *	-	-
Naphthalene	ng/g	17.27 *	8.61 *	-	-

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250325-145-29**	**250325-145-30**	**250325-145-31**	**250325-145-32**
Client Sample ID:					
Sample Date/Time:		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Toro ramp PAH25MARCH4	Toro ramp PAH25MARCH5	Te Toro MET25MARCH1	Te Toro MET25MARCH2
Organics					
Adhoc investigation					
Phenanathrene	ng/g	2.41 *	9.77 *	-	-
Pyrene	ng/g	2.08 *	1.86 *	-	-

Sample Details					
Lab Sample ID:		**250325-145-33**	**250325-145-34**	**250325-145-35**	**250325-145-36**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Te Toro MET25MARCH3	Te Toro MET25MARCH4	Te Toro MET25MARCH5	Te Toro PAH25MARCH1
General Testing					
Percentage Moisture	%	93.0	92.7	92.8	-
Percentage Solids	%	7.0	7.3	7.2	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	10	9.9	11	-
Copper (Recoverable Dry Wt.)	mg/kg	430	360	590	-
Lead (Recoverable Dry Wt.)	mg/kg	0.18	0.19	0.19	-
Zinc (Recoverable Dry Wt.)	mg/kg	2000	1900	2600	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	-	-	<0.2 *
Acenaphthylene	ng/g	-	-	-	<0.2 *
Anthracene	ng/g	-	-	-	<0.2 *
Ben[a]anthracene	ng/g	-	-	-	<0.2 *
Benzo[a]pyrene	ng/g	-	-	-	<0.2 *
Benzo[b+k]fluoranthene	ng/g	-	-	-	<0.2 *
Benzo[g,h,i]perylene	ng/g	-	-	-	<1 *
Chrysene	ng/g	-	-	-	<1 *
Comments		-	-	-	Analyze by GC-MS *
Dibenz[a,h]anthrancene	ng/g	-	-	-	<0.2 *
Fluoranthene	ng/g	-	-	-	4.18 *
Fluorene	ng/g	-	-	-	<0.2 *
Indeno[1,2,3-cd]pyrene	ng/g	-	-	-	<1 *
Naphthalene	ng/g	-	-	-	0.24 *
Phenanathrene	ng/g	-	-	-	3.62 *
Pyrene	ng/g	-	-	-	2.43 *

Sample Details					
Lab Sample ID:		**250325-145-37**	**250325-145-38**	**250325-145-39**	**250325-145-40**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Te Toro PAH25MARCH2	Te Toro PAH25MARCH3	Te Toro PAH25MARCH4	Te Toro PAH25MARCH5
Organics					
Adhoc investigation					
Acenaphthene	ng/g	4.66 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Ben[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[g,h,i]perylene	ng	-	-	-	<1 *
Benzo[g,h,i]perylene	ng/g	<1 *	<1 *	<1 *	-
Chrysene	ng/g	<1 *	<1 *	<1 *	<1 *
Comments		Analyze by GC-MS *	Analyze by GC-MS *	Analyze by GC-MS *	Analyze by GC-MS *
Dibenz[a,h]anthrancene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Fluoranthene	ng/g	3.01 *	3.80 *	2.50 *	2.64 *

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250325-145-37**	**250325-145-38**	**250325-145-39**	**250325-145-40**
Client Sample ID:					
Sample Date/Time:		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Te Toro PAH25MARCH2	Te Toro PAH25MARCH3	Te Toro PAH25MARCH4	Te Toro PAH25MARCH5
Organics					
Adhoc investigation					
Fluorene	ng/g	8.09 *	<0.2 *	<0.2 *	<0.2 *
Indeno[1,2,3-cd]pyrene	ng/g	<1 *	<1 *	<1 *	<1 *
Naphthalene	ng/g	12.38 *	7.10 *	3.95 *	2.10 *
Phenanathrene	ng/g	12.44 *	2.23 *	0.97 *	2.45 *
Pyrene	ng/g	1.66 *	1.85 *	1.27 *	1.28 *

Sample Details					
Lab Sample ID:		**250325-145-41**	**250325-145-42**	**250325-145-43**	**250325-145-44**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Gordons MET25MARCH1	Gordons MET25MARCH2	Gordons MET25MARCH3	Gordons MET25MARCH4
General Testing					
Percentage Moisture	%	93.2	90.4	91.5	91.5
Percentage Solids	%	6.8	9.6	8.5	8.5
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	10	14	11	13
Copper (Recoverable Dry Wt.)	mg/kg	740	410	490	420
Lead (Recoverable Dry Wt.)	mg/kg	0.21	0.25	0.29	0.22
Zinc (Recoverable Dry Wt.)	mg/kg	2800	1900	2500	2200

Sample Details					
Lab Sample ID:		**250325-145-45**	**250325-145-46**	**250325-145-47**	**250325-145-48**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Gordons MET25MARCH5	Gordons PAH25MARCH1	Gordons PAH25MARCH2	Gordons PAH25MARCH3
General Testing					
Percentage Moisture	%	90.7	-	-	-
Percentage Solids	%	9.3	-	-	-
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	450	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.24	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	2400	-	-	-
Organics					
Adhoc investigation					
Acenaphthene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Ben[a]anthracene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Benzo[g,h,i]perylene	ng/g	-	<1 *	<1 *	<1 *
Chrysene	ng/g	-	<1 *	<1 *	<1 *
Comments		-	Analyze by GC-MS *	Analyze by GC-MS *	Analyze by GC-MS *
Dibenz[a,h]anthrancene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Fluoranthene	ng/g	-	3.32 *	2.88 *	2.41 *
Fluorene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Indeno[1,2,3-cd]pyrene	ng/g	-	<1 *	<1 *	<1 *
Naphthalene	ng/g	-	1.11 *	2.31 *	2.43 *
Phenanathrene	ng/g	-	2.09 *	1.97 *	2.14 *
Pyrene	ng/g	-	1.51 *	1.55 *	1.51 *

Sample Details			
Lab Sample ID:		**250325-145-49**	**250325-145-50**
Client Sample ID:			
Sample Date/Time		06/03/2025	06/03/2025
Description:		Gordons PAH25MAR CH4	Gordons PAH25MAR CH5
Organics			
Adhoc investigation			
Acenaphthene	ng/g	<0.2 *	2.39 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *
Ben[a]anthracene	ng/g	<0.2 *	2.058 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.2 *	<0.2 *
Benzo[g,h,i]perylene	ng/g	<1 *	<1 *
Chrysene	ng/g	<1 *	<1 *
Comments		Analyze by GC-MS *	Analyze by GC-MS *
Dibenz[a,h]anthrancene	ng/g	<0.2 *	<0.2 *
Fluoranthene	ng/g	2.65 *	1.52 *
Fluorene	ng/g	<0.2 *	3.83 *
Indeno[1,2,3-cd]pyrene	ng/g	<1 *	<1 *
Naphthalene	ng/g	2.99 *	4.51 *
Phenanathrene	ng/g	1.98 *	4.80 *
Pyrene	ng/g	1.62 *	0.66 *

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.

The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Organics				
Adhoc investigation				
Comments	As specified above		6, 7, 8, 9, 10, 16, 17, 18, 19, 20, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland

Preparations			
Biomatter Percentage Solids	APHA (online edition) 2540 B	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Metals & PAH - May 2025

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Laboratory Services

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Certificate of Analysis
Laboratory Reference: 250516-129

Attention:		*Final Report:*	**593508-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**19-Jun-2025**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**29-May-2025**
Client Reference:	**SW Clark WWTP Monitoring - Contaminants**	*Laboratory Activity Dates:*	**29-May-2025 - 19-Jun-2025**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16353**

Sample Details					
Lab Sample ID:		**250516-129-1**	**250516-129-2**	**250516-129-3**	**250516-129-4**
Client Sample ID:					
Sample Date/Time		16/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Matakawau MET25May-1	Matakawau MET25May-2	Matakawau MET25May-3	Matakawau MET25May-4
General Testing					
Percentage Moisture	%	89.5	89.5	91.0	89.8
Percentage Solids	%	10.5	10.5	9.0	10.2
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	16	13	15	16
Copper (Recoverable Dry Wt.)	mg/kg	280	340	450	410
Lead (Recoverable Dry Wt.)	mg/kg	0.33	0.31	0.34	0.34
Zinc (Recoverable Dry Wt.)	mg/kg	1100	1200	1800	1400

Sample Details					
Lab Sample ID:		**250516-129-5**	**250516-129-6**	**250516-129-7**	**250516-129-8**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Matakawau MET25May-5	Matakawau PAH25May-1	Matakawau PAH25May-2	Matakawau PAH25May-3
General Testing					
Percentage Moisture	%	89.1	78.2	76.8	89.5
Percentage Solids	%	10.9	21.8	23.2	10.5
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	16	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	390	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.37	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1600	-	-	-
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	-	0.4 *	<0.2 *	0.5 *
Anthracene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	-	0.9 *	0.6 *	1.3 *
Benzo[a]pyrene	ng/g	-	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	-	1.3 *	0.8 *	1.8 *
Benzo[g,h,i]perylene	ng/g	-	2.4 *	1.9 *	2.3 *
Chrysene	ng/g	-	1.7 *	1.2 *	2.9 *
Dibenz[a,h]anthracene	ng/g	-	1.7 *	1.2 *	2.1 *
Fluoranthene	ng/g	-	3.4 *	2.4 *	4.9 *
Fluorene	ng/g	-	1.1 *	1.0 *	1.8 *
Indeno[1,2,3-cd]pyrene	ng/g	-	<1.0 *	<1.0 *	1.3 *
Naphthalene	ng/g	-	8.7 *	6.7 *	17 *
Phenanthrene	ng/g	-	3.9 *	3.4 *	7.4 *
Pyrene	ng/g	-	2.1 *	1.5 *	3.1 *

Sample Details					
Lab Sample ID:		**250516-129-9**	**250516-129-10**	**250516-129-11**	**250516-129-12**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Matakawau PAH25May-4	Matakawau PAH25May-5	Karaka MET25May-1	Karaka MET25May-2
General Testing					
Percentage Moisture	%	83.8	77.2	88.9	89.9
Percentage Solids	%	16.2	22.8	11.1	10.1
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	-	15	14
Copper (Recoverable Dry Wt.)	mg/kg	-	-	510	560
Lead (Recoverable Dry Wt.)	mg/kg	-	-	0.27	0.29
Zinc (Recoverable Dry Wt.)	mg/kg	-	-	2000	2400
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	-	-
Acenaphthylene	ng/g	<0.2 *	<0.2 *	-	-
Anthracene	ng/g	<0.2 *	<0.2 *	-	-
Benzo[a]anthracene	ng/g	0.8 *	0.6 *	-	-
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	-	-
Benzo[b+k]fluoranthene	ng/g	1.2 *	0.5 *	-	-
Benzo[g,h,i]perylene	ng/g	1.8 *	<1.0 *	-	-
Chrysene	ng/g	1.3 *	0.6 *	-	-
Dibenz[a,h]anthracene	ng/g	1.4 *	<1.0 *	-	-
Fluoranthene	ng/g	3.5 *	2.0 *	-	-
Fluorene	ng/g	1.0 *	0.9 *	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	-	-
Naphthalene	ng/g	11 *	7.0 *	-	-
Phenanthrene	ng/g	4.7 *	2.9 *	-	-
Pyrene	ng/g	1.9 *	1.1 *	-	-

Sample Details					
Lab Sample ID:		**250516-129-13**	**250516-129-14**	**250516-129-15**	**250516-129-21**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Karaka MET25May-3	Karaka MET25May-4	Karaka MET25May-5	Toro Ramp MET25May-1
General Testing					
Percentage Moisture	%	87.5	88.7	89.1	89.6
Percentage Solids	%	12.5	11.3	10.9	10.4
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	15	14	14	14
Copper (Recoverable Dry Wt.)	mg/kg	310	400	580	410
Lead (Recoverable Dry Wt.)	mg/kg	0.27	0.27	0.28	0.28
Zinc (Recoverable Dry Wt.)	mg/kg	1800	1700	2300	1900

Sample Details					
Lab Sample ID:		**250516-129-22**	**250516-129-23**	**250516-129-24**	**250516-129-25**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Toro Ramp MET25May-2	Toro Ramp MET25May-3	Toro Ramp MET25May-4	Toro Ramp MET25May-5
General Testing					
Percentage Moisture	%	88.9	88.0	87.1	88.2
Percentage Solids	%	11.1	12.0	12.9	11.8
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	14	15	15
Copper (Recoverable Dry Wt.)	mg/kg	350	310	320	420
Lead (Recoverable Dry Wt.)	mg/kg	0.27	0.25	0.25	0.27
Zinc (Recoverable Dry Wt.)	mg/kg	1400	1300	1500	1900

Sample Details					
Lab Sample ID:		250516-129-26	250516-129-27	250516-129-28	250516-129-29
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Toro Ramp PAH25May-1	Toro Ramp PAH25May-2	Toro Ramp PAH25May-3	Toro Ramp PAH25May-4
General Testing					
Percentage Moisture	%	86.1	77.9	78.7	87.0
Percentage Solids	%	13.9	22.1	21.3	13.0
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	0.7 *	0.4 *	0.4 *	0.5 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	0.8 *	0.7 *	0.6 *	1.9 *
Benzo[a]pyrene	ng/g	0.8 *	0.5 *	0.9 *	1.9 *
Benzo[b+k]fluoranthene	ng/g	1.0 *	0.7 *	0.9 *	1.9 *
Benzo[g,h,i]perylene	ng/g	1.0 *	<1.0 *	<1.0 *	1.4 *
Chrysene	ng/g	1.8 *	1.2 *	1.3 *	2.6 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	1.0 *
Fluoranthene	ng/g	7.7 *	5.5 *	8.0 *	13 *
Fluorene	ng/g	1.5 *	1.2 *	1.3 *	2.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	9.9 *	8.6 *	10 *	16 *
Phenanthrene	ng/g	8.6 *	6.0 *	7.9 *	13 *
Pyrene	ng/g	4.3 *	3.1 *	4.0 *	6.0 *

Sample Details					
Lab Sample ID:		250516-129-30	250516-129-31	250516-129-32	250516-129-33
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Toro Ramp PAH25May-5	Toro Toro MET25May-1	Toro Toro MET25May-2	Toro Toro MET25May-3
General Testing					
Percentage Moisture	%	77.9	89.7	88.8	89.3
Percentage Solids	%	22.1	10.3	11.2	10.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	16	16	16
Copper (Recoverable Dry Wt.)	mg/kg	-	410	410	470
Lead (Recoverable Dry Wt.)	mg/kg	-	0.29	0.26	0.32
Zinc (Recoverable Dry Wt.)	mg/kg	-	1600	1500	1600
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	-	-	-
Acenaphthylene	ng/g	<0.2 *	-	-	-
Anthracene	ng/g	<0.2 *	-	-	-
Benzo[a]anthracene	ng/g	0.4 *	-	-	-
Benzo[a]pyrene	ng/g	0.4 *	-	-	-
Benzo[b+k]fluoranthene	ng/g	0.6 *	-	-	-
Benzo[g,h,i]perylene	ng/g	<1.0 *	-	-	-
Chrysene	ng/g	0.7 *	-	-	-
Dibenz[a,h]anthracene	ng/g	<1.0 *	-	-	-
Fluoranthene	ng/g	3.2 *	-	-	-
Fluorene	ng/g	1.1 *	-	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	-	-	-
Naphthalene	ng/g	10 *	-	-	-
Phenanthrene	ng/g	3.9 *	-	-	-
Pyrene	ng/g	1.9 *	-	-	-

Sample Details					
Lab Sample ID:		250516-129-34	250516-129-35	250516-129-36	250516-129-37
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Toro Toro MET25May-4	Toro Toro MET25May-5	Toro Toro PAH25May-1	Toro Toro PAH25May-2
General Testing					
Percentage Moisture	%	92.2	91.2	89.8	82.1
Percentage Solids	%	7.8	8.8	10.2	17.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	15	-	-
Copper (Recoverable Dry Wt.)	mg/kg	540	520	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.25	0.28	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	2100	1700	-	-
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	-	-	<0.2 *	<0.2 *
Acenaphthylene	ng/g	-	-	<0.2 *	0.4 *
Anthracene	ng/g	-	-	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	-	-	0.7 *	0.5 *
Benzo[a]pyrene	ng/g	-	-	0.8 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	-	-	1.0 *	0.6 *
Benzo[g,h,i]perylene	ng/g	-	-	<1.0 *	<1.0 *
Chrysene	ng/g	-	-	1.7 *	0.9 *
Dibenz[a,h]anthracene	ng/g	-	-	<1.0 *	<1.0 *
Fluoranthene	ng/g	-	-	9.1 *	4.5 *
Fluorene	ng/g	-	-	2.7 *	1.4 *
Indeno[1,2,3-cd]pyrene	ng/g	-	-	<1.0 *	<1.0 *
Naphthalene	ng/g	-	-	15 *	10.0 *
Phenanthrene	ng/g	-	-	10 *	5.7 *
Pyrene	ng/g	-	-	4.6 *	2.5 *

Sample Details					
Lab Sample ID:		250516-129-38	250516-129-39	250516-129-40	250516-129-41
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Toro Toro PAH25May-3	Toro Toro PAH25May-4	Toro Toro PAH25May-5	Gordons MET25May-1
General Testing					
Percentage Moisture	%	84.7	79.0	91.8	93.5
Percentage Solids	%	15.3	21.0	8.2	6.5
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	-	-	-	16
Copper (Recoverable Dry Wt.)	mg/kg	-	-	-	770
Lead (Recoverable Dry Wt.)	mg/kg	-	-	-	0.31
Zinc (Recoverable Dry Wt.)	mg/kg	-	-	-	2700
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	-
Acenaphthylene	ng/g	<0.2 *	0.2 *	<0.2 *	-
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	-
Benzo[a]anthracene	ng/g	0.8 *	0.6 *	2.4 *	-
Benzo[a]pyrene	ng/g	0.5 *	<0.2 *	<0.2 *	-
Benzo[b+k]fluoranthene	ng/g	0.6 *	0.4 *	1.8 *	-
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	-
Chrysene	ng/g	1.1 *	0.5 *	2.9 *	-
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	1.6 *	-
Fluoranthene	ng/g	7.2 *	3.2 *	10 *	-
Fluorene	ng/g	1.1 *	0.8 *	2.8 *	-
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	-
Naphthalene	ng/g	14 *	5.9 *	18 *	-
Phenanthrene	ng/g	7.2 *	3.4 *	12 *	-
Pyrene	ng/g	3.4 *	1.7 *	5.3 *	-

Sample Details					
Lab Sample ID:		250516-129-42	250516-129-43	250516-129-44	250516-129-45
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Gordons MET25May-2	Gordons MET25May-3	Gordons MET25May-4	Gordons MET25May-5
General Testing					
Percentage Moisture	%	92.4	93.0	92.5	92.9
Percentage Solids	%	7.6	7.0	7.5	7.1
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	18	16	17	17
Copper (Recoverable Dry Wt.)	mg/kg	1000	950	900	1100
Lead (Recoverable Dry Wt.)	mg/kg	0.36	0.35	0.32	0.35
Zinc (Recoverable Dry Wt.)	mg/kg	3100	2700	2800	3300

Sample Details					
Lab Sample ID:		250516-129-46	250516-129-47	250516-129-48	250516-129-49
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Gordons PAH25May-1	Gordons PAH25May-2	Gordons PAH25May-3	Gordons PAH25May-4
General Testing					
Percentage Moisture	%	84.4	89.0	84.5	87.5
Percentage Solids	%	15.6	11.0	15.5	12.5
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	0.5 *	1.1 *	1.2 *	0.8 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	0.9 *	1.2 *	0.7 *	1.3 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	0.7 *	1.2 *	0.5 *	1.3 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	3.5 *	4.6 *	2.9 *	5.2 *
Fluorene	ng/g	1.4 *	1.7 *	1.0 *	1.2 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	8.5 *	9.7 *	6.9 *	8.7 *
Phenanthrene	ng/g	5.1 *	5.3 *	3.0 *	5.2 *
Pyrene	ng/g	2.2 *	2.9 *	1.7 *	3.4 *

Sample Details		
Lab Sample ID:		250516-129-50
Client Sample ID:		
Sample Date/Time		20/05/2025
Description:		Gordons PAH25May-5
General Testing		
Percentage Moisture	%	84.4
Percentage Solids	%	15.6
Organics		
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)		
Acenaphthene	ng/g	<0.2 *
Acenaphthylene	ng/g	<0.2 *
Anthracene	ng/g	<0.2 *
Benzo[a]anthracene	ng/g	0.6 *
Benzo[a]pyrene	ng/g	<0.2 *
Benzo[b+k]fluoranthene	ng/g	0.7 *
Benzo[g,h,i]perylene	ng/g	<1.0 *
Chrysene	ng/g	0.6 *
Dibenz[a,h]anthracene	ng/g	<1.0 *
Fluoranthene	ng/g	3.3 *
Fluorene	ng/g	1.1 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *
Naphthalene	ng/g	7.4 *

Sample Details (continued)		ENV_BIOL
Lab Sample ID:		250516-129-50
Client Sample ID:		
Sample Date/Time:		20/05/2025
Description:		Gordons PAH25May-5
Organics		
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)		
Phenanthrene	ng/g	4.2 *
Pyrene	ng/g	2.2 *

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Acenaphthene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Acenaphthylene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Anthracene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Benzo[a]anthracene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Benzo[a]pyrene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Benzo[b+k]fluoranthene	In-house by GC-MS/MS	0.4 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Benzo[g,h,i]perylene	In-house by GC-MS/MS	1 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Chrysene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Dibenz[a,h]anthracene	In-house by GC-MS/MS	1 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland

Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Fluoranthene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Fluorene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Indeno[1,2,3-cd]pyrene	In-house by GC-MS/MS	1 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Naphthalene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Phenanthrene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Pyrene	In-house by GC-MS/MS	0.2 ng/g	6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Preps - Do not report				
QuEChERS Extraction	In-house by QuEChERS		6, 7, 8, 9, 10, 26, 27, 28, 29, 30, 36, 37, 38, 39, 40, 46, 47, 48, 49, 50	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		All	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B		All	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Metals & PAH - August 2025

Watercare Laboratory Services

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Certificate of Analysis
Laboratory Reference: 250731-094

Attention:		*Final Report:*	**602513-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**09-Sep-2025**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**27-Aug-2025**
Client Reference:	**SW Clark WWTP Monitoring - Contaminants**	*Laboratory Activity Dates:*	**28-Aug-2025 - 09-Sep-2025**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16353**

Sample Details					
Lab Sample ID:		**250731-094-1**	**250731-094-2**	**250731-094-3**	**250731-094-4**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Matakawau 25AUG-1	Matakawau 25AUG-2	Matakawau 25AUG-3	Matakawau 25AUG-4
General Testing					
Percentage Moisture	%	89.1	89.4	91.0	91.2
Percentage Solids	%	10.9	10.6	9.0	8.8
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	13	14	13
Copper (Recoverable Dry Wt.)	mg/kg	670	570	270	650
Lead (Recoverable Dry Wt.)	mg/kg	0.24	0.28	0.28	0.3
Zinc (Recoverable Dry Wt.)	mg/kg	1900	1700	900	1900
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	1.7 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	2.6 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.1 *	<1.1 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.1 *	<1.1 *
Fluoranthene	ng/g	9.4 *	9.8 *	7.3 *	6.8 *
Fluorene	ng/g	2.4 *	3.2 *	1.7 *	2.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.1 *	<1.1 *
Naphthalene	ng/g	10 *	11 *	8.0 *	8.4 *
Phenanthrene	ng/g	14 *	15 *	11 *	11 *
Pyrene	ng/g	5.0 *	6.3 *	4.4 *	3.8 *

Sample Details					
Lab Sample ID:		**250731-094-5**	**250731-094-11**	**250731-094-12**	**250731-094-13**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Matakawau 25AUG-5	Karaka 25AUG-1	Karaka 25AUG-2	Karaka 25AUG-3
General Testing					
Percentage Moisture	%	90.4	86.7	88.7	85.7
Percentage Solids	%	9.6	13.3	11.3	14.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	14	14	15
Copper (Recoverable Dry Wt.)	mg/kg	900	460	430	290
Lead (Recoverable Dry Wt.)	mg/kg	0.25	0.18	0.2	0.2
Zinc (Recoverable Dry Wt.)	mg/kg	2500	1300	1300	940
Organics					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250731-094-5**	**250731-094-11**	**250731-094-12**	**250731-094-13**
Client Sample ID:					
Sample Date/Time:		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Matakawau 25AUG-5	Karaka 25AUG-1	Karaka 25AUG-2	Karaka 25AUG-3
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	1.0 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	1.5 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	7.3 *	16 *	17 *	19 *
Fluorene	ng/g	2.0 *	2.8 *	3.1 *	3.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	13 *	13 *	16 *	22 *
Phenanthrene	ng/g	12 *	26 *	30 *	34 *
Pyrene	ng/g	4.3 *	8.9 *	8.6 *	10 *

Sample Details					
Lab Sample ID:		**250731-094-14**	**250731-094-15**	**250731-094-21**	**250731-094-22**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Karaka 25AUG-4	Karaka 25AUG-5	Te Toro Ramp 25AUG -1	Te Toro Ramp 25AUG-2
General Testing					
Percentage Moisture	%	86.4	88.0	87.3	87.3
Percentage Solids	%	13.6	12.0	12.7	12.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	14	15	14
Copper (Recoverable Dry Wt.)	mg/kg	350	460	300	330
Lead (Recoverable Dry Wt.)	mg/kg	0.21	0.21	0.21	0.22
Zinc (Recoverable Dry Wt.)	mg/kg	980	1400	920	1000
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	1.6 *	<0.2 *	1.1 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	1.3 *	<0.2 *	1.7 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	16 *	16 *	23 *	24 *
Fluorene	ng/g	3.3 *	3.0 *	3.9 *	3.9 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	22 *	18 *	21 *	28 *
Phenanthrene	ng/g	27 *	28 *	42 *	42 *
Pyrene	ng/g	8.5 *	9.6 *	15 *	14 *

Sample Details					
Lab Sample ID:		**250731-094-23**	**250731-094-24**	**250731-094-25**	**250731-094-31**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Te Toro Ramp 25AUG -3	Te Toro Ramp 25AUG -4	Te Toro Ramp 25AUG -5	Te Toro Settlement 25 AUG-1
General Testing					
Percentage Moisture	%	85.6	84.6	86.8	87.7
Percentage Solids	%	14.4	15.4	13.2	12.3

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250731-094-23**	**250731-094-24**	**250731-094-25**	**250731-094-31**
Client Sample ID:					
Sample Date/Time:		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Te Toro Ramp 25AUG -3	Te Toro Ramp 25AUG -4	Te Toro Ramp 25AUG -5	Te Toro Settlement 25 AUG-1
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	15	15	14
Copper (Recoverable Dry Wt.)	mg/kg	300	290	280	330
Lead (Recoverable Dry Wt.)	mg/kg	0.18	0.18	0.28	0.21
Zinc (Recoverable Dry Wt.)	mg/kg	760	860	850	960
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	2.0 *	2.0 *	1.3 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	1.9 *	2.5 *	2.9 *	1.6 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	26 *	27 *	26 *	18 *
Fluorene	ng/g	4.2 *	3.8 *	4.2 *	3.4 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	29 *	26 *	32 *	26 *
Phenanthrene	ng/g	49 *	47 *	45 *	34 *
Pyrene	ng/g	16 *	16 *	16 *	12 *

Sample Details					
Lab Sample ID:		**250731-094-32**	**250731-094-33**	**250731-094-34**	**250731-094-35**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Te Toro Settlement 25 AUG-2	Te Toro Settlement 25 AUG-3	Te Toro Settlement 25 AUG-4	Te Toro Settlement 25 AUG-5
General Testing					
Percentage Moisture	%	89.0	88.2	89.7	91.3
Percentage Solids	%	11.0	11.8	10.3	8.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	14	14	12
Copper (Recoverable Dry Wt.)	mg/kg	620	470	460	590
Lead (Recoverable Dry Wt.)	mg/kg	0.26	0.25	0.22	0.28
Zinc (Recoverable Dry Wt.)	mg/kg	1800	1300	1500	2000
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.1 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.1 *
Fluoranthene	ng/g	18 *	18 *	21 *	16 *
Fluorene	ng/g	3.6 *	3.0 *	3.4 *	3.0 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.1 *
Naphthalene	ng/g	29 *	22 *	27 *	27 *
Phenanthrene	ng/g	31 *	32 *	33 *	24 *
Pyrene	ng/g	10 *	12 *	12 *	9.4 *

Sample Details					
Lab Sample ID:		**250731-094-41**	**250731-094-42**	**250731-094-43**	**250731-094-44**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Gordons 25AUG-1	Gordons 25AUG-2	Gordons 25AUG-3	Gordons 25AUG-4
General Testing					
Percentage Moisture	%	88.3	90.5	89.5	91.1
Percentage Solids	%	11.7	9.5	10.5	8.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	10	14	13	14
Copper (Recoverable Dry Wt.)	mg/kg	510	760	620	890
Lead (Recoverable Dry Wt.)	mg/kg	0.17	0.22	0.2	0.24
Zinc (Recoverable Dry Wt.)	mg/kg	1700	2200	1600	2500
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	1.9 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.1 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.1 *
Fluoranthene	ng/g	16 *	18 *	25 *	19 *
Fluorene	ng/g	2.5 *	3.5 *	4.1 *	3.2 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.1 *
Naphthalene	ng/g	12 *	17 *	21 *	18 *
Phenanthrene	ng/g	27 *	33 *	48 *	32 *
Pyrene	ng/g	11 *	11 *	15 *	12 *

Sample Details					
Lab Sample ID:		**250731-094-45**	**250731-094-51**	**250731-094-52**	**250731-094-53**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Gordons 25AUG-5	Control 25AUG-1	Control 25AUG-2	Control 25AUG-3
General Testing					
Percentage Moisture	%	90.2	91.1	89.8	91.7
Percentage Solids	%	9.8	8.9	10.2	8.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	890	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.2	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	2600	-	-	-
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	-	-	-
Acenaphthylene	ng/g	<0.2 *	-	-	-
Anthracene	ng/g	<0.2 *	-	-	-
Benzo[a]anthracene	ng/g	<0.2 *	-	-	-
Benzo[a]pyrene	ng/g	<0.2 *	-	-	-
Benzo[b+k]fluoranthene	ng/g	<0.4 *	-	-	-
Benzo[g,h,i]perylene	ng/g	<1.0 *	-	-	-
Chrysene	ng/g	<0.2 *	-	-	-
Dibenz[a,h]anthracene	ng/g	<1.0 *	-	-	-
Fluoranthene	ng/g	20 *	-	-	-
Fluorene	ng/g	2.1 *	-	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	-	-	-
Naphthalene	ng/g	16 *	-	-	-
Phenanthrene	ng/g	29 *	-	-	-
Pyrene	ng/g	12 *	-	-	-

Sample Details			
Lab Sample ID:		**250731-094-54**	**250731-094-55**
Client Sample ID:			
Sample Date/Time		20/08/2025	20/08/2025
Description:		Control 25AUG-4	Control 25AUG-5
General Testing			
Percentage Moisture	%	89.5	87.4
Percentage Solids	%	10.5	12.6

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.

The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Acenaphthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Acenaphthylene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Benzo[a]anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Benzo[a]pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Benzo[b+k]fluoranthene	In-house by GC-MS/MS	0.4 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Benzo[g,h,i]perylene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland

Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Chrysene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Dibenz[a,h]anthracene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Fluoranthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Fluorene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Indeno[1,2,3-cd]pyrene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Naphthalene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Phenanthrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Preps - Do not report				
QuEChERS Extraction	In-house by QuEChERS		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 11, 12, 13, 14, 15, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 45	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		All	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B		All	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Metals & PAH - October 2025

Watercare
Laboratory Services

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Certificate of Analysis
Laboratory Reference: 251107-124

Attention:	Diana Villa Ortega	*Final Report:*	**611559-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**28-Nov-2025**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**11-Nov-2025**
		Sampled By:	**Lucia Duder**
Client Reference:	**SW Clark WWTP monitoring - contaminants**	*Laboratory Activity Dates:*	**12-Nov-2025 - 27-Nov-2025**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**251107-124-1**	**251107-124-2**	**251107-124-3**	**251107-124-4**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Matakawau METPAH25OCT1	Matakawau METPAH25OCT2	Karaka METPAH25O CT1	Karaka METPAH25OC T2
General Testing					
Percentage Moisture	%	88.1	85.0	86.9	86.1
Percentage Solids	%	11.9	15.0	13.1	13.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	14	16	14
Copper (Recoverable Dry Wt.)	mg/kg	340	340	330	210
Lead (Recoverable Dry Wt.)	mg/kg	0.21	0.21	0.21	0.18
Zinc (Recoverable Dry Wt.)	mg/kg	1100	1200	1200	940
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	3.1 *	4.3 *	3.4 *	5.7 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	2.4 *	1.9 *	2.3 *	2.0 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	<0.2 *	<0.2 *	2.5 *	3.0 *
Fluorene	ng/g	1.3 *	1.5 *	1.5 *	1.5 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	6.6 *	8.8 *	11 *	8.6 *
Phenanthrene	ng/g	5.0 *	3.8 *	7.9 *	8.0 *
Pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *

Sample Details					
Lab Sample ID:		**251107-124-5**	**251107-124-6**	**251107-124-7**	**251107-124-8**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Karaka METPAH25O CT3	Karaka METPAH25O CT4	Karaka METPAH25O CT5	Te Toro Settlement METPAH25OCT1
General Testing					
Percentage Moisture	%	87.1	84.5	86.6	90.0
Percentage Solids	%	12.9	15.5	13.4	10.0
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	14	15	14
Copper (Recoverable Dry Wt.)	mg/kg	320	190	340	250
Lead (Recoverable Dry Wt.)	mg/kg	0.2	0.19	0.2	0.35
Zinc (Recoverable Dry Wt.)	mg/kg	1300	950	1200	1000

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**251107-124-5**	**251107-124-6**	**251107-124-7**	**251107-124-8**
Client Sample ID:					
Sample Date/Time:		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Karaka METPAH25O CT3	Karaka METPAH25O CT4	Karaka METPAH25O CT5	Te Toro Settlement METPAH25OCT1
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	8.6 *	6.2 *	5.3 *	4.4 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	2.5 *	1.7 *	1.5 *	2.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	4.2 *	3.8 *	<0.2 *	<0.2 *
Fluorene	ng/g	2.1 *	1.8 *	1.7 *	2.1 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	14 *	15 *	11 *	15 *
Phenanthrene	ng/g	11 *	9.5 *	8.9 *	13 *
Pyrene	ng/g	5.2 *	3.7 *	4.4 *	7.3 *

Sample Details					
Lab Sample ID:		**251107-124-9**	**251107-124-10**	**251107-124-11**	**251107-124-12**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Te Toro Settlement METPAH25OCT2	Te Toro Settlement METPAH25OCT3	Te Toro Settlement METPAH25OCT4	Te Toro Settlement METPAH25OCT5
General Testing					
Percentage Moisture	%	88.7	86.9	86.7	89.5
Percentage Solids	%	11.3	13.1	13.3	10.5
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	14	14	14
Copper (Recoverable Dry Wt.)	mg/kg	280	440	330	420
Lead (Recoverable Dry Wt.)	mg/kg	0.23	0.2	0.19	0.28
Zinc (Recoverable Dry Wt.)	mg/kg	1100	1700	1100	1400
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	6.2 *	4.4 *	5.1 *	4.9 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	1.8 *	1.3 *	2.0 *	1.9 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	<0.2 *	3.8 *	4.6 *	3.5 *
Fluorene	ng/g	1.6 *	1.5 *	1.7 *	2.2 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	9.9 *	11 *	10 *	15 *
Phenanthrene	ng/g	10 *	9.1 *	10.0 *	11 *
Pyrene	ng/g	6.4 *	5.1 *	4.1 *	<0.2 *

Sample Details					
Lab Sample ID:		**251107-124-13**	**251107-124-14**	**251107-124-15**	**251107-124-16**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Gordons METPAH25O CT1	Gordons METPAH25O CT2	Gordons METPAH25O CT3	Gordons METPAH25O CT4
General Testing					
Percentage Moisture	%	89.8	89.4	88.6	88.5

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**251107-124-13**	**251107-124-14**	**251107-124-15**	**251107-124-16**
Client Sample ID:					
Sample Date/Time:		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Gordons METPAH25 OCT1	Gordons METPAH25O CT2	Gordons METPAH25O CT3	Gordons METPAH25O CT4
General Testing					
Percentage Solids	%	10.2	10.6	11.4	11.5
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	15	13	14	14
Copper (Recoverable Dry Wt.)	mg/kg	340	280	340	390
Lead (Recoverable Dry Wt.)	mg/kg	0.2	0.2	0.62	0.19
Zinc (Recoverable Dry Wt.)	mg/kg	1400	1100	1200	1200
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	4.5 *	8.5 *	5.4 *	5.3 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	1.3 *	1.4 *	1.5 *	2.3 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	6.9 *	8.3 *	9.0 *	7.4 *
Fluorene	ng/g	2.7 *	3.1 *	2.8 *	2.4 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	15 *	18 *	20 *	17 *
Phenanthrene	ng/g	15 *	18 *	16 *	15 *
Pyrene	ng/g	7.2 *	9.9 *	1.5 *	7.0 *

Sample Details					
Lab Sample ID:		**251107-124-17**	**251107-124-18**	**251107-124-19**	**251107-124-20**
Client Sample ID:					
Sample Date/Time		16/10/2025	19/08/2025	19/08/2025	19/08/2025
Description:		Gordons METPAH25O CT5	Control 25OCT1	Control 25OCT2	Control 25OCT3
General Testing					
Percentage Moisture	%	87.3	86.8	86.4	85.3
Percentage Solids	%	12.7	13.2	13.6	14.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	240	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.16	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	770	-	-	-
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	-	-	-
Acenaphthylene	ng/g	<0.2 *	-	-	-
Anthracene	ng/g	<0.2 *	-	-	-
Benzo[a]anthracene	ng/g	3.4 *	-	-	-
Benzo[a]pyrene	ng/g	<0.2 *	-	-	-
Benzo[b+k]fluoranthene	ng/g	<0.4 *	-	-	-
Benzo[g,h,i]perylene	ng/g	<1.0 *	-	-	-
Chrysene	ng/g	2.2 *	-	-	-
Dibenz[a,h]anthracene	ng/g	<1.0 *	-	-	-
Fluoranthene	ng/g	8.3 *	-	-	-
Fluorene	ng/g	2.6 *	-	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	-	-	-
Naphthalene	ng/g	20 *	-	-	-
Phenanthrene	ng/g	16 *	-	-	-
Pyrene	ng/g	7.5 *	-	-	-

Sample Details			
Lab Sample ID:		**251107-124-21**	**251107-124-22**
Client Sample ID:			
Sample Date/Time		19/08/2025	19/08/2025
Description:		Control 25OCT4	Control 25OCT5
General Testing			
Percentage Moisture	%	84.1	86.6
Percentage Solids	%	15.9	13.4

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.

The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Acenaphthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Acenaphthylene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Benzo[a]anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Benzo[a]pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Benzo[b+k]fluoranthene	In-house by GC-MS/MS	0.4 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Benzo[g,h,i]perylene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Chrysene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Dibenz[a,h]anthracene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Fluoranthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Fluorene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Indeno[1,2,3-cd]pyrene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Naphthalene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Phenanthrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland

Preps - Do not report			
QuEChERS Extraction	In-house by QuEChERS	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Preparations			
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B	All	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B	All	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)	All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Metals & PAH - December 2025

Watercare
Laboratory Services

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Certificate of Analysis
Laboratory Reference: 260115-168

Attention:	Diana Villa Ortega	*Final Report:*	**618933-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**02-Feb-2026**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**15-Jan-2026**
		Sampled By:	**Lucia Duder**
Client Reference:	**SW Clark WWTP monitoring - contaminants**	*Laboratory Activity Dates:*	**19-Jan-2026 - 02-Feb-2026**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**260115-168-1**	**260115-168-2**	**260115-168-3**	**260115-168-4**
Client Sample ID:					
Sample Date/Time		15/01/2026	15/01/2026	15/01/2026	15/01/2026
Description:		Matakawau METPAH25DEC1	Matakawau METPAH25DEC2	Matakawau METPAH25AUG3	Matakawau METPAH25AUG4
General Testing					
Percentage Moisture	%	85.2	87.0	88.1	84.6
Percentage Solids	%	14.8	13.0	11.9	15.4
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	18	17	15	18
Copper (Recoverable Dry Wt.)	mg/kg	350	350	490	410
Lead (Recoverable Dry Wt.)	mg/kg	0.19	0.19	0.21	0.22
Zinc (Recoverable Dry Wt.)	mg/kg	1300	1500	2100	1600
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.7 *	0.8 *	0.8 *	0.8 *
Acenaphthylene	ng/g	0.7 *	0.8 *	0.7 *	0.5 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	1.4 *	1.8 *	1.6 *	1.5 *
Fluorene	ng/g	2.8 *	2.4 *	2.4 *	2.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	57 *	39 *	26 *	44 *
Phenanthrene	ng/g	3.2 *	4.3 *	4.4 *	2.8 *
Pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *

Sample Details					
Lab Sample ID:		**260115-168-5**	**260115-168-6**	**260115-168-7**	**260115-168-8**
Client Sample ID:					
Sample Date/Time		15/01/2026	15/01/2026	15/01/2026	15/01/2026
Description:		Matakawau METPAH25AUG5	Karaka METPAH25DE C1	Karaka METPAH25DE C2	Karaka METPAH25DE C3
General Testing					
Percentage Moisture	%	86.6	85.4	85.4	85.8
Percentage Solids	%	13.4	14.6	14.6	14.2
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	18	20	18	18
Copper (Recoverable Dry Wt.)	mg/kg	360	300	280	310
Lead (Recoverable Dry Wt.)	mg/kg	0.23	0.17	0.15	0.15
Zinc (Recoverable Dry Wt.)	mg/kg	1500	1200	1300	1200

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260115-168-5**	**260115-168-6**	**260115-168-7**	**260115-168-8**
Client Sample ID:					
Sample Date/Time:		15/01/2026	15/01/2026	15/01/2026	15/01/2026
Description:		Matakawau METPAH25AUG5	Karaka METPAH25DE C1	Karaka METPAH25DE C2	Karaka METPAH25DE C3
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.9 *	1.0 *	1.1 *	1.4 *
Acenaphthylene	ng/g	0.6 *	0.8 *	0.6 *	0.7 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	1.8 *	1.7 *	2.6 *	1.4 *
Fluorene	ng/g	1.9 *	2.5 *	2.6 *	2.5 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	26 *	49 *	49 *	6.9 *
Phenanthrene	ng/g	4.2 *	2.5 *	4.2 *	3.9 *
Pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *

Sample Details					
Lab Sample ID:		**260115-168-9**	**260115-168-10**	**260115-168-11**	**260115-168-12**
Client Sample ID:					
Sample Date/Time		15/01/2026	15/01/2026	15/01/2026	15/01/2026
Description:		Karaka METPAH25D EC4	Karaka METPAH25D EC5	Te Toro Settlement METPAH25DEC1	Te Toro Settlement METPAH25DEC2
General Testing					
Percentage Moisture	%	84.7	82.5	89.1	89.9
Percentage Solids	%	15.3	17.5	10.9	10.1
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	19	20	16	15
Copper (Recoverable Dry Wt.)	mg/kg	320	320	490	510
Lead (Recoverable Dry Wt.)	mg/kg	0.15	0.14	0.37	0.28
Zinc (Recoverable Dry Wt.)	mg/kg	1400	1300	2100	2300
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	2.1 *	0.9 *	0.9 *	0.8 *
Acenaphthylene	ng/g	1.9 *	0.6 *	0.7 *	0.7 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	2.4 *	2.6 *	1.9 *	2.3 *
Fluorene	ng/g	4.6 *	1.3 *	2.3 *	1.6 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	160 *	19 *	13 *	19 *
Phenanthrene	ng/g	4.3 *	3.5 *	5.0 *	5.5 *
Pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *

Sample Details					
Lab Sample ID:		**260115-168-13**	**260115-168-14**	**260115-168-15**	**260115-168-16**
Client Sample ID:					
Sample Date/Time		15/01/2026	15/01/2026	15/01/2026	15/01/2026
Description:		Te Toro Settlement METPAH25DEC3	Te Toro Settlement METPAH25DEC4	Te Toro Settlement METPAH25DEC5	Gordons METPAH25D EC1
General Testing					
Percentage Moisture	%	89.3	89.1	89.6	88.7

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260115-168-13**	**260115-168-14**	**260115-168-15**	**260115-168-16**
Client Sample ID:					
Sample Date/Time:		15/01/2026	15/01/2026	15/01/2026	15/01/2026
Description:		Te Toro Settlement METPAH25DEC3	Te Toro Settlement METPAH25DEC4	Te Toro Settlement METPAH25DEC5	Gordons METPAH25D EC1
General Testing					
Percentage Solids	%	10.7	10.9	10.4	11.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	17	14	17	15
Copper (Recoverable Dry Wt.)	mg/kg	400	480	390	430
Lead (Recoverable Dry Wt.)	mg/kg	0.31	0.38	0.27	0.25
Zinc (Recoverable Dry Wt.)	mg/kg	1900	1900	1800	1700
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.7 *	0.8 *	0.8 *	0.9 *
Acenaphthylene	ng/g	0.7 *	0.5 *	0.5 *	0.6 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	1.7 *	1.8 *	1.8 *	3.6 *
Fluorene	ng/g	2.0 *	1.4 *	1.5 *	1.2 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	12 *	17 *	6.6 *	8.4 *
Phenanthrene	ng/g	4.3 *	3.5 *	4.7 *	5.5 *
Pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *

Sample Details					
Lab Sample ID:		**260115-168-17**	**260115-168-18**	**260115-168-19**	**260115-168-20**
Client Sample ID:					
Sample Date/Time		15/01/2026	15/01/2026	15/01/2026	15/01/2026
Description:		Gordons METPAH25D EC2	Gordons METPAH25D EC3	Gordons METPAH25D EC4	Gordons METPAH25D EC5
General Testing					
Percentage Moisture	%	87.9	88.9	89.0	89.1
Percentage Solids	%	12.1	11.1	11.0	10.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	15	15	15	14
Copper (Recoverable Dry Wt.)	mg/kg	390	430	410	410
Lead (Recoverable Dry Wt.)	mg/kg	0.19	0.21	0.22	0.22
Zinc (Recoverable Dry Wt.)	mg/kg	1500	1700	1700	1500
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.6 *	0.9 *	0.8 *	0.8 *
Acenaphthylene	ng/g	0.6 *	0.8 *	0.8 *	0.8 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	3.8 *	3.8 *	4.3 *	3.3 *
Fluorene	ng/g	1.2 *	1.5 *	1.2 *	1.5 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	8.8 *	17 *	15 *	21 *
Phenanthrene	ng/g	6.3 *	6.8 *	6.2 *	5.5 *
Pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *

Sample Details					
Lab Sample ID:		**260115-168-21**	**260115-168-22**	**260115-168-23**	**260115-168-24**
Client Sample ID:					
Sample Date/Time		15/01/2026	15/01/2026	15/01/2026	15/01/2026
Description:		Control 25DEC1	Control 25DEC2	Control 25DEC3	Control 25DEC4
General Testing					
Percentage Moisture	%	86.5	85.7	85.1	88.0
Percentage Solids	%	13.5	14.3	14.9	12.0

Sample Details		
Lab Sample ID:		**260115-168-25**
Client Sample ID:		
Sample Date/Time		15/01/2026
Description:		Control 25DEC5
General Testing		
Percentage Moisture	%	88.2
Percentage Solids	%	11.8

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.

The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Acenaphthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Acenaphthylene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Benzo[a]anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Benzo[a]pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Benzo[b+k]fluoranthene	In-house by GC-MS/MS	0.4 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Benzo[g,h,i]perylene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland

Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Chrysene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Dibenz[a,h]anthracene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Fluoranthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Fluorene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Indeno[1,2,3-cd]pyrene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Naphthalene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Phenanthrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Preps - Do not report				
QuEChERS Extraction	In-house by QuEChERS		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		All	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B		All	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Metals & PAH - January 2026

Watercare
Laboratory Services

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Certificate of Analysis
Laboratory Reference: 260220-090

Attention:	Diana Villa Ortega	*Final Report:*	**623077-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**10-Mar-2026**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**23-Feb-2026**
		Sampled By:	**Lucia Duder**
Client Reference:	**SW Clark WWTP monitoring - contaminants**	*Laboratory Activity Dates:*	**23-Feb-2026 - 09-Mar-2026**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**260220-090-1**	**260220-090-2**	**260220-090-3**	**260220-090-4**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Matakawau METPAH26JAN1	Matakawau METPAH26JAN2	Matakawau METPAH26JAN3	Matakawau METPAH26JAN4
General Testing					
Percentage Moisture	%	90.5	92.1	92.2	91.5
Percentage Solids	%	9.5	7.9	7.8	8.5
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	15	15	15	16
Copper (Recoverable Dry Wt.)	mg/kg	370	560	650	550
Lead (Recoverable Dry Wt.)	mg/kg	0.3	0.27	0.31	0.33
Zinc (Recoverable Dry Wt.)	mg/kg	1200	1600	2000	1800
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.6 *	0.5 *	0.3 *	0.7 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.5 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.2 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.2 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	1.1 *	0.7 *	0.7 *	0.7 *
Fluorene	ng/g	4.0 *	3.8 *	1.7 *	3.5 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.2 *	<1.0 *	<1.0 *
Naphthalene	ng/g	27 *	18 *	10 *	20 *
Phenanthrene	ng/g	3.2 *	3.1 *	2.9 *	2.7 *
Pyrene	ng/g	0.3 *	0.2 *	0.3 *	0.3 *

Sample Details					
Lab Sample ID:		**260220-090-5**	**260220-090-6**	**260220-090-7**	**260220-090-8**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Matakawau METPAH26JAN5	Karaka METPAH26JA N1	Karaka METPAH26JA N2	Karaka METPAH26JA N3
General Testing					
Percentage Moisture	%	92.0	89.4	89.9	89.3
Percentage Solids	%	8.0	10.6	10.1	10.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	17	18	16	17
Copper (Recoverable Dry Wt.)	mg/kg	610	460	490	440
Lead (Recoverable Dry Wt.)	mg/kg	0.28	0.26	0.29	0.27
Zinc (Recoverable Dry Wt.)	mg/kg	2100	1500	1500	1600

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260220-090-5**	**260220-090-6**	**260220-090-7**	**260220-090-8**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Matakawau METPAH26JAN5	Karaka METPAH26JA N1	Karaka METPAH26JA N2	Karaka METPAH26JA N3
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.6 *	0.9 *	0.7 *	0.5 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	0.7 *	2.1 *	1.7 *	1.3 *
Fluorene	ng/g	2.0 *	4.2 *	3.5 *	3.0 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	18 *	42 *	30 *	18 *
Phenanthrene	ng/g	2.8 *	4.5 *	3.2 *	2.8 *
Pyrene	ng/g	0.3 *	0.8 *	0.7 *	0.5 *

Sample Details					
Lab Sample ID:		**260220-090-9**	**260220-090-10**	**260220-090-11**	**260220-090-12**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Karaka METPAH26JA N4	Karaka METPAH26JA N5	Te Toro Ramp METPAH26JAN1	Te Toro Ramp METPAH26JAN2
General Testing					
Percentage Moisture	%	89.7	90.3	93.2	93.1
Percentage Solids	%	10.3	9.7	6.8	6.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	15	13	14
Copper (Recoverable Dry Wt.)	mg/kg	330	300	650	520
Lead (Recoverable Dry Wt.)	mg/kg	0.25	0.29	0.26	0.19
Zinc (Recoverable Dry Wt.)	mg/kg	1600	1200	2100	2000
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.7 *	0.4 *	0.5 *	0.5 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.5 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.1 *	<1.1 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.1 *	<1.1 *
Fluoranthene	ng/g	1.2 *	1.3 *	0.9 *	1.1 *
Fluorene	ng/g	3.4 *	1.7 *	2.0 *	1.7 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.1 *	<1.1 *
Naphthalene	ng/g	23 *	15 *	11 *	10 *
Phenanthrene	ng/g	2.9 *	2.6 *	3.2 *	2.9 *
Pyrene	ng/g	0.6 *	0.5 *	0.4 *	0.5 *

Sample Details					
Lab Sample ID:		**260220-090-13**	**260220-090-14**	**260220-090-15**	**260220-090-16**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Te Toro Ramp METPAH26JAN3	Te Toro Ramp METPAH26JAN4	Te Toro Ramp METPAH26JAN5	Te Toro Settlement METPAH26JAN1
General Testing					
Percentage Moisture	%	93.9	93.9	94.5	93.4

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260220-090-13**	**260220-090-14**	**260220-090-15**	**260220-090-16**
Client Sample ID:					
Sample Date/Time:		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Te Toro Ramp METPAH26JAN3	Te Toro Ramp METPAH26JAN4	Te Toro Ramp METPAH26JAN5	Te Toro Settlement METPAH26JAN1
General Testing					
Percentage Solids	%	6.1	6.1	5.5	6.6
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	12	11	12
Copper (Recoverable Dry Wt.)	mg/kg	470	460	400	410
Lead (Recoverable Dry Wt.)	mg/kg	0.27	0.15	0.13	0.22
Zinc (Recoverable Dry Wt.)	mg/kg	1600	1500	1400	1500
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.6 *	0.6 *	0.5 *	0.8 *
Acenaphthylene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Anthracene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Benzo[a]anthracene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Benzo[a]pyrene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Benzo[b+k]fluoranthene	ng/g	<0.6 *	<0.6 *	<0.6 *	<0.6 *
Benzo[g,h,i]perylene	ng/g	<1.5 *	<1.5 *	<1.6 *	<1.4 *
Chrysene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Dibenz[a,h]anthracene	ng/g	<1.5 *	<1.5 *	<1.6 *	<1.4 *
Fluoranthene	ng/g	1.1 *	1.1 *	0.9 *	0.8 *
Fluorene	ng/g	3.0 *	4.1 *	2.7 *	3.9 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.5 *	<1.5 *	<1.6 *	<1.4 *
Naphthalene	ng/g	12 *	16 *	13 *	18 *
Phenanthrene	ng/g	3.6 *	3.6 *	3.7 *	3.6 *
Pyrene	ng/g	0.5 *	0.7 *	0.6 *	0.5 *

Sample Details					
Lab Sample ID:		**260220-090-17**	**260220-090-18**	**260220-090-19**	**260220-090-20**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Te Toro Settlement METPAH26JAN2	Te Toro Settlement METPAH26JAN3	Te Toro Settlement METPAH26JAN4	Te Toro Settlement METPAH26JAN5
General Testing					
Percentage Moisture	%	93.8	92.9	93.8	92.0
Percentage Solids	%	6.2	7.1	6.2	8.0
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	13	12	13
Copper (Recoverable Dry Wt.)	mg/kg	390	370	310	330
Lead (Recoverable Dry Wt.)	mg/kg	0.19	0.21	0.26	0.22
Zinc (Recoverable Dry Wt.)	mg/kg	1500	1400	1200	1200
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	1.1 *	0.8 *	<0.2 *	0.9 *
Acenaphthylene	ng/g	<0.3 *	<0.3 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.3 *	<0.3 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.3 *	<0.3 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.3 *	<0.3 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.6 *	<0.6 *	<0.5 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.6 *	<1.4 *	<1.2 *	<1.2 *
Chrysene	ng/g	<0.3 *	<0.3 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.6 *	<1.4 *	<1.2 *	<1.2 *
Fluoranthene	ng/g	1.0 *	1.0 *	1.0 *	1.4 *
Fluorene	ng/g	3.7 *	3.8 *	4.7 *	3.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.6 *	<1.4 *	<1.2 *	<1.2 *
Naphthalene	ng/g	21 *	22 *	35 *	28 *
Phenanthrene	ng/g	3.5 *	3.2 *	2.9 *	3.6 *
Pyrene	ng/g	0.8 *	0.6 *	0.6 *	0.5 *

Report Number: **623077-0** Watercare Laboratory Services **Page 3 of 6**

Sample Details					
Lab Sample ID:		**260220-090-21**	**260220-090-22**	**260220-090-23**	**260220-090-24**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Gordons METPAH26JAN1	Gordons METPAH26JAN2	Gordons METPAH26JAN3	Gordons METPAH26JAN4
General Testing					
Percentage Moisture	%	93.3	92.8	93.2	92.8
Percentage Solids	%	6.7	7.2	6.8	7.2
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	14	15	15
Copper (Recoverable Dry Wt.)	mg/kg	470	710	660	490
Lead (Recoverable Dry Wt.)	mg/kg	0.23	0.23	0.31	0.26
Zinc (Recoverable Dry Wt.)	mg/kg	1700	2300	2300	1600
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.6 *	0.8 *	0.4 *	0.9 *
Acenaphthylene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.3 *
Anthracene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.3 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.3 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.3 *
Benzo[b+k]fluoranthene	ng/g	<0.5 *	<0.5 *	<0.5 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.1 *	<1.3 *	<1.2 *	<1.3 *
Chrysene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.3 *
Dibenz[a,h]anthracene	ng/g	<1.1 *	<1.3 *	<1.2 *	<1.3 *
Fluoranthene	ng/g	1.1 *	1.1 *	1.3 *	1.7 *
Fluorene	ng/g	2.6 *	3.5 *	1.9 *	4.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.1 *	<1.3 *	<1.2 *	<1.3 *
Naphthalene	ng/g	13 *	12 *	9.6 *	22 *
Phenanthrene	ng/g	2.8 *	3.5 *	2.9 *	3.6 *
Pyrene	ng/g	0.6 *	0.5 *	0.6 *	0.8 *

Sample Details					
Lab Sample ID:		**260220-090-25**	**260220-090-26**	**260220-090-27**	**260220-090-28**
Client Sample ID:					
Sample Date/Time		28/01/2026	15/12/2025	15/12/2025	15/12/2025
Description:		Gordons METPAH26JAN5	Control 26JAN1	Control 26JAN2	Control 26JAN3
General Testing					
Percentage Moisture	%	92.8	89.5	90.3	89.6
Percentage Solids	%	7.2	10.5	9.7	10.4
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	15	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	670	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.33	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	2300	-	-	-
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.5 *	-	-	-
Acenaphthylene	ng/g	<0.2 *	-	-	-
Anthracene	ng/g	<0.2 *	-	-	-
Benzo[a]anthracene	ng/g	<0.2 *	-	-	-
Benzo[a]pyrene	ng/g	<0.2 *	-	-	-
Benzo[b+k]fluoranthene	ng/g	<0.5 *	-	-	-
Benzo[g,h,i]perylene	ng/g	<1.2 *	-	-	-
Chrysene	ng/g	<0.2 *	-	-	-
Dibenz[a,h]anthracene	ng/g	<1.2 *	-	-	-
Fluoranthene	ng/g	1.1 *	-	-	-
Fluorene	ng/g	2.1 *	-	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1.2 *	-	-	-
Naphthalene	ng/g	13 *	-	-	-
Phenanthrene	ng/g	3.1 *	-	-	-
Pyrene	ng/g	0.6 *	-	-	-

Report Number: **623077-0** Watercare Laboratory Services **Page 4 of 6**

Sample Details			
Lab Sample ID:		**260220-090-29**	**260220-090-30**
Client Sample ID:			
Sample Date/Time		15/12/2025	15/12/2025
Description:		Control 26JAN4	Control 26JAN5
General Testing			
Percentage Moisture	%	91.4	91.7
Percentage Solids	%	8.6	8.3

**Result(s) are not accredited to International Accreditation New Zealand.*
-Result(s) marked as '-' indicates no test performed.
†Result(s) are subcontracted, refer to the attached certificate(s) of analysis for IANZ accreditation details.
Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Acenaphthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Acenaphthylene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[a]anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[a]pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[b+k]fluoranthene	In-house by GC-MS/MS	0.4 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[g,h,i]perylene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland

Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Chrysene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Dibenz[a,h]anthracene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Fluoranthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Fluorene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Indeno[1,2,3-cd]pyrene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Naphthalene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Phenanthrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Preps - Do not report				
QuEChERS Extraction	In-house by QuEChERS		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		All	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B		All	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Metals & PAH - March 2026

Watercare
Laboratory Services

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Certificate of Analysis
Laboratory Reference: 260409-123

Attention:	Marine .	*Final Report:*	**629018-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**01-May-2026**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**09-Apr-2026**
		Sampled By:	**Lucia Duder**
Client Reference:	**SW Clark WWTP monitoring - contaminants**	*Laboratory Activity Dates:*	**13-Apr-2026 - 01-May-2026**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**260409-123-1**	**260409-123-2**	**260409-123-3**	**260409-123-4**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Matakawau METPAH26MAR1	Matakawau METPAH26MAR2	Matakawau METPAH26MAR3	Matakawau METPAH26MAR4
General Testing					
Percentage Moisture	%	93.5	93.6	92.9	93.1
Percentage Solids	%	6.5	6.4	7.1	6.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	12	13	14
Copper (Recoverable Dry Wt.)	mg/kg	600	530	510	670
Lead (Recoverable Dry Wt.)	mg/kg	0.21	0.25	0.21	0.21
Zinc (Recoverable Dry Wt.)	mg/kg	2100	1800	2000	2000
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.3 *	<0.2 *	<2.2 *	<0.3 *
Acenaphthylene	ng/g	<0.3 *	<0.2 *	<2.2 *	<0.3 *
Anthracene	ng/g	<0.3 *	<0.2 *	<2.2 *	<0.3 *
Benzo[a]anthracene	ng/g	<0.3 *	<0.2 *	25 *	<0.3 *
Benzo[a]pyrene	ng/g	<0.3 *	<0.2 *	<2.2 *	<0.3 *
Benzo[b+k]fluoranthene	ng/g	<0.6 *	<0.5 *	18 *	<0.6 *
Benzo[g,h,i]perylene	ng/g	<1.4 *	<1.2 *	<11 *	<1.4 *
Chrysene	ng/g	<0.3 *	<0.2 *	23 *	<0.3 *
Dibenz[a,h]anthracene	ng/g	<1.4 *	<1.2 *	<11 *	<1.4 *
Fluoranthene	ng/g	1.8 *	0.8 *	55 *	0.7 *
Fluorene	ng/g	<0.3 *	2.4 *	14 *	<0.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.4 *	<1.2 *	<11 *	<1.4 *
Naphthalene	ng/g	13 *	16 *	130 *	8.8 *
Phenanthrene	ng/g	2.4 *	0.7 *	28 *	<0.3 *
Pyrene	ng/g	1.7 *	<0.2 *	20 *	<0.3 *

Sample Details					
Lab Sample ID:		**260409-123-5**	**260409-123-6**	**260409-123-7**	**260409-123-8**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Matakawau METPAH26MAR5	Karaka METPAH26M AR1	Karaka METPAH26M AR2	Karaka METPAH26MA R3
General Testing					
Percentage Moisture	%	93.1	92.1	91.9	92.2
Percentage Solids	%	6.9	7.9	8.1	7.8
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	14	16	14
Copper (Recoverable Dry Wt.)	mg/kg	540	410	520	500
Lead (Recoverable Dry Wt.)	mg/kg	0.22	0.22	0.26	0.24
Zinc (Recoverable Dry Wt.)	mg/kg	1900	1300	1800	1800

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260409-123-5**	**260409-123-6**	**260409-123-7**	**260409-123-8**
Client Sample ID:					
Sample Date/Time:		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Matakawau METPAH26MAR5	Karaka METPAH26M AR1	Karaka METPAH26M AR2	Karaka METPAH26M AR3
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	0.8 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	0.6 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.1 *	<1.1 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.1 *	<1.1 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	0.9 *	1.2 *	2.1 *	0.8 *
Fluorene	ng/g	1.4 *	0.9 *	1.9 *	0.7 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.1 *	<1.1 *	<1.0 *	<1.0 *
Naphthalene	ng/g	8.2 *	20 *	28 *	9.8 *
Phenanthrene	ng/g	1.1 *	0.9 *	2.0 *	0.4 *
Pyrene	ng/g	<0.2 *	0.3 *	0.8 *	0.2 *

Sample Details					
Lab Sample ID:		**260409-123-9**	**260409-123-10**	**260409-123-11**	**260409-123-12**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Karaka METPAH26M AR4	Karaka METPAH26M AR5	Te Toro Ramp METPAH26MAR1	Te Toro Ramp METPAH26MAR2
General Testing					
Percentage Moisture	%	91.9	90.2	93.9	93.8
Percentage Solids	%	8.1	9.8	6.1	6.2
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	14	14	12
Copper (Recoverable Dry Wt.)	mg/kg	530	320	730	560
Lead (Recoverable Dry Wt.)	mg/kg	0.26	0.19	0.21	0.21
Zinc (Recoverable Dry Wt.)	mg/kg	1900	1200	2000	1700
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.3 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.3 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.3 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.3 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.3 *
Benzo[b+k]fluoranthene	ng/g	1.2 *	<0.4 *	<0.5 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.2 *	<1.0 *	<1.3 *	<1.3 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.3 *
Dibenz[a,h]anthracene	ng/g	<1.2 *	<1.0 *	<1.3 *	<1.3 *
Fluoranthene	ng/g	0.9 *	1.8 *	0.6 *	0.6 *
Fluorene	ng/g	0.4 *	2.0 *	<0.3 *	<0.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.2 *	<1.0 *	<1.3 *	<1.3 *
Naphthalene	ng/g	13 *	7.9 *	2.1 *	5.8 *
Phenanthrene	ng/g	1.3 *	2.4 *	0.5 *	<0.3 *
Pyrene	ng/g	<0.2 *	0.8 *	<0.3 *	<0.3 *

Sample Details					
Lab Sample ID:		**260409-123-13**	**260409-123-14**	**260409-123-15**	**260409-123-16**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Te Toro Ramp METPAH26MAR3	Te Toro Ramp METPAH26MAR4	Te Toro Ramp METPAH26MAR5	Te Toro Settlement METPAH26MAR1
General Testing					
Percentage Moisture	%	93.3	93.1	94.8	91.2

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260409-123-13**	**260409-123-14**	**260409-123-15**	**260409-123-16**
Client Sample ID:					
Sample Date/Time:		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Te Toro Ramp METPAH26MAR3	Te Toro Ramp METPAH26MAR4	Te Toro Ramp METPAH26MAR5	Te Toro Settlement METPAH26MAR1
General Testing					
Percentage Solids	%	6.7	6.9	5.2	8.8
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	12	11	13
Copper (Recoverable Dry Wt.)	mg/kg	560	600	620	660
Lead (Recoverable Dry Wt.)	mg/kg	0.18	0.27	0.23	0.32
Zinc (Recoverable Dry Wt.)	mg/kg	1900	2100	2100	2500
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	0.8 *	<0.3 *	<0.4 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.3 *	<0.4 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.3 *	<0.4 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.3 *	<0.4 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.3 *	<0.4 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.5 *	<0.5 *	<0.7 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.2 *	<1.3 *	<1.9 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.3 *	<0.4 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.2 *	<1.3 *	<1.9 *	<1.0 *
Fluoranthene	ng/g	1.3 *	1.0 *	<0.4 *	0.9 *
Fluorene	ng/g	2.0 *	1.4 *	<0.4 *	1.9 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.2 *	<1.3 *	<1.9 *	<1.0 *
Naphthalene	ng/g	4.3 *	3.9 *	1.2 *	10 *
Phenanthrene	ng/g	0.3 *	1.4 *	<0.4 *	1.0 *
Pyrene	ng/g	0.5 *	<0.3 *	<0.4 *	0.4 *

Sample Details					
Lab Sample ID:		**260409-123-17**	**260409-123-18**	**260409-123-19**	**260409-123-20**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Te Toro Settlement METPAH26MAR2	Te Toro Settlement METPAH26MAR3	Te Toro Settlement METPAH26MAR4	Te Toro Settlement METPAH26MAR5
General Testing					
Percentage Moisture	%	93.1	92.4	93.7	93.7
Percentage Solids	%	6.9	7.6	6.3	6.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	14	12	12
Copper (Recoverable Dry Wt.)	mg/kg	530	500	660	600
Lead (Recoverable Dry Wt.)	mg/kg	0.29	0.26	0.2	0.25
Zinc (Recoverable Dry Wt.)	mg/kg	1800	1700	2100	2400
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	1.1 *	1.0 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.6 *	<0.4 *	<0.5 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.4 *	<1.0 *	<1.2 *	<1.2 *
Chrysene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.4 *	<1.0 *	<1.2 *	<1.2 *
Fluoranthene	ng/g	1.6 *	1.0 *	0.6 *	0.7 *
Fluorene	ng/g	2.1 *	3.2 *	1.8 *	2.1 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.4 *	<1.0 *	<1.2 *	<1.2 *
Naphthalene	ng/g	4.8 *	8.9 *	7.1 *	3.6 *
Phenanthrene	ng/g	0.6 *	2.2 *	0.3 *	<0.2 *
Pyrene	ng/g	0.7 *	0.4 *	0.3 *	<0.2 *

Sample Details					
Lab Sample ID:		**260409-123-21**	**260409-123-22**	**260409-123-23**	**260409-123-24**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Gordons METPAH26 MAR1	Gordons METPAH26 MAR2	Gordons METPAH26 MAR3	Gordons METPAH26M AR4
General Testing					
Percentage Moisture	%	94.6	93.9	94.4	94.3
Percentage Solids	%	5.4	6.1	5.6	5.7
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	13	13	13
Copper (Recoverable Dry Wt.)	mg/kg	520	630	610	760
Lead (Recoverable Dry Wt.)	mg/kg	0.25	0.23	0.26	0.25
Zinc (Recoverable Dry Wt.)	mg/kg	1700	2000	1900	2500
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Acenaphthylene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Anthracene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Benzo[a]anthracene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Benzo[a]pyrene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Benzo[b+k]fluoranthene	ng/g	<0.6 *	<0.5 *	<0.5 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.6 *	<1.4 *	<1.3 *	<1.3 *
Chrysene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Dibenz[a,h]anthracene	ng/g	<1.6 *	<1.4 *	<1.3 *	<1.3 *
Fluoranthene	ng/g	0.5 *	1.0 *	2.0 *	1.9 *
Fluorene	ng/g	<0.3 *	<0.3 *	0.6 *	0.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.6 *	<1.4 *	<1.3 *	<1.3 *
Naphthalene	ng/g	2.7 *	8.2 *	12 *	1.7 *
Phenanthrene	ng/g	0.8 *	0.4 *	1.2 *	1.4 *
Pyrene	ng/g	<0.3 *	0.4 *	1.2 *	1.3 *

Sample Details					
Lab Sample ID:		**260409-123-25**	**260409-123-26**	**260409-123-27**	**260409-123-28**
Client Sample ID:					
Sample Date/Time		12/03/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Gordons METPAH26 MAR5	Control 26MAR1	Control 26MAR2	Control 26MAR3
General Testing					
Percentage Moisture	%	93.3	93.1	93.3	92.7
Percentage Solids	%	6.7	6.9	6.7	7.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	390	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.6	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	1000	-	-	-
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	-	-	-
Acenaphthylene	ng/g	<0.2 *	-	-	-
Anthracene	ng/g	<0.2 *	-	-	-
Benzo[a]anthracene	ng/g	<0.2 *	-	-	-
Benzo[a]pyrene	ng/g	<0.2 *	-	-	-
Benzo[b+k]fluoranthene	ng/g	0.5 *	-	-	-
Benzo[g,h,i]perylene	ng/g	<1.1 *	-	-	-
Chrysene	ng/g	<0.2 *	-	-	-
Dibenz[a,h]anthracene	ng/g	<1.1 *	-	-	-
Fluoranthene	ng/g	1.7 *	-	-	-
Fluorene	ng/g	2.7 *	-	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1.1 *	-	-	-
Naphthalene	ng/g	16 *	-	-	-
Phenanthrene	ng/g	2.3 *	-	-	-
Pyrene	ng/g	0.6 *	-	-	-

Sample Details			
Lab Sample ID:		**260409-123-29**	**260409-123-30**
Client Sample ID:			
Sample Date/Time		28/01/2026	28/01/2026
Description:		Control 26MAR4	Control 26MAR5
General Testing			
Percentage Moisture	%	92.9	93.2
Percentage Solids	%	7.1	6.8

**Result(s) are not accredited to International Accreditation New Zealand.*
-Result(s) marked as '-' indicates no test performed.
†Result(s) are subcontracted, refer to the attached certificate(s) of analysis for IANZ accreditation details.
Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Acenaphthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Acenaphthylene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[a]anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[a]pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[b+k]fluoranthene	In-house by GC-MS/MS	0.4 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[g,h,i]perylene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland

Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Chrysene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Dibenz[a,h]anthracene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Fluoranthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Fluorene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Indeno[1,2,3-cd]pyrene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Naphthalene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Phenanthrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Preps - Do not report				
QuEChERS Extraction	In-house by QuEChERS		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		All	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B		All	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Metals & PAH – April 2026

Watercare Laboratory Services

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Certificate of Analysis
Laboratory Reference: 260430-108

Attention:	Diana Villa Ortega	*Final Report:*	**632070-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**27-May-2026**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**30-Apr-2026**
		Sampled By:	**Lucia Duder**
Client Reference:	**SW Clark WWTP Monitoring - Contaminants**	*Laboratory Activity Dates:*	**05-May-2026 - 22-May-2026**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**260430-108-1**	**260430-108-2**	**260430-108-3**	**260430-108-4**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Matakawau METPAH26APR1	Matakawau METPAH26APR2	Matakawau METPAH26APR3	Matakawau METPAH26APR4
General Testing					
Percentage Moisture	%	90.8	92.3	90.9	90.9
Percentage Solids	%	9.2	7.7	9.1	9.1
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	15	13	14	15
Copper (Recoverable Dry Wt.)	mg/kg	820	580	650	480
Lead (Recoverable Dry Wt.)	mg/kg	0.35	0.31	0.34	0.28
Zinc (Recoverable Dry Wt.)	mg/kg	2800	1800	2300	1700
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.6 *	<0.5 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.4 *	<1.1 *	<1.2 *
Chrysene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.4 *	<1.1 *	1.6 *
Fluoranthene	ng/g	1.3 *	1.5 *	1.3 *	1.0 *
Fluorene	ng/g	4.3 *	<0.3 *	<0.2 *	<0.2 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.4 *	<1.1 *	<1.2 *
Naphthalene	ng/g	22 *	10.0 *	7.0 *	9.6 *
Phenanthrene	ng/g	4.4 *	5.2 *	<0.2 *	3.7 *
Pyrene	ng/g	1.0 *	1.0 *	0.9 *	0.7 *

Sample Details					
Lab Sample ID:		**260430-108-5**	**260430-108-6**	**260430-108-7**	**260430-108-8**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Matakawau METPAH26APR5	Karaka METPAH26AP R1	Karaka METPAH26AP R2	Karaka METPAH26AP R3
General Testing					
Percentage Moisture	%	91.8	90.9	90.2	91.1
Percentage Solids	%	8.2	9.1	9.8	8.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	15	13	12	16
Copper (Recoverable Dry Wt.)	mg/kg	740	580	560	660
Lead (Recoverable Dry Wt.)	mg/kg	0.29	0.27	0.27	0.38
Zinc (Recoverable Dry Wt.)	mg/kg	2400	1800	1900	2300

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260430-108-5**	**260430-108-6**	**260430-108-7**	**260430-108-8**
Client Sample ID:					
Sample Date/Time:		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Matakawau METPAH26APR5	Karaka METPAH26AP R1	Karaka METPAH26AP R2	Karaka METPAH26AP R3
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.5 *	<0.5 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.2 *	<1.2 *	<1.0 *	<1.1 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.2 *	<1.2 *	<1.0 *	<1.1 *
Fluoranthene	ng/g	1.1 *	1.4 *	1.1 *	1.6 *
Fluorene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.2 *	<1.2 *	<1.0 *	<1.1 *
Naphthalene	ng/g	23 *	20 *	9.4 *	14 *
Phenanthrene	ng/g	3.7 *	4.7 *	2.9 *	4.5 *
Pyrene	ng/g	0.8 *	1.1 *	0.7 *	1.2 *

Sample Details					
Lab Sample ID:		**260430-108-9**	**260430-108-10**	**260430-108-11**	**260430-108-12**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Karaka METPAH26AP R4	Karaka METPAH26AP R5	Te Toro Ramp METPAH26APR1	Te Toro Ramp METPAH26APR2
General Testing					
Percentage Moisture	%	89.7	90.9	92.1	93.1
Percentage Solids	%	10.3	9.1	7.9	6.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	13	16	15
Copper (Recoverable Dry Wt.)	mg/kg	590	530	470	640
Lead (Recoverable Dry Wt.)	mg/kg	0.25	0.26	0.29	0.37
Zinc (Recoverable Dry Wt.)	mg/kg	1900	1800	1700	2100
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	1.2 *	0.9 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.5 *	<0.6 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.1 *	<1.2 *	<1.4 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.1 *	<1.2 *	<1.4 *
Fluoranthene	ng/g	1.3 *	<0.2 *	1.1 *	1.3 *
Fluorene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.1 *	<1.2 *	<1.4 *
Naphthalene	ng/g	32 *	<0.2 *	23 *	17 *
Phenanthrene	ng/g	3.7 *	<0.2 *	4.0 *	5.5 *
Pyrene	ng/g	1.2 *	<0.2 *	0.8 *	0.9 *

Sample Details					
Lab Sample ID:		**260430-108-13**	**260430-108-14**	**260430-108-15**	**260430-108-16**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Te Toro Ramp METPAH26APR3	Te Toro Ramp METPAH26APR4	Te Toro Ramp METPAH26APR5	Te Toro Settlement METPAH26APR1
General Testing					
Percentage Moisture	%	93.6	92.4	93.9	90.6

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260430-108-13**	**260430-108-14**	**260430-108-15**	**260430-108-16**
Client Sample ID:					
Sample Date/Time:		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Te Toro Ramp METPAH26APR3	Te Toro Ramp METPAH26APR4	Te Toro Ramp METPAH26APR5	Te Toro Settlement METPAH26APR1
General Testing					
Percentage Solids	%	6.4	7.6	6.1	9.4
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	14	16	14
Copper (Recoverable Dry Wt.)	mg/kg	920	460	810	480
Lead (Recoverable Dry Wt.)	mg/kg	0.28	0.26	0.27	0.24
Zinc (Recoverable Dry Wt.)	mg/kg	3100	1500	2600	1700
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.3 *	<0.2 *	<0.3 *	<0.2 *
Acenaphthylene	ng/g	<0.3 *	<0.2 *	<0.3 *	<0.2 *
Anthracene	ng/g	<0.3 *	<0.2 *	<0.3 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.3 *	<0.2 *	<0.3 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.3 *	<0.2 *	<0.3 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.5 *	<0.4 *	<0.7 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.3 *	<1.1 *	<1.7 *	<1.0 *
Chrysene	ng/g	<0.3 *	<0.2 *	<0.3 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.3 *	<1.1 *	<1.7 *	<1.0 *
Fluoranthene	ng/g	<0.3 *	0.9 *	1.5 *	1.4 *
Fluorene	ng/g	<0.3 *	<0.2 *	<0.3 *	4.6 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.3 *	<1.1 *	<1.7 *	<1.0 *
Naphthalene	ng/g	15 *	17 *	27 *	31 *
Phenanthrene	ng/g	4.5 *	3.0 *	5.1 *	3.7 *
Pyrene	ng/g	0.6 *	0.6 *	1.2 *	1.0 *

Sample Details					
Lab Sample ID:		**260430-108-17**	**260430-108-18**	**260430-108-19**	**260430-108-20**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Te Toro Settlement METPAH26APR2	Te Toro Settlement METPAH26APR3	Te Toro Settlement METPAH26APR4	Te Toro Settlement METPAH26APR5
General Testing					
Percentage Moisture	%	89.6	88.9	90.1	91.9
Percentage Solids	%	10.4	11.1	9.9	8.1
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	14	13	14	13
Copper (Recoverable Dry Wt.)	mg/kg	550	440	430	530
Lead (Recoverable Dry Wt.)	mg/kg	0.23	0.25	0.23	0.32
Zinc (Recoverable Dry Wt.)	mg/kg	1800	1500	1500	2000
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Benzo[b+k]fluoranthene	ng/g	<0.5 *	<0.4 *	<0.4 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.2 *	<1.1 *	<1.1 *	<1.3 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.3 *
Dibenz[a,h]anthracene	ng/g	<1.2 *	<1.1 *	<1.1 *	<1.3 *
Fluoranthene	ng/g	1.7 *	1.6 *	1.3 *	1.7 *
Fluorene	ng/g	<0.2 *	4.5 *	5.1 *	<0.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.2 *	<1.1 *	<1.1 *	<1.3 *
Naphthalene	ng/g	44 *	18 *	30 *	11 *
Phenanthrene	ng/g	5.2 *	4.2 *	4.0 *	6.1 *
Pyrene	ng/g	1.5 *	1.1 *	1.2 *	1.3 *

Sample Details					
Lab Sample ID:		**260430-108-21**	**260430-108-22**	**260430-108-23**	**260430-108-24**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Gordons METPAH26A PR1	Gordons METPAH26A PR2	Gordons METPAH26A PR3	Gordons METPAH26A PR4
General Testing					
Percentage Moisture	%	94.0	93.5	93.4	93.6
Percentage Solids	%	6.0	6.5	6.6	6.4
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	15	14	14
Copper (Recoverable Dry Wt.)	mg/kg	580	580	740	680
Lead (Recoverable Dry Wt.)	mg/kg	0.27	0.34	0.25	0.25
Zinc (Recoverable Dry Wt.)	mg/kg	2000	2600	2500	2400
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Acenaphthylene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Anthracene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Benzo[a]anthracene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Benzo[a]pyrene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Benzo[b+k]fluoranthene	ng/g	<0.7 *	<0.7 *	<0.5 *	<0.7 *
Benzo[g,h,i]perylene	ng/g	<1.6 *	<1.7 *	<1.3 *	<1.6 *
Chrysene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Dibenz[a,h]anthracene	ng/g	<1.6 *	<1.7 *	<1.3 *	<1.6 *
Fluoranthene	ng/g	<0.3 *	1.8 *	1.7 *	1.5 *
Fluorene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.6 *	<1.7 *	<1.3 *	<1.6 *
Naphthalene	ng/g	26 *	35 *	28 *	28 *
Phenanthrene	ng/g	<0.3 *	<0.3 *	5.9 *	7.4 *
Pyrene	ng/g	<0.3 *	1.5 *	1.3 *	1.1 *

Sample Details					
Lab Sample ID:		**260430-108-25**	**260430-108-26**	**260430-108-27**	**260430-108-28**
Client Sample ID:					
Sample Date/Time		13/04/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Gordons METPAH26A PR5	Control 26APR1	Control 26APR2	Control 26APR3
General Testing					
Percentage Moisture	%	93.0	91.1	91.2	90.6
Percentage Solids	%	7.0	8.9	8.8	9.4
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	16	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	870	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.24	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	2700	-	-	-
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.3 *	-	-	-
Acenaphthylene	ng/g	<0.3 *	-	-	-
Anthracene	ng/g	<0.3 *	-	-	-
Benzo[a]anthracene	ng/g	<0.3 *	-	-	-
Benzo[a]pyrene	ng/g	<0.3 *	-	-	-
Benzo[b+k]fluoranthene	ng/g	<0.6 *	-	-	-
Benzo[g,h,i]perylene	ng/g	<1.6 *	-	-	-
Chrysene	ng/g	<0.3 *	-	-	-
Dibenz[a,h]anthracene	ng/g	<1.6 *	-	-	-
Fluoranthene	ng/g	2.0 *	-	-	-
Fluorene	ng/g	<0.3 *	-	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1.6 *	-	-	-
Naphthalene	ng/g	32 *	-	-	-
Phenanthrene	ng/g	<0.3 *	-	-	-
Pyrene	ng/g	1.6 *	-	-	-

Sample Details			
Lab Sample ID:		**260430-108-29**	**260430-108-30**
Client Sample ID:			
Sample Date/Time		12/03/2026	12/03/2026
Description:		Control 26APR4	Control 26APR5
General Testing			
Percentage Moisture	%	92.2	91.6
Percentage Solids	%	7.8	8.4

**Result(s) are not accredited to International Accreditation New Zealand.*
-Result(s) marked as '-' indicates no test performed.
†Result(s) are subcontracted, refer to the attached certificate(s) of analysis for IANZ accreditation details.
Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Acenaphthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Acenaphthylene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[a]anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[a]pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[b+k]fluoranthene	In-house by GC-MS/MS	0.4 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[g,h,i]perylene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland

Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Chrysene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Dibenz[a,h]anthracene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Fluoranthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Fluorene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Indeno[1,2,3-cd]pyrene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Naphthalene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Phenanthrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Preps - Do not report				
QuEChERS Extraction	In-house by QuEChERS		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		All	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B		All	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Metals & PAH – May 2026

Watercare
Laboratory Services

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Certificate of Analysis
Laboratory Reference: 260513-110

Attention:	Diana Villa Ortega	*Final Report:*	**635108-0**	*Replaces Report*	**633575-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**24-Jun-2026**		
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**18-May-2026**		
		Sampled By:	**Lucia Duder**		
Client Reference:	**SW Clark WWTP Monitoring - Contaminants**	*Laboratory Activity Dates:*	**20-May-2026** - **04-Jun-2026**		
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**		

Amended COA: Updated lead result for sample 260513-110-12 as potential spot contamination found during first analysis. Refer to case 26-0279 for further information.

Sample Details					
Lab Sample ID:		**260513-110-1**	**260513-110-2**	**260513-110-3**	**260513-110-4**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Matakawau METPAH26MAY1	Matakawau METPAH26MAY2	Matakawau METPAH26MAY3	Matakawau METPAH26MAY4
General Testing					
Percentage Moisture	%	92.1	91.9	91.8	91.0
Percentage Solids	%	7.9	8.1	8.2	9.0
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	13	15	14
Copper (Recoverable Dry Wt.)	mg/kg	430	480	610	460
Lead (Recoverable Dry Wt.)	mg/kg	0.21	0.31	0.26	0.23
Zinc (Recoverable Dry Wt.)	mg/kg	1400	1800	1700	1400
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.4 *	<0.4 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.0 *	<1.1 *	<1.1 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.0 *	<1.1 *	<1.1 *
Fluoranthene	ng/g	2.0 *	3.8 *	2.4 *	3.5 *
Fluorene	ng/g	7.8 *	9.9 *	7.0 *	11 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.0 *	<1.1 *	<1.1 *
Naphthalene	ng/g	33 *	45 *	21 *	33 *
Phenanthrene	ng/g	1.3 *	2.8 *	1.4 *	1.9 *
Pyrene	ng/g	1.7 *	3.2 *	1.8 *	2.4 *

Sample Details					
Lab Sample ID:		**260513-110-5**	**260513-110-6**	**260513-110-7**	**260513-110-8**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Matakawau METPAH26MAY5	Karaka METPAH26MA Y1	Karaka METPAH26MA Y2	Karaka METPAH26MA Y3
General Testing					
Percentage Moisture	%	91.8	91.4	91.1	90.6
Percentage Solids	%	8.2	8.6	8.9	9.4
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	14	15	12

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260513-110-5**	**260513-110-6**	**260513-110-7**	**260513-110-8**
Client Sample ID:					
Sample Date/Time:		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Matakawau METPAH26MAY5	Karaka METPAH26MA Y1	Karaka METPAH26MA Y2	Karaka METPAH26MA Y3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Copper (Recoverable Dry Wt.)	mg/kg	390	480	410	220
Lead (Recoverable Dry Wt.)	mg/kg	0.25	0.26	0.26	0.22
Zinc (Recoverable Dry Wt.)	mg/kg	1500	1700	1400	780
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.5 *	<0.4 *	<0.4 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.3 *	<1.0 *	<1.0 *	<1.0 *
Chrysene	ng/g	<0.3 *	<0.2 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.3 *	<1.0 *	<1.0 *	<1.0 *
Fluoranthene	ng/g	2.0 *	2.7 *	4.6 *	3.0 *
Fluorene	ng/g	11 *	7.6 *	9.5 *	3.3 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.3 *	<1.0 *	<1.0 *	<1.0 *
Naphthalene	ng/g	34 *	38 *	36 *	3.2 *
Phenanthrene	ng/g	<0.3 *	0.7 *	3.0 *	0.6 *
Pyrene	ng/g	1.7 *	1.9 *	3.1 *	1.9 *

Sample Details					
Lab Sample ID:		**260513-110-9**	**260513-110-10**	**260513-110-11**	**260513-110-12**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Karaka METPAH26MA Y4	Karaka METPAH26MA Y5	Te Toro Ramp METPAH26MAY1	Te Toro Ramp METPAH26MAY2
General Testing					
Percentage Moisture	%	91.2	90.4	92.3	92.5
Percentage Solids	%	8.8	9.6	7.7	7.5
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	14	13	14
Copper (Recoverable Dry Wt.)	mg/kg	520	440	400	530
Lead (Recoverable Dry Wt.)	mg/kg	0.32	0.24	0.21	0.24
Zinc (Recoverable Dry Wt.)	mg/kg	1500	1500	1500	2000
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.5 *	<0.4 *	<0.6 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.2 *	<1.0 *	<1.4 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.2 *	<0.3 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.2 *	<1.0 *	<1.4 *	<1.0 *
Fluoranthene	ng/g	2.6 *	3.0 *	3.8 *	3.8 *
Fluorene	ng/g	3.9 *	3.4 *	9.6 *	4.7 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.2 *	<1.0 *	<1.4 *	<1.0 *
Naphthalene	ng/g	1.6 *	4.5 *	28 *	7.5 *
Phenanthrene	ng/g	0.3 *	1.1 *	2.7 *	3.5 *
Pyrene	ng/g	1.9 *	1.9 *	2.5 *	3.0 *

Sample Details					
Lab Sample ID:		260513-110-13	260513-110-14	260513-110-15	260513-110-16
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Te Toro Ramp METPAH26MAY3	Te Toro Ramp METPAH26MAY4	Te Toro Ramp METPAH26MAY5	Te Toro Settlement METPAH26MAY1
General Testing					
Percentage Moisture	%	92.6	91.9	93.1	92.4
Percentage Solids	%	7.4	8.1	6.9	7.6
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	12	13	12	12
Copper (Recoverable Dry Wt.)	mg/kg	360	590	690	320
Lead (Recoverable Dry Wt.)	mg/kg	0.21	0.23	0.22	0.2
Zinc (Recoverable Dry Wt.)	mg/kg	1300	1800	2500	1100
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.3 *	<0.3 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.3 *	<0.3 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.3 *	<0.3 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.3 *	<0.3 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.3 *	<0.3 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.5 *	<0.5 *	<0.6 *	<0.4 *
Benzo[g,h,i]perylene	ng/g	<1.2 *	<1.4 *	<1.4 *	<1.0 *
Chrysene	ng/g	<0.2 *	<0.3 *	<0.3 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.2 *	<1.4 *	<1.4 *	<1.0 *
Fluoranthene	ng/g	4.1 *	4.0 *	3.4 *	4.4 *
Fluorene	ng/g	6.1 *	8.0 *	8.5 *	6.6 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.2 *	<1.4 *	<1.4 *	<1.0 *
Naphthalene	ng/g	7.5 *	14 *	14 *	18 *
Phenanthrene	ng/g	3.0 *	3.4 *	2.6 *	2.9 *
Pyrene	ng/g	2.5 *	2.7 *	2.4 *	2.9 *

Sample Details					
Lab Sample ID:		260513-110-17	260513-110-18	260513-110-19	260513-110-20
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Te Toro Settlement METPAH26MAY2	Te Toro Settlement METPAH26MAY3	Te Toro Settlement METPAH26MAY4	Te Toro Settlement METPAH26MAY5
General Testing					
Percentage Moisture	%	90.6	91.1	90.3	91.7
Percentage Solids	%	9.4	8.9	9.7	8.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	13	13	13	12
Copper (Recoverable Dry Wt.)	mg/kg	430	500	420	510
Lead (Recoverable Dry Wt.)	mg/kg	0.2	0.26	0.27	0.25
Zinc (Recoverable Dry Wt.)	mg/kg	1400	1700	1400	1500
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Acenaphthylene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Anthracene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.4 *	<0.5 *	<0.4 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.0 *	<1.3 *	<1.1 *	<1.1 *
Chrysene	ng/g	<0.2 *	<0.3 *	<0.2 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.0 *	<1.3 *	<1.1 *	<1.1 *
Fluoranthene	ng/g	5.9 *	4.1 *	4.6 *	3.7 *
Fluorene	ng/g	9.5 *	7.4 *	6.7 *	6.5 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.0 *	<1.3 *	<1.1 *	<1.1 *
Naphthalene	ng/g	41 *	12 *	30 *	11 *
Phenanthrene	ng/g	3.8 *	3.7 *	3.6 *	2.9 *
Pyrene	ng/g	3.9 *	2.6 *	3.0 *	2.3 *

Sample Details					
Lab Sample ID:		260513-110-21	260513-110-22	260513-110-23	260513-110-24
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Gordons METPAH26 MAY1	Gordons METPAH26 MAY2	Gordons METPAH26 MAY3	Gordons METPAH26M AY4
General Testing					
Percentage Moisture	%	93.0	93.2	93.0	92.1
Percentage Solids	%	7.0	6.8	7.0	7.9
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	13	12	12
Copper (Recoverable Dry Wt.)	mg/kg	420	530	490	520
Lead (Recoverable Dry Wt.)	mg/kg	0.16	0.26	0.2	0.18
Zinc (Recoverable Dry Wt.)	mg/kg	1400	1800	1500	1700
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.2 *
Acenaphthylene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.2 *
Anthracene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.2 *
Benzo[a]anthracene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.2 *
Benzo[a]pyrene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.2 *
Benzo[b+k]fluoranthene	ng/g	<0.6 *	<0.5 *	<0.5 *	<0.5 *
Benzo[g,h,i]perylene	ng/g	<1.4 *	<1.4 *	<1.3 *	<1.1 *
Chrysene	ng/g	<0.3 *	<0.3 *	<0.3 *	<0.2 *
Dibenz[a,h]anthracene	ng/g	<1.4 *	<1.4 *	<1.3 *	<1.1 *
Fluoranthene	ng/g	5.3 *	5.0 *	5.1 *	5.1 *
Fluorene	ng/g	7.1 *	14 *	11 *	8.6 *
Indeno[1,2,3-cd]pyrene	ng/g	<1.4 *	<1.4 *	<1.3 *	<1.1 *
Naphthalene	ng/g	12 *	29 *	17 *	11 *
Phenanthrene	ng/g	2.7 *	3.3 *	2.9 *	3.6 *
Pyrene	ng/g	3.2 *	2.9 *	3.2 *	2.9 *

Sample Details					
Lab Sample ID:		260513-110-25	260513-110-26	260513-110-27	260513-110-28
Client Sample ID:					
Sample Date/Time		13/05/2026	15/05/2026	15/05/2026	15/05/2026
Description:		Gordons METPAH26 MAY5	Control 26MAY1	Control 26MAY2	Control 26MAY3
General Testing					
Percentage Moisture	%	93.4	93.2	92.6	92.7
Percentage Solids	%	6.6	6.8	7.4	7.3
Metals					
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)					
Arsenic (Recoverable Dry Wt.)	mg/kg	11	-	-	-
Copper (Recoverable Dry Wt.)	mg/kg	600	-	-	-
Lead (Recoverable Dry Wt.)	mg/kg	0.24	-	-	-
Zinc (Recoverable Dry Wt.)	mg/kg	2000	-	-	-
Organics					
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)					
Acenaphthene	ng/g	<0.3 *	-	-	-
Acenaphthylene	ng/g	<0.3 *	-	-	-
Anthracene	ng/g	<0.3 *	-	-	-
Benzo[a]anthracene	ng/g	<0.3 *	-	-	-
Benzo[a]pyrene	ng/g	<0.3 *	-	-	-
Benzo[b+k]fluoranthene	ng/g	<0.6 *	-	-	-
Benzo[g,h,i]perylene	ng/g	<1.4 *	-	-	-
Chrysene	ng/g	<0.3 *	-	-	-
Dibenz[a,h]anthracene	ng/g	<1.4 *	-	-	-
Fluoranthene	ng/g	5.1 *	-	-	-
Fluorene	ng/g	16 *	-	-	-
Indeno[1,2,3-cd]pyrene	ng/g	<1.4 *	-	-	-
Naphthalene	ng/g	27 *	-	-	-
Phenanthrene	ng/g	5.8 *	-	-	-
Pyrene	ng/g	3.3 *	-	-	-

Sample Details			
Lab Sample ID:		**260513-110-29**	**260513-110-30**
Client Sample ID:			
Sample Date/Time		15/05/2026	15/05/2026
Description:		Control 26MAY4	Control 26MAY5
General Testing			
Percentage Moisture	%	93.6	93.6
Percentage Solids	%	6.4	6.4

**Result(s) are not accredited to International Accreditation New Zealand.*
-Result(s) marked as '-' indicates no test performed.
†Result(s) are subcontracted, refer to the attached certificate(s) of analysis for IANZ accreditation details.
Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Metals				
Recoverable Metals on Biomatter by ICP-MS - Trace (Dry Weight Basis)				
Arsenic (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.04 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Copper (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	2 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Lead (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Zinc (Recoverable Dry Wt.)	In House based on APHA (online edition) 3125 B by ICPMS	5 mg/kg	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Acenaphthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Acenaphthylene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[a]anthracene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[a]pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[b+k]fluoranthene	In-house by GC-MS/MS	0.4 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Benzo[g,h,i]perylene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland

Organics				
Polycyclic Aromatic Hydrocarbons (PAH) (Dry Weight Basis) by Gas Chromatography-Mass Spectrometry(Trace level)				
Chrysene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Dibenz[a,h]anthracene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Fluoranthene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Fluorene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Indeno[1,2,3-cd]pyrene	In-house by GC-MS/MS	1 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Naphthalene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Phenanthrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Pyrene	In-house by GC-MS/MS	0.2 ng/g	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Preps - Do not report				
QuEChERS Extraction	In-house by QuEChERS		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Preparations				
Digestion for Recoverable Metals in Biomatter	In House (8 mL Nitric, 1 mL Hydrochloric Acid: 1 hr 95°C: 2 mL hydrogen peroxide 1 hr 85°C)		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	Auckland
Biomatter Percentage Moisture	APHA (online edition) 2540 B		All	Auckland
Biomatter Percentage Solids	APHA (online edition) 2540 B		All	Auckland
Tissue Homogenising for Metals Analysis	In-house method (ML01)		All	Auckland

The stated method detection limit (MDL) applies to a relatively clean matrix under standard analytical conditions. Detection limits may change depending on sample volumes employed or required dilutions.
For further information, please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Bacteria & virus - August 2024

Watercare
Laboratory Services

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Certificate of Analysis
Laboratory Reference:240816-065

Attention:	Marine .	*Final Report:*	**561368-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**02-Sep-2024**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**16-Aug-2024**
		Sampled By:	**Bioresearches**
Client Reference:	**SW Clark WWTP Monitoring - Microbiology**	*Laboratory Activity Dates:*	**16-Aug-2024 - 29-Aug-2024**
Purchase Order:	**Y-3310-LB-002**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**240816-065-1**	**240816-065-2**	**240816-065-3**	**240816-065-4**
Client Sample ID:					
Sample Date/Time		16/08/2024	16/08/2024	16/08/2024	16/08/2024
Description:		Matakawau BAC24WI 1 dry	Matakawau BAC24WI 2 dry	Matakawau BAC24WI 3 dry	Matakawau BAC24WI 4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	45 *	78 *	78 *	20 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	170	490	490	220

Sample Details					
Lab Sample ID:		**240816-065-5**	**240816-065-6**	**240816-065-7**	**240816-065-8**
Client Sample ID:					
Sample Date/Time		16/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Matakawau BAC24WI 5 dry	Matakawau VIR24WI1 dry	Matakawau VIR24WI2 dry	Matakawau VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	230 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	330	-	-	-

Sample Details					
Lab Sample ID:		**240816-065-9**	**240816-065-10**	**240816-065-11**	**240816-065-12**
Client Sample ID:					
Sample Date/Time		16/08/2024	16/08/2024	16/08/2024	16/08/2024
Description:		Karaka BAC24WI1 dry	Karaka BAC24WI2 dry	Karaka BAC24WI3 dry	Karaka BAC24WI4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	78 *	20 *	45 *	40 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	78	130	20	45

Sample Details					
Lab Sample ID:		**240816-065-13**	**240816-065-14**	**240816-065-15**	**240816-065-16**
Client Sample ID:					
Sample Date/Time		16/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Karaka BAC24WI5 dry	Karaka VIR24WI1 dry	Karaka VIR24WI2 dry	Karaka VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240816-065-13**	**240816-065-14**	**240816-065-15**	**240816-065-16**
Client Sample ID:					
Sample Date/Time:		16/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Karaka BAC24WI5 dry	Karaka VIR24WI1 dry	Karaka VIR24WI2 dry	Karaka VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	20 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	330	-	-	-

Sample Details					
Lab Sample ID:		**240816-065-17**	**240816-065-18**	**240816-065-19**	**240816-065-20**
Client Sample ID:					
Sample Date/Time		16/08/2024	16/08/2024	16/08/2024	16/08/2024
Description:		Toro ramp BAC24WI1 dry	Toro ramp BAC24WI2 dry	Toro ramp BAC24WI3 dry	Toro ramp BAC24WI4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	78 *	130 *	61 *	20 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	110	45	330	120

Sample Details					
Lab Sample ID:		**240816-065-21**	**240816-065-22**	**240816-065-23**	**240816-065-24**
Client Sample ID:					
Sample Date/Time		16/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Toro ramp BAC24WI5 dry	Toro ramp VIR24WI1 dry	Toro ramp VIR24WI2 dry	Toro ramp VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	140	-	-	-

Sample Details					
Lab Sample ID:		**240816-065-25**	**240816-065-26**	**240816-065-27**	**240816-065-28**
Client Sample ID:					
Sample Date/Time		16/08/2024	16/08/2024	16/08/2024	16/08/2024
Description:		Te Toro BAC24WI1 dry	Te Toro BAC24WI2 dry	Te Toro BAC24WI3 dry	Te Toro BAC24WI4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	20 *	<18 *	20 *	20 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	110	<18	<18

Sample Details					
Lab Sample ID:		**240816-065-29**	**240816-065-30**	**240816-065-31**	**240816-065-32**
Client Sample ID:					
Sample Date/Time		16/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Te Toro BAC24WI5 dry	Te Toro VIR24WI1 dry	Te Toro VIR24WI2 dry	Te Toro VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	-

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**240816-065-29**	**240816-065-30**	**240816-065-31**	**240816-065-32**
Client Sample ID:					
Sample Date/Time:		16/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Te Toro BAC24WI5 dry	Te Toro VIR24WI1 dry	Te Toro VIR24WI2 dry	Te Toro VIR24WI3 dry
Microbiology					
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	18	-	-	-

Sample Details					
Lab Sample ID:		**240816-065-33**	**240816-065-34**	**240816-065-35**	**240816-065-36**
Client Sample ID:					
Sample Date/Time		16/08/2024	16/08/2024	16/08/2024	16/08/2024
Description:		Gordons BAC24WI1 dry	Gordons BAC24WI2 dry	Gordons BAC24WI3 dry	Gordons BAC24WI4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	170 *	78 *	490 *	140 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	45	110	78

Sample Details					
Lab Sample ID:		**240816-065-37**	**240816-065-38**	**240816-065-39**	**240816-065-40**
Client Sample ID:					
Sample Date/Time		16/08/2024	15/08/2024	15/08/2024	15/08/2024
Description:		Gordons BAC24WI5 dry	Gordons VIR24WI1 dry	Gordons VIR24WI2 dry	Gordons VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	110 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	110	-	-	-

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.

The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Qi Zhu

KTP Signatory

Certificate of Analysis Bacteria & virus - October 2024

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Certificate of Analysis
Laboratory Reference:241014-105

Attention:	Environmental Care	*Final Report:*	**570058-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**21-Nov-2024**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**31-Oct-2024**
Client Reference:	**SW Clark WWTP Monitoring - Microbiology**	*Laboratory Activity Dates:*	**31-Oct-2024 - 20-Nov-2024**
Purchase Order:	**Y-3310-LB-002**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**241014-105-1**	**241014-105-2**	**241014-105-3**	**241014-105-4**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Matakawau BAC24WI 1 dry	Matakawau BAC24WI 2 dry	Matakawau BAC24WI 3 dry	Matakawau BAC24WI 4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	78 *	170 *	2300 *	330 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	460	330	490	790

Sample Details					
Lab Sample ID:		**241014-105-5**	**241014-105-6**	**241014-105-7**	**241014-105-8**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Matakawau BAC24WI 5 dry	Matakawau VIR24WI1 dry	Matakawau VIR24WI2 dry	Matakawau VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	45 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	790	-	-	-

Sample Details					
Lab Sample ID:		**241014-105-9**	**241014-105-10**	**241014-105-11**	**241014-105-12**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Karaka BAC24WI1 dry	Karaka BAC24WI2 dry	Karaka BAC24WI3 dry	Karaka BAC24WI4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	20 *	20 *	45 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	130	18	<18

Sample Details					
Lab Sample ID:		**241014-105-13**	**241014-105-14**	**241014-105-15**	**241014-105-16**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Karaka BAC24WI5 dry	Karaka VIR24WI1 dry	Karaka VIR24WI2 dry	Karaka VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**241014-105-13**	**241014-105-14**	**241014-105-15**	**241014-105-16**
Client Sample ID:					
Sample Date/Time:		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Karaka BAC24WI5 dry	Karaka VIR24WI1 dry	Karaka VIR24WI2 dry	Karaka VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	45 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	-	-	-

Sample Details					
Lab Sample ID:		**241014-105-17**	**241014-105-18**	**241014-105-19**	**241014-105-20**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Toro ramp BAC24WI1 dry	Toro ramp BAC24WI2 dry	Toro ramp BAC24WI3 dry	Toro ramp BAC24WI4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	790 *	130 *	<18 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	78	230	<18	68

Sample Details					
Lab Sample ID:		**241014-105-21**	**241014-105-22**	**241014-105-23**	**241014-105-24**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Toro ramp BAC24WI5 dry	Toro ramp VIR24WI1 dry	Toro ramp VIR24WI2 dry	Toro ramp VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	20 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	170	-	-	-

Sample Details					
Lab Sample ID:		**241014-105-25**	**241014-105-26**	**241014-105-27**	**241014-105-28**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Te Toro BAC24WI1 dry	Te Toro BAC24WI2 dry	Te Toro BAC24WI3 dry	Te Toro BAC24WI4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	<18 *	<18 *	20 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	<18	<18	20

Sample Details					
Lab Sample ID:		**241014-105-29**	**241014-105-30**	**241014-105-31**	**241014-105-32**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Te Toro BAC24WI5 dry	Te Toro VIR24WI1 dry	Te Toro VIR24WI2 dry	Te Toro VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	-

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**241014-105-29**	**241014-105-30**	**241014-105-31**	**241014-105-32**
Client Sample ID:					
Sample Date/Time:		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Te Toro BAC24WI5 dry	Te Toro VIR24WI1 dry	Te Toro VIR24WI2 dry	Te Toro VIR24WI3 dry
Microbiology					
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

Sample Details					
Lab Sample ID:		**241014-105-33**	**241014-105-34**	**241014-105-35**	**241014-105-36**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Gordons BAC24WI1 dry	Gordons BAC24WI2 dry	Gordons BAC24WI3 dry	Gordons BAC24WI4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	<18 *	<18 *	40 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	20	<18	<18

Sample Details					
Lab Sample ID:		**241014-105-37**	**241014-105-38**	**241014-105-39**	**241014-105-40**
Client Sample ID:					
Sample Date/Time		30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00	30/10/2024 16:00
Description:		Gordons BAC24WI5 dry	Gordons VIR24WI1 dry	Gordons VIR24WI2 dry	Gordons VIR24WI3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	45 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	-	-	-

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Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

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Marina Fisher

KTP Signatory

Certificate of Analysis Bacteria & virus – January 2025

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Certificate of Analysis
Laboratory Reference:250123-106

Attention:		*Final Report:*	**578512-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**07-Feb-2025**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**23-Jan-2025**
Client Reference:	**SW Clark WWTP monitoring - microbiology**	*Laboratory Activity Dates:*	**23-Jan-2025 - 06-Feb-2025**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**250123-106-1**	**250123-106-2**	**250123-106-3**	**250123-106-4**
Client Sample ID:					
Sample Date/Time		23/01/2025	23/01/2025	23/01/2025	23/01/2025
Description:		Matakawau BAC25SU 1 dry	Matakawau BAC25SU 2 dry	Matakawau BAC25SU 3 dry	Matakawau BAC25SU 4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	460 *	790 *	2300 *	3300 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	1300	490	790	1300

Sample Details					
Lab Sample ID:		**250123-106-5**	**250123-106-6**	**250123-106-7**	**250123-106-8**
Client Sample ID:					
Sample Date/Time		23/01/2025	23/01/2025	23/01/2025	23/01/2025
Description:		Matakawau BAC25SU 5 dry	Matakawau VIR25SU 1 dry	Matakawau VIR25SU 2 dry	Matakawau VIR25SU3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	2300 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	490	-	-	-

Sample Details					
Lab Sample ID:		**250123-106-9**	**250123-106-10**	**250123-106-11**	**250123-106-12**
Client Sample ID:					
Sample Date/Time		23/01/2025	23/01/2025	23/01/2025	23/01/2025
Description:		Te Toro BAC25SU1 dry	Te Toro BAC25SU2 dry	Te Toro BAC25SU3 dry	Te Toro BAC25SU4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	<18 *	45 *	78 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	<18	<18	<18

Sample Details					
Lab Sample ID:		**250123-106-13**	**250123-106-14**	**250123-106-15**	**250123-106-16**
Client Sample ID:					
Sample Date/Time		23/01/2025	23/01/2025	23/01/2025	23/01/2025
Description:		Te Toro BAC25SU5 dry	Te Toro VIR25SU1 dry	Te Toro VIR25SU2 dry	Te Toro VIR25SU3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250123-106-13**	**250123-106-14**	**250123-106-15**	**250123-106-16**
Client Sample ID:					
Sample Date/Time:		23/01/2025	23/01/2025	23/01/2025	23/01/2025
Description:		Te Toro BAC25SU5 dry	Te Toro VIR25SU1 dry	Te Toro VIR25SU2 dry	Te Toro VIR25SU3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

Sample Details					
Lab Sample ID:		**250123-106-17**	**250123-106-18**	**250123-106-19**	**250123-106-20**
Client Sample ID:					
Sample Date/Time		23/01/2025	23/01/2025	23/01/2025	23/01/2025
Description:		Gordons BAC25SU1 dry	Gordons BAC25SU2 dry	Gordons BAC25SU3 dry	Gordons BAC25SU4 dry
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	170 *	68 *	68 *	45 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	93	78	170

Sample Details					
Lab Sample ID:		**250123-106-21**	**250123-106-22**	**250123-106-23**	**250123-106-24**
Client Sample ID:					
Sample Date/Time		23/01/2025	23/01/2025	23/01/2025	23/01/2025
Description:		Gordons BAC25SU5 dry	Gordons VIR25SU1 dry	Gordons VIR25SU2 dry	Gordons VIR25SU3 dry
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 16, 22, 23, 24	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		6, 7, 8, 14, 15, 16, 22, 23, 24	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Marina Fisher

KTP Signatory

Certificate of Analysis Bacteria & virus – March 2025

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Certificate of Analysis
Laboratory Reference: 250307-104

Attention:		*Final Report:*	**588386-0**	*Replaces Report*	**583819-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**02-May-2025**		
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**07-Mar-2025**		
		Sampled By:	**Levi Murdoch-Tighe**		
Client Reference:	**SW Clark WWTP Monitoring - Microbiology**	*Laboratory Activity Dates:*	**07-Mar-2025 - 24-Mar-2025**		
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16353**		

Amended CoA generated with corrected accreditation status .

Sample Details					
Lab Sample ID:		**250307-104-1**	**250307-104-2**	**250307-104-3**	**250307-104-4**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Matakawau BAC25MA RCH-1	Matakawau BAC25MA RCH-2	Matakawau BAC25MA RCH-3	Matakawau BAC25MA RCH-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	230 *	490 *	110 *	45 *

Sample Details					
Lab Sample ID:		**250307-104-5**	**250307-104-6**	**250307-104-7**	**250307-104-8**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Matakawau BAC25MA RCH-5	Matakawau VIR25MA RCH-1	Matakawau VIR25MA RCH-2	Matakawau VIR25MA RCH-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	130 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	-	45	78	220

Sample Details					
Lab Sample ID:		**250307-104-9**	**250307-104-10**	**250307-104-11**	**250307-104-12**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Karaka BAC25MARC H-1	Karaka BAC25MARC H-2	Karaka BAC25MARC H-3	Karaka BAC25MARC H-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	78 *	45 *	78 *

Sample Details					
Lab Sample ID:		**250307-104-13**	**250307-104-14**	**250307-104-15**	**250307-104-16**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Karaka BAC25MARC H-5	Karaka VIR25MARCH -1	Karaka VIR25MARCH -2	Karaka VIR25MARCH -3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250307-104-13**	**250307-104-14**	**250307-104-15**	**250307-104-16**
Client Sample ID:					
Sample Date/Time:		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Karaka BAC25MARC H-5	Karaka VIR25MARCH -1	Karaka VIR25MARCH -2	Karaka VIR25MARCH -3
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	45 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	-	45	78	78

Sample Details					
Lab Sample ID:		**250307-104-17**	**250307-104-18**	**250307-104-19**	**250307-104-20**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Toro Ramp BAC25MA RCH-1	Toro Ramp BAC25MA RCH-2	Toro Ramp BAC25MA RCH-3	Toro Ramp BAC25MA RCH-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	490 *	78 *	790 *	170 *

Sample Details					
Lab Sample ID:		**250307-104-21**	**250307-104-22**	**250307-104-23**	**250307-104-24**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Toro Ramp BAC25MA RCH-5	Toro Ramp VIR25MA RCH-1	Toro Ramp VIR25MA RCH-2	Toro Ramp VIR25MAR CH-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	78 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	-	45	45	<18

Sample Details					
Lab Sample ID:		**250307-104-25**	**250307-104-26**	**250307-104-27**	**250307-104-28**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Te Toro BAC25MARC H-1	Te Toro BAC25MARC H-2	Te Toro BAC25MARC H-3	Te Toro BAC25MARC H-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	230 *	45 *	45 *	78 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	-	20	<18	<18

Sample Details					
Lab Sample ID:		**250307-104-29**	**250307-104-30**	**250307-104-31**	**250307-104-32**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Te Toro BAC25MARC H-5	Te Toro VIR25MARCH -1	Te Toro VIR25MARCH -2	Te Toro VIR25MARCH -3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	170 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	-	-	-

Sample Details					
Lab Sample ID:		**250307-104-33**	**250307-104-34**	**250307-104-35**	**250307-104-36**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Gordons BAC25MAR CH-1	Gordons BAC25MAR CH-2	Gordons BAC25MAR CH-3	Gordons BAC25MAR CH-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	170 *	68 *	110 *	170 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	<18	<18	20

Sample Details					
Lab Sample ID:		**250307-104-37**	**250307-104-38**	**250307-104-39**	**250307-104-40**
Client Sample ID:					
Sample Date/Time		06/03/2025	06/03/2025	06/03/2025	06/03/2025
Description:		Gordons BAC25MAR CH-5	Gordons VIR25MARC H-1	Gordons VIR25MARC H-2	Gordons VIR25MARC H-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	20 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	6, 7, 8, 14, 15, 16, 22, 23, 24, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Bacteria & virus – May 2025

Watercare
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Certificate of Analysis
Laboratory Reference: 250515-136

Attention:	General -	*Final Report:*	**591914-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**05-Jun-2025**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**21-May-2025**
		Sampled By:	**Levi-Murdoch-Tighe**
Client Reference:	**SW Clark WWTP monitoring - microbiology**	*Laboratory Activity Dates:*	**21-May-2025 - 05-Jun-2025**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16353**

Sample Details					
Lab Sample ID:		**250515-136-1**	**250515-136-2**	**250515-136-3**	**250515-136-4**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Matakawau BAC25MA Y-1	Matakawau BAC25MA Y-2	Matakawau BAC25MA Y-3	Matakawau BAC25MA Y-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	170 *	140 *	78 *	170 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	45	40	230

Sample Details					
Lab Sample ID:		**250515-136-5**	**250515-136-6**	**250515-136-7**	**250515-136-8**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Matakawau BAC25MA Y-5	Matakawau VIR25MA Y-1	Matakawau VIR25MA Y-2	Matakawau VIR25MA Y-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	130 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	270	-	-	-

Sample Details					
Lab Sample ID:		**250515-136-9**	**250515-136-10**	**250515-136-11**	**250515-136-12**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Karaka BAC25MAY-1	Karaka BAC25MAY-2	Karaka BAC25MAY-3	Karaka BAC25MAY-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	130 *	330 *	700 *	130 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	230	45	45

Sample Details					
Lab Sample ID:		**250515-136-13**	**250515-136-14**	**250515-136-15**	**250515-136-17**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Karaka BAC25MAY-5	Karaka VIR25MAY-1	Karaka VIR25MAY-2	Toro Ramp BAC25MA Y-1
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	-

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250515-136-13**	**250515-136-14**	**250515-136-15**	**250515-136-17**
Client Sample ID:					
Sample Date/Time:		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Karaka BAC25MAY-5	Karaka VIR25MAY-1	Karaka VIR25MAY-2	Toro Ramp BAC25MA Y-1
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	45 *	-	-	230 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	130	-	-	230

Sample Details					
Lab Sample ID:		**250515-136-18**	**250515-136-19**	**250515-136-20**	**250515-136-21**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Toro Ramp BAC25MA Y-2	Toro Ramp BAC25MA Y-3	Toro Ramp BAC25MA Y-4	Toro Ramp BAC25MA Y-5
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	330 *	140 *	230 *	330 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	170	330	78	790

Sample Details					
Lab Sample ID:		**250515-136-22**	**250515-136-23**	**250515-136-24**	**250515-136-25**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Toro Ramp VIR25MAY -1	Toro Ramp VIR25MAY -2	Toro Ramp VIR25MAY -3	Te Toro BAC25MAY-1
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	<4.0	<4.0	<4.0	-
Enterococci by MPN					
Enterococci	MPN/100g	-	-	-	78 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	-	-	-	170

Sample Details					
Lab Sample ID:		**250515-136-26**	**250515-136-27**	**250515-136-28**	**250515-136-29**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Te Toro BAC25MAY-2	Te Toro BAC25MAY-3	Te Toro BAC25MAY-4	Te Toro BAC25MAY-5
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	790 *	110 *	78 *	110 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	20	20	230

Sample Details					
Lab Sample ID:		**250515-136-30**	**250515-136-31**	**250515-136-32**	**250515-136-33**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Te Toro VIR25MAY-1	Te Toro VIR25MAY-2	Te Toro VIR25MAY-3	Gordons BAC25MAY-1
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	<4.0	<4.0	<4.0	-
Enterococci by MPN					
Enterococci	MPN/100g	-	-	-	78 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	-	-	-	310

Sample Details					
Lab Sample ID:		**250515-136-34**	**250515-136-35**	**250515-136-36**	**250515-136-37**
Client Sample ID:					
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025	20/05/2025
Description:		Gordons BAC25MAY-2	Gordons BAC25MAY-3	Gordons BAC25MAY-4	Gordons BAC25MAY-5
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	68 *	1300 *	1300 *	220 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	130	<18	20	78

Sample Details				
Lab Sample ID:		**250515-136-38**	**250515-136-39**	**250515-136-40**
Client Sample ID:				
Sample Date/Time		20/05/2025	20/05/2025	20/05/2025
Description:		Gordons VIR25MAY-1	Gordons VIR25MAY-2	Gordons VIR25MAY-3
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	pfu/100 g	<4.0	<4.0	<4.0

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Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		6, 7, 8, 14, 15, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Bacteria & virus – August 2025

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Certificate of Analysis
Laboratory Reference: 250821-096

Attention:		*Final Report:*	**602384-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**08-Sep-2025**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**21-Aug-2025**
Client Reference:	**SW Clark WWTP monitoring - microbiology**	*Laboratory Activity Dates:*	**21-Aug-2025 - 07-Sep-2025**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**250821-096-1**	**250821-096-2**	**250821-096-3**	**250821-096-4**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Matakawau BAC25AU G-1	Matakawau BAC25AU G-2	Matakawau BAC25AU G-3	Matakawau BAC25AU G-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	40 *	20 *	330 *	45 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	330	270	220	700

Sample Details					
Lab Sample ID:		**250821-096-5**	**250821-096-6**	**250821-096-7**	**250821-096-8**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Matakawau BAC25AU G-5	Matakawau VIR25AU G-1	Matakawau VIR25AU G-2	Matakawau VIR25AU G-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	78 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	490	-	-	-

Sample Details					
Lab Sample ID:		**250821-096-9**	**250821-096-10**	**250821-096-11**	**250821-096-12**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Karaka BAC25AUG-1	Karaka BAC25AUG-2	Karaka BAC25AUG-3	Karaka BAC25AUG-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	45 *	170 *	45 *	45 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	78	220	110	230

Sample Details					
Lab Sample ID:		**250821-096-13**	**250821-096-14**	**250821-096-15**	**250821-096-16**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Karaka BAC25AUG-5	Karaka VIR25AUG-1	Karaka VIR25AUG-2	Karaka VIR25AUG-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**250821-096-13**	**250821-096-14**	**250821-096-15**	**250821-096-16**
Client Sample ID:					
Sample Date/Time:		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Karaka BAC25AUG-5	Karaka VIR25AUG-1	Karaka VIR25AUG-2	Karaka VIR25AUG-3
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	130 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	330	-	-	-

Sample Details					
Lab Sample ID:		**250821-096-17**	**250821-096-18**	**250821-096-19**	**250821-096-20**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Te Toro ramp BAC25A UG-1	Te Toro ramp BAC25A UG-2	Te Toro ramp BAC25A UG-3	Te Toro ramp BAC25A UG-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	170 *	490 *	330 *	170 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	230	61	490	78

Sample Details					
Lab Sample ID:		**250821-096-21**	**250821-096-22**	**250821-096-23**	**250821-096-24**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Te Toro ramp BAC25A UG-5	Te Toro ramp VIR25A UG-1	Te Toro ramp VIR25A UG-2	Te Toro ramp VIR25A UG-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	110 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	230	-	-	-

Sample Details					
Lab Sample ID:		**250821-096-25**	**250821-096-26**	**250821-096-27**	**250821-096-28**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Te Toro Settlement BAC25AUG-1	Te Toro Settlement BAC25AUG-2	Te Toro Settlement BAC25AUG-3	Te Toro Settlement BAC25AUG-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	120 *	110 *	130 *	78 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	170	110	170	230

Sample Details					
Lab Sample ID:		**250821-096-29**	**250821-096-30**	**250821-096-31**	**250821-096-32**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Te Toro Settlement BAC25AUG-5	Te Toro Settlement VIR25AUG-1	Te Toro Settlement VIR25AUG-2	Te Toro Settlement VIR25AUG-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	230 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	330	-	-	-

Sample Details					
Lab Sample ID:		**250821-096-33**	**250821-096-34**	**250821-096-35**	**250821-096-36**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Gordons BAC25AUG-1	Gordons BAC25AUG-2	Gordons BAC25AUG-3	Gordons BAC25AUG-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	230 *	130 *	170 *	170 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	78	790	310	<18

Sample Details					
Lab Sample ID:		**250821-096-37**	**250821-096-38**	**250821-096-39**	**250821-096-40**
Client Sample ID:					
Sample Date/Time		20/08/2025	20/08/2025	20/08/2025	20/08/2025
Description:		Gordons BAC25AUG-5	Gordons VIR25AUG-1	Gordons VIR25AUG-2	Gordons VIR25AUG-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	20 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	130	-	-	-

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Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Bacteria & virus – October 2025

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Certificate of Analysis
Laboratory Reference: 251017-069

Attention:	Marine .		*Final Report:*	**608629-0**	
Client:	**WATERCARE SERVICES LTD**	Gordons and Karaka results need to be swapped	*Report Issue Date:*	**03-Nov-2025**	
Address:	**PO Box 92521, Wellesley Street, 1141**		*Received Date:*	**17-Oct-2025**	
			Sampled By:	**Lucia Duder**	
Client Reference:	**SW Clark WWTP - microbiology**		*Laboratory Activity Dates:*	**17-Oct-2025** - **03-Nov-2025**	
Purchase Order:	**3310-WV-02-693040**		*Quote Reference :*	**16391**	

Sample Details					
Lab Sample ID:		**251017-069-9**	**251017-069-10**	**251017-069-11**	**251017-069-12**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Karaka BAC25OCT-1	Karaka BAC25OCT-2	Karaka BAC25OCT-3	Karaka BAC25OCT-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	20 *	20 *	40 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	20	45	45

Sample Details					
Lab Sample ID:		**251017-069-13**	**251017-069-14**	**251017-069-15**	**251017-069-16**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Karaka BAC25OCT-5	Karaka VIR25OCT-1	Karaka VIR25OCT-2	Karaka VIR25OCT-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	68 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	-	-	-

Sample Details					
Lab Sample ID:		**251017-069-25**	**251017-069-26**	**251017-069-27**	**251017-069-28**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Te Toro Settlement BAC25OCT-1	Te Toro Settlement BAC25OCT-2	Te Toro Settlement BAC25OCT-3	Te Toro Settlement BAC25OCT-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	<18 *	<18 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	20	170	68

Sample Details					
Lab Sample ID:		**251017-069-29**	**251017-069-30**	**251017-069-31**	**251017-069-32**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Te Toro Settlement BAC25OCT-5	Te Toro Settlement VIR25OCT-1	Te Toro Settlement VIR25OCT-2	Te Toro Settlement VIR25OCT-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**251017-069-29**	**251017-069-30**	**251017-069-31**	**251017-069-32**
Client Sample ID:					
Sample Date/Time:		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Te Toro Settlement BAC25OCT-5	Te Toro Settlement VIR25OCT-1	Te Toro Settlement VIR25OCT-2	Te Toro Settlement VIR25OCT-3
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	20 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	-	-	-

Sample Details					
Lab Sample ID:		**251017-069-33**	**251017-069-34**	**251017-069-35**	**251017-069-36**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Gordons BAC25OCT-1	Gordons BAC25OCT-2	Gordons BAC25OCT-3	Gordons BAC25OCT-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	<18 *	<18 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	78	20	78

Sample Details					
Lab Sample ID:		**251017-069-37**	**251017-069-38**	**251017-069-39**	**251017-069-40**
Client Sample ID:					
Sample Date/Time		16/10/2025	16/10/2025	16/10/2025	16/10/2025
Description:		Gordons BAC25OCT-5	Gordons VIR25OCT-1	Gordons VIR25OCT-2	Gordons VIR25OCT-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	78 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	14, 15, 16, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	9, 10, 11, 12, 13, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	9, 10, 11, 12, 13, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		14, 15, 16, 30, 31, 32, 38, 39, 40	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Bacteria & virus – December 2025

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Certificate of Analysis
Laboratory Reference: 251211-128

Attention:		*Final Report:*	**615252-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**30-Dec-2025**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**16-Dec-2025**
Client Reference:	**SW Clark WWTP monitoring - microbiology**	*Laboratory Activity Dates:*	**16-Dec-2025 - 30-Dec-2025**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**251211-128-1**	**251211-128-2**	**251211-128-3**	**251211-128-4**
Client Sample ID:					
Sample Date/Time		15/12/2025	15/12/2025	15/12/2025	15/12/2025
Description:		Matakawau BAC25DEC-1	Matakawau BAC25DEC-2	Matakawau BAC25DEC-3	Matakawau BAC25DEC-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	45 *	<18 *	40 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	330	<18	78

Sample Details					
Lab Sample ID:		**251211-128-5**	**251211-128-6**	**251211-128-7**	**251211-128-8**
Client Sample ID:					
Sample Date/Time		15/12/2025	15/12/2025	15/12/2025	15/12/2025
Description:		Matakawau BAC25DEC-5	Matakawau VIR25DEC-1	Matakawau VIR25DEC-2	Matakawau VIR25DEC-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

Sample Details					
Lab Sample ID:		**251211-128-9**	**251211-128-10**	**251211-128-11**	**251211-128-12**
Client Sample ID:					
Sample Date/Time		15/12/2025	15/12/2025	15/12/2025	15/12/2025
Description:		Karaka BAC25DEC-1	Karaka BAC25DEC-2	Karaka BAC25DEC-3	Karaka BAC25DEC-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	45 *	20 *	<18 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	<18	<18	490

Sample Details					
Lab Sample ID:		**251211-128-13**	**251211-128-14**	**251211-128-15**	**251211-128-17**
Client Sample ID:					
Sample Date/Time		15/12/2025	15/12/2025	15/12/2025	15/12/2025
Description:		Karaka BAC25DEC-5	Karaka VIR25DEC-1	Karaka VIR25DEC-2	Te Toro Settlement BAC25DEC-1
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	-

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**251211-128-13**	**251211-128-14**	**251211-128-15**	**251211-128-17**
Client Sample ID:					
Sample Date/Time:		15/12/2025	15/12/2025	15/12/2025	15/12/2025
Description:		Karaka BAC25DEC-5	Karaka VIR25DEC-1	Karaka VIR25DEC-2	Te Toro Settlement BAC25DEC-1
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	<18

Sample Details					
Lab Sample ID:		**251211-128-18**	**251211-128-19**	**251211-128-20**	**251211-128-21**
Client Sample ID:					
Sample Date/Time		15/12/2025	15/12/2025	15/12/2025	15/12/2025
Description:		Te Toro Settlement BAC25DEC-2	Te Toro Settlement BAC25DEC-3	Te Toro Settlement BAC25DEC-4	Te Toro Settlement BAC25DEC-5
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	20 *	330 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	<18	<18	<18

Sample Details					
Lab Sample ID:		**251211-128-22**	**251211-128-23**	**251211-128-24**	**251211-128-25**
Client Sample ID:					
Sample Date/Time		15/12/2025	15/12/2025	15/12/2025	15/12/2025
Description:		Te Toro Settlement VIR25DEC-1	Te Toro Settlement VIR25DEC-2	Te Toro Settlement VIR25DEC-3	Gordons BAC25DEC-1
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	<4.0	<4.0	<4.0	-
Enterococci by MPN					
Enterococci	MPN/100g	-	-	-	2300 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	-	-	-	210

Sample Details					
Lab Sample ID:		**251211-128-26**	**251211-128-27**	**251211-128-28**	**251211-128-29**
Client Sample ID:					
Sample Date/Time		15/12/2025	15/12/2025	15/12/2025	15/12/2025
Description:		Gordons BAC25DEC-2	Gordons BAC25DEC-3	Gordons BAC25DEC-4	Gordons BAC25DEC-5
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	78 *	20 *	230 *	230 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	130	130	490	920

Sample Details				
Lab Sample ID:		**251211-128-30**	**251211-128-31**	**251211-128-32**
Client Sample ID:				
Sample Date/Time		15/12/2025	15/12/2025	15/12/2025
Description:		Gordons VIR25DEC-1	Gordons VIR25DEC-2	Gordons VIR25DEC-3
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	pfu/100 g	<4.0	<4.0	<4.0

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 22, 23, 24, 30, 31, 32	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		6, 7, 8, 14, 15, 22, 23, 24, 30, 31, 32	Auckland

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Bacteria & virus – January 2026

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Certificate of Analysis
Laboratory Reference: 260129-078

Attention:		*Final Report:*	**623054-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**09-Mar-2026**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**30-Jan-2026**
Client Reference:	**SW Clark WWTP monitoring - microbiology**	*Laboratory Activity Dates:*	**30-Jan-2026 - 09-Mar-2026**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**260129-078-1**	**260129-078-2**	**260129-078-3**	**260129-078-4**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Matakawau BAC26JAN-1	Matakawau BAC26JAN-2	Matakawau BAC26JAN-3	Matakawau BAC26JAN-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	45 *	130 *	20 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	330	20	130	45

Sample Details					
Lab Sample ID:		**260129-078-5**	**260129-078-6**	**260129-078-7**	**260129-078-8**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Matakawau BAC26JAN-5	Matakawau VIR26JAN-1	Matakawau VIR26JAN-2	Matakawau VIR26JAN-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	45 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

Sample Details					
Lab Sample ID:		**260129-078-9**	**260129-078-10**	**260129-078-11**	**260129-078-12**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Karaka BAC26JAN-1	Karaka BAC26JAN-2	Karaka BAC26JAN-3	Karaka BAC26JAN-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	<18 *	<18 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	68	45	130	20

Sample Details					
Lab Sample ID:		**260129-078-13**	**260129-078-14**	**260129-078-15**	**260129-078-16**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Karaka BAC26JAN-5	Karaka VIR26JAN-1	Karaka VIR26JAN-2	Karaka VIR25AUG-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260129-078-13**	**260129-078-14**	**260129-078-15**	**260129-078-16**
Client Sample ID:					
Sample Date/Time:		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Karaka BAC26JAN-5	Karaka VIR26JAN-1	Karaka VIR26JAN-2	Karaka VIR25AUG-3
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	110	-	-	-

Sample Details					
Lab Sample ID:		**260129-078-17**	**260129-078-18**	**260129-078-19**	**260129-078-20**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Te Toro ramp BAC26JAN-1	Te Toro ramp BAC26JAN-2	Te Toro ramp BAC26JAN-3	Te Toro ramp BAC26JAN-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	20 *	<18 *	20 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	20	<18	110

Sample Details					
Lab Sample ID:		**260129-078-21**	**260129-078-22**	**260129-078-23**	**260129-078-24**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Te Toro ramp BAC26JAN-5	Te Toro ramp VIR26JAN-1	Te Toro ramp VIR26JAN-2	Te Toro ramp VIR26JAN-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	-	-	-

Sample Details					
Lab Sample ID:		**260129-078-25**	**260129-078-26**	**260129-078-27**	**260129-078-28**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Te Toro Settlement BAC26JAN-1	Te Toro Settlement BAC26JAN-2	Te Toro Settlement BAC26JAN-3	Te Toro Settlement BAC26JAN-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	<18 *	20 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	<18	<18	<18

Sample Details					
Lab Sample ID:		**260129-078-29**	**260129-078-30**	**260129-078-31**	**260129-078-32**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Te Toro Settlement BAC26JAN-5	Te Toro Settlement VIR26JAN-1	Te Toro Settlement VIR26JAN-2	Te Toro Settlement VIR26JAN-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

Sample Details					
Lab Sample ID:		**260129-078-33**	**260129-078-34**	**260129-078-35**	**260129-078-36**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Gordons BAC26JAN-1	Gordons BAC26JAN-2	Gordons BAC26JAN-3	Gordons BAC26JAN-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	20 *	<18 *	20 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	<18	20	<18

Sample Details					
Lab Sample ID:		**260129-078-37**	**260129-078-38**	**260129-078-39**	**260129-078-40**
Client Sample ID:					
Sample Date/Time		28/01/2026	28/01/2026	28/01/2026	28/01/2026
Description:		Gordons BAC26JAN-5	Gordons VIR26JAN-1	Gordons VIR26JAN-2	Gordons VIR26JAN-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	45 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

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-Result(s) marked as '-' indicates no test performed.
†Result(s) are subcontracted, refer to the attached certificate(s) of analysis for IANZ accreditation details.

Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Bacteria & virus – March 2026

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Laboratory Services

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www.watercarelabs.co.nz

Certificate of Analysis
Laboratory Reference: 260312-131

Attention:	Marine .	*Final Report:*	**627317-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**16-Apr-2026**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**13-Mar-2026**
		Sampled By:	**Lucia Duder**
Client Reference:	**SW Clark WWTP monitoring -microbiology**	*Laboratory Activity Dates:*	**13-Mar-2026 - 08-Apr-2026**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**260312-131-1**	**260312-131-2**	**260312-131-3**	**260312-131-4**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Matakawau BAC26MA R-1	Matakawau BAC26MA R-2	Matakawau BAC26MA R-3	Matakawau BAC26MA R-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	45 *	700 *	140 *	78 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	20	68	20

Sample Details					
Lab Sample ID:		**260312-131-5**	**260312-131-6**	**260312-131-7**	**260312-131-8**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Matakawau BAC26MA R-5	Matakawau VIR26MA R-1	Matakawau VIR26MA R-2	Matakawau VIR26MA R-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	78 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	-	-	-

Sample Details					
Lab Sample ID:		**260312-131-9**	**260312-131-10**	**260312-131-11**	**260312-131-12**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Karaka BAC26MAR-1	Karaka BAC26MAR-2	Karaka BAC26MAR-3	Karaka BAC26MAR-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	130 *	11000 *	450 *	220 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	20	20	45	110

Sample Details					
Lab Sample ID:		**260312-131-13**	**260312-131-14**	**260312-131-15**	**260312-131-16**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Karaka BAC26MAR-5	Karaka VIR26MAR-1	Karaka VIR26MAR-2	Karaka VIR26MAR-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260312-131-13**	**260312-131-14**	**260312-131-15**	**260312-131-16**
Client Sample ID:					
Sample Date/Time:		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Karaka BAC26MAR-5	Karaka VIR26MAR-1	Karaka VIR26MAR-2	Karaka VIR26MAR-3
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	330 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

Sample Details					
Lab Sample ID:		**260312-131-17**	**260312-131-18**	**260312-131-19**	**260312-131-20**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Te Toro Ramp BAC26 MAR-1	Te Toro Ramp BAC26 MAR-2	Te Toro Ramp BAC26 MAR-3	Te Toro Ramp BAC26 MAR-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	140 *	110 *	330 *	130 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	210	<18	<18

Sample Details					
Lab Sample ID:		**260312-131-21**	**260312-131-22**	**260312-131-23**	**260312-131-24**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Te Toro Ramp BAC26 MAR-5	Te Toro Ramp VIR26M AR-1	Te Toro Ramp VIR26M AR-2	Te Toro Ramp VIR26M AR-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	130 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	-	-	-

Sample Details					
Lab Sample ID:		**260312-131-25**	**260312-131-26**	**260312-131-27**	**260312-131-28**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Te Toro Settlement BAC26MAR-1	Te Toro Settlement BAC26MAR-2	Te Toro Settlement BAC26MAR-3	Te Toro Settlement BAC26MAR-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	45 *	40 *	<18 *	110 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	<18	45	170	20

Sample Details					
Lab Sample ID:		**260312-131-29**	**260312-131-30**	**260312-131-31**	**260312-131-32**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Te Toro Settlement BAC26MAR-5	Te Toro Settlement VIR26MAR-1	Te Toro Settlement VIR26MAR-2	Te Toro Settlement VIR26MAR-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	45 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	-	-	-

Sample Details					
Lab Sample ID:		**260312-131-33**	**260312-131-34**	**260312-131-35**	**260312-131-36**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Gordons BAC26MAR-1	Gordons BAC26MAR-2	Gordons BAC26MAR-3	Gordons BAC26MAR-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	<18 *	20 *	<18 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	40	45	<18	78

Sample Details					
Lab Sample ID:		**260312-131-37**	**260312-131-38**	**260312-131-39**	**260312-131-40**
Client Sample ID:					
Sample Date/Time		12/03/2026	12/03/2026	12/03/2026	12/03/2026
Description:		Gordons BAC26MAR-5	Gordons VIR26MAR-1	Gordons VIR26MAR-2	Gordons VIR26MAR-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	20 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	230	-	-	-

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Reference Methods
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Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method		6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Bacteria & virus – April 2026

Watercare Laboratory Services

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Certificate of Analysis
Laboratory Reference: 260414-128

Attention:	Diana Villa Ortega	*Final Report:*	**629690-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**06-May-2026**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**14-Apr-2026**
Client Reference:	**SW Clark WWTP monitoring - microbiology**	*Laboratory Activity Dates:*	**14-Apr-2026 - 06-May-2026**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**260414-128-1**	**260414-128-2**	**260414-128-3**	**260414-128-4**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Matakawau BAC26APR-1	Matakawau BAC26APR-2	Matakawau BAC26APR-3	Matakawau BAC26APR-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	1300 *	4900 *	1700 *	13000 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	790	490	1300	1100

Sample Details					
Lab Sample ID:		**260414-128-5**	**260414-128-6**	**260414-128-7**	**260414-128-8**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Matakawau BAC26APR-5	Matakawau VIR26APR-1	Matakawau VIR26APR-2	Matakawau VIR26APR-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	3300 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	230	-	-	-

Sample Details					
Lab Sample ID:		**260414-128-9**	**260414-128-10**	**260414-128-11**	**260414-128-12**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Karaka BAC26APR-1	Karaka BAC26APR-2	Karaka BAC26APR-3	Karaka BAC26APR-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	220 *	220 *	920 *	170 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	330	130	700	330

Sample Details					
Lab Sample ID:		**260414-128-13**	**260414-128-14**	**260414-128-15**	**260414-128-16**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Karaka BAC26APR-5	Karaka VIR26APR-1	Karaka VIR26APR-2	Karaka VIR26APR-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260414-128-13**	**260414-128-14**	**260414-128-15**	**260414-128-16**
Client Sample ID:					
Sample Date/Time:		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Karaka BAC26APR-5	Karaka VIR26APR-1	Karaka VIR26APR-2	Karaka VIR26APR-3
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	1100 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	220	-	-	-

Sample Details					
Lab Sample ID:		**260414-128-17**	**260414-128-18**	**260414-128-19**	**260414-128-20**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Te Toro Ramp BAC26APR-1	Te Toro Ramp BAC26APR-2	Te Toro Ramp BAC26APR-3	Te Toro Ramp BAC26APR-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	790 *	490 *	490 *	1400 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	1300	1300	2300	2300

Sample Details					
Lab Sample ID:		**260414-128-21**	**260414-128-22**	**260414-128-23**	**260414-128-24**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Te Toro Ramp BAC26APR-5	Te Toro Ramp VIR26APR-1	Te Toro Ramp VIR26APR-2	Te Toro Ramp VIR26APR-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	200 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	1100	-	-	-

Sample Details					
Lab Sample ID:		**260414-128-25**	**260414-128-26**	**260414-128-27**	**260414-128-28**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Te Toro Settlement BAC26APR-1	Te Toro Settlement BAC26APR-2	Te Toro Settlement BAC26APR-3	Te Toro Settlement BAC26APR-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	790 *	330 *	40 *	790 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	490	790	790	130

Sample Details					
Lab Sample ID:		**260414-128-29**	**260414-128-30**	**260414-128-31**	**260414-128-32**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Te Toro Settlement BAC26APR-5	Te Toro Settlement VIR26APR-1	Te Toro Settlement VIR26APR-2	Te Toro Settlement VIR26APR-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	93 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	170	-	-	-

Sample Details					
Lab Sample ID:		**260414-128-33**	**260414-128-34**	**260414-128-35**	**260414-128-36**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Gordons BAC26APR-1	Gordons BAC26APR-2	Gordons BAC26APR-3	Gordons BAC26APR-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	3300 *	4900 *	390 *	2300 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	790	3300	2300	3100

Sample Details					
Lab Sample ID:		**260414-128-37**	**260414-128-38**	**260414-128-39**	**260414-128-40**
Client Sample ID:					
Sample Date/Time		13/04/2026	13/04/2026	13/04/2026	13/04/2026
Description:		Gordons BAC26APR-5	Gordons VIR26APR-1	Gordons VIR26APR-2	Gordons VIR26APR-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	2300 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	1300	-	-	-

**Result(s) are not accredited to International Accreditation New Zealand.*
-Result(s) marked as '-' indicates no test performed.
†Result(s) are subcontracted, refer to the attached certificate(s) of analysis for IANZ accreditation details.

Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
Microbiology				
Culturable Enteroviruses (presumptive) by Enumeration				
Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method MM60		6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

Certificate of Analysis Bacteria & virus – May 2026

Watercare
Laboratory Services

Watercare Services Limited
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PO Box 107028, Auckland, 2150
T: 0800 522 365
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www.watercarelabs.co.nz

Certificate of Analysis
Laboratory Reference: 260514-081

Attention:	Diana Villa Ortega	*Final Report:*	**632147-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**28-May-2026**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**14-May-2026**
Client Reference:	**SW Clark WWTP monitoring - microbiology**	*Laboratory Activity Dates:*	**14-May-2026 - 27-May-2026**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**16391**

Sample Details					
Lab Sample ID:		**260514-081-1**	**260514-081-2**	**260514-081-3**	**260514-081-4**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Matakawau BAC26MAY-1	Matakawau BAC26MAY-2	Matakawau BAC26MAY-3	Matakawau BAC26MAY-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	330 *	130 *	170 *	330 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	1700	220	330	790

Sample Details					
Lab Sample ID:		**260514-081-5**	**260514-081-6**	**260514-081-7**	**260514-081-8**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Matakawau BAC26MAY-5	Matakawau VIR26MAY-1	Matakawau VIR26MAY-2	Matakawau VIR26MAY-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	1400 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	220	-	-	-

Sample Details					
Lab Sample ID:		**260514-081-9**	**260514-081-10**	**260514-081-11**	**260514-081-12**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Karaka BAC26MAY-1	Karaka BAC26MAY-2	Karaka BAC26MAY-3	Karaka BAC26MAY-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	78 *	<18 *	<18 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	45	<18	78	45

Sample Details					
Lab Sample ID:		**260514-081-13**	**260514-081-14**	**260514-081-15**	**260514-081-16**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Karaka BAC26MAY-5	Karaka VIR26MAY-1	Karaka VIR26MAY-2	Karaka VIR26MAY-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					

Sample Details (continued)		ENV_BIOL	ENV_BIOL	ENV_BIOL	ENV_BIOL
Lab Sample ID:		**260514-081-13**	**260514-081-14**	**260514-081-15**	**260514-081-16**
Client Sample ID:					
Sample Date/Time:		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Karaka BAC26MAY-5	Karaka VIR26MAY-1	Karaka VIR26MAY-2	Karaka VIR26MAY-3
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	20 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	18	-	-	-

Sample Details					
Lab Sample ID:		**260514-081-17**	**260514-081-18**	**260514-081-19**	**260514-081-20**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Te Toro Ramp BAC26MAY-1	Te Toro Ramp BAC26MAY-2	Te Toro Ramp BAC26MAY-3	Te Toro Ramp BAC26MAY-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	110 *	170 *	1700 *	1100 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	230	700	790	36

Sample Details					
Lab Sample ID:		**260514-081-21**	**260514-081-22**	**260514-081-23**	**260514-081-24**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Te Toro Ramp BAC26MAY-5	Te Toro Ramp VIR26MAY-1	Te Toro Ramp VIR26MAY-2	Te Toro Ramp VIR26MAY-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	1100 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	940	-	-	-

Sample Details					
Lab Sample ID:		**260514-081-25**	**260514-081-26**	**260514-081-27**	**260514-081-28**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Te Toro Settlement BAC26MAY-1	Te Toro Settlement BAC26MAY-2	Te Toro Settlement BAC26MAY-3	Te Toro Settlement BAC26MAY-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	45 *	<18 *	330 *	<18 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	170	330	40	78

Sample Details					
Lab Sample ID:		**260514-081-29**	**260514-081-30**	**260514-081-31**	**260514-081-32**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Te Toro Settlement BAC26MAY-5	Te Toro Settlement VIR26MAY-1	Te Toro Settlement VIR26MAY-2	Te Toro Settlement VIR26MAY-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	78 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	130	-	-	-

Sample Details					
Lab Sample ID:		**260514-081-33**	**260514-081-34**	**260514-081-35**	**260514-081-36**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Gordons BAC26MAY-1	Gordons BAC26MAY-2	Gordons BAC26MAY-3	Gordons BAC26MAY-4
Microbiology					
Enterococci by MPN					
Enterococci	MPN/100g	1100 *	700 *	490 *	140 *
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	330	330	790	330

Sample Details					
Lab Sample ID:		**260514-081-37**	**260514-081-38**	**260514-081-39**	**260514-081-40**
Client Sample ID:					
Sample Date/Time		13/05/2026	13/05/2026	13/05/2026	13/05/2026
Description:		Gordons BAC26MAY-5	Gordons VIR26MAY-1	Gordons VIR26MAY-2	Gordons VIR26MAY-3
Microbiology					
Culturable Enteroviruses (presumptive) by Enumeration					
Enterovirus (presumptive)	pfu/100 g	-	<4.0	<4.0	<4.0
Enterococci by MPN					
Enterococci	MPN/100g	400 *	-	-	-
Faecal coliforms by MPN					
Faecal coliforms (MPN)	MPN/100g	790	-	-	-

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Microbiology				
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Enterovirus (presumptive)	In-house method MM61	4 pfu/100 g	6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland
Enterococci by MPN				
Enterococci	APHA (online edition) 9230 B	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Preparations				
Faecal coliforms (MPN)	In-house based on APHA 9221	2 MPN/100g	1, 2, 3, 4, 5, 9, 10, 11, 12, 13, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29, 33, 34, 35, 36, 37	Auckland
Shellfish Blending	In-house method		All	Auckland
Shellfish Preparation (virus)	In-house method MM60		6, 7, 8, 14, 15, 16, 22, 23, 24, 30, 31, 32, 38, 39, 40	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

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Robyn Abernethy
Compliance and Projects Manager

APPENDIX 4 WILD SHELLFISH POPULATION MONITORING

Table A 4.1 Wild Oyster Lengths 2024-2026 (mm)

Site	K1				K2				C3Oys				K3				K4			
Size Bin	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
20	0	2	5	2	4	0	1	2	1	0	1	1	0	1	7	0	0	1	3	4
25	12	7	7	5	32	8	4	2	17	2	10	5	1	8	11	6	7	10	3	3
30	23	22	11	7	38	10	11	8	35	11	22	7	4	9	6	8	14	18	5	8
35	23	31	9	11	24	31	17	7	19	20	34	15	5	14	17	21	29	27	17	18
40	19	14	14	19	19	23	21	10	18	22	28	18	12	18	19	10	22	21	17	15
45	18	11	19	51	11	15	18	21	15	16	18	18	12	13	17	17	17	18	25	14
50	15	8	11	19	8	8	18	17	12	13	11	14	20	13	15	11	12	7	18	12
55	5	3	13	8	8	7	20	15	6	8	2	10	21	7	13	13	4	10	13	15
60	3	1	10	9	7	0	14	5	9	5	6	8	17	11	2	6	3	5	12	8
65	2	3	3	3	4	1	7	9	0	1	0	3	10	5	3	5	2	3	3	3
70	0	0	4	4	2	0	2	6	0	3	3	1	4	0	2	0	1	4	4	0
75	0	2	0	0	0	2	2	1	0	2	1	0	4	1	0	0	1	0	1	0
80	0	0	1	1	1	0	0	0	0	0	0	0	4	0	0	1	1	0	1	0
85	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
95	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
n	**121**	**104**	**107**	**102**	**147**	**105**	**135**	**105**	**132**	**105**	**137**	**100**	**114**	**100**	**112**	**98**	**113**	**124**	**122**	**100**
Mean	**37.25**	**36.45**	**42.27**	**39.71**	**34.85**	**37.86**	**44.60**	**46.95**	**30.00**	**41.74**	**37.0**	**42.13**	**51.16**	**41.74**	**39.31**	**41.95**	**38.82**	**39.01**	**44.25**	**41.65**
S.D.	11.03	10.51	12.99	11.15	12.21	9.25	11.55	12.95	32.00	11.97	10.20	10.47	11.68	11.97	11.65	11.33	10.25	11.23	11.49	11.36
±95%CI	**1.99**	**2.04**	**2.49**	**2.19**	**1.92**	**1.79**	**1.97**	**2.51**	**23.00**	**2.37**	**1.72**	**2.08**	**2.17**	**2.37**	**2.18**	**2.27**	**1.91**	**2.00**	**2.06**	**2.26**
Min	21	18	19	19	16	21	19	19	16	25	14	20	25	20	17	21	22	20	16	16
Max	95	72	78	74	77	72	73	84	60	89	74	69	80	73	68	79	79	69	80	65

Table A 4.2 Wild Oyster Density (nb/0.25m²)

Site	K1				K2				C3Oys				K3				K4			
Quadrat	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26
1	0	0	11	0	40	33	1	2	56	7	0	0	0	0	13	0	21	0	6	23
2	0	0	0	0	53	37	9	5	76	2	0	0	0	9	0	0	7	50	20	42
3	1	0	0	0	65	23	14	9	21	1	0	1	0	2	0	0	14	36	38	78
4	7	0	0	0	13	12	0	6	47	2	3	0	0	0	47	0	6	38	6	7
5	0	0	10	0	85	48	40	13	9	4	0	0	0	7	2	50	0	40	52	88
6	2	0	0	0	24	37	16	5	58	41	0	0	0	3	19	17	0	35	32	28
7	1	0	0	0	18	41	55	3	11	1	0	4	0	0	0	0	0	55	86	23
8	5	0	0	0	63	13	72	0	36	1	0	0	0	5	0	1	3	25	41	22
9	0	0	0	0	39	48	7	1	41	0	9	0	3	1	31	2	8	28	27	32
10	0	0	0	0	76	28	51	4	63	16	15	1	10	0	18	3	32	52	13	25
11	0	0	0	0	11	0	6	24	0	0	0	0	8	3	0	0	3	36	1	30
12	1	0	2	0	0	3	24	33	70	0	0	6	2	11	31	0	0	51	19	17
13	2	0	0	0	8	1	17	10	1	7	14	5	5	2	18	0	0	0	0	10
14	0	1	11	0	7	2	14	4	0	0	0	0	15	4	28	0	0	59	0	23
15	7	0	0	0	9	49	30	5	4	0	0	0	0	1	32	9	19	57	0	1
16	9	0	0	19	0	56	42	42	1	22	95	0	0	2	0	0	0	54	0	0
17	0	0	0	0	12	14	5	24	4	0	140	53	0	0	31	0	2	0	0	11
18	2	2	0	18	6	4	0	7	0	0	3	0	0	0	8	0	43	18	0	1
19	0	1	0	30	7	33	16	0	3	13	14	0	0	0	1	0	20	0	0	0
20	3	0	0	1	22	6	18	13	0	8	59	30	1	0	0	0	37	0	0	2
21	2	4	14	28	27	3	6	2	0	0	36	21	1	0	0	0	8	0	0	9
22	0	0	23	6	44	6	2	0	0	7	31	26	0	0	0	0	51	0	0	2
23	0	21	0	0	33	14	0	1	1	14	62	14	0	0	0	0	96	0	0	0
24	8	0	9	0	5	51	1	9	0	169	58	11	0	0	0	0	77	0	0	0
25	2	0	0	11	3	16	0	1	0	71	64	18	3	0	0	7	89	0	0	1
26	24	0	13	14	9	10	0	0	3	96	42	1	0	0	16	0	98	2	0	0
27	1	11	0	18	7	0	0	0	5	54	0	20	0	0	31	0	88	0	0	1
28	0	0	0	6	1	0	0	0	0	21	0	0	0	0	1	0	49	0	0	3
29	18	8	2	0	0	0	0	0	0	5	0	0	0	0	0	0	15	0	0	0
30	1	13	10	4	0	0	1	0	0	0	0	0	0	0	0	9	0	0	0	3
31	25	43	-	-	-	-	-	-	-	-	-	-	29	50	-	-	-	-	-	-
32	-	-	-	-	-	-	-	-	-	-	-	-	19	-	-	-	-	-	-	-
33	-	-	-	-	-	-	-	-	-	-	-	-	18	-	-	-	-	-	-	-
n	31	31	30	30	30	30	30	30	30	30	30	30	33	31	30	30	30	30	30	30
Mean	3.90	3.35	3.50	5.17	22.90	19.60	14.90	7.43	17.00	18.73	21.50	7.03	3.45	3.23	10.30	3.27	26.20	21.20	11.37	16.07
SD	6.72	8.79	6.04	8.90	24.50	18.85	19.24	10.44	25.18	36.53	34.38	12.41	7.00	9.13	14.21	9.64	32.65	23.19	20.43	21.91
±95%CI	2.37	3.09	2.25	3.32	8.77	6.75	7.19	3.90	9.01	13.07	12.84	4.63	2.39	3.21	5.31	3.60	11.69	8.30	7.63	8.18

Table A 4.3 Cockle size frequency data

Site	C1				C2				C3				C4				C5			
Size (mm)	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26
<8	21	10	4	6	51	0	1	8	14	13	2	27	3	0	15	22	26	13	6	25
8	3	7	2	3	9	0	0	6	13	8	0	2	6	1	4	7	13	6	0	5
9	0	9	5	7	8	0	0	5	11	5	5	2	8	0	2	8	6	6	0	13
10	1	6	8	5	7	3	3	5	11	17	3	2	13	5	6	10	4	5	0	8
11	0	2	10	9	7	2	4	2	6	23	6	1	11	4	5	8	2	3	2	2
12	1	0	10	7	8	4	11	4	8	19	3	9	11	4	6	4	7	10	5	2
13	2	0	7	2	9	2	9	3	11	16	9	4	12	5	5	6	16	5	1	6
14	3	0	4	7	4	6	12	2	9	10	17	13	7	10	4	3	12	9	5	15
15	8	2	2	18	1	13	12	2	15	13	13	22	15	12	12	21	16	14	9	4
16	17	1	2	3	4	14	9	1	7	13	21	24	15	11	12	19	13	19	6	3
17	32	1	3	7	8	15	12	3	7	6	20	33	19	14	10	18	26	23	8	10
18	25	6	5	1	7	8	9	5	1	16	7	29	20	20	2	19	15	30	11	5
19	25	12	14	5	2	12	4	10	5	3	9	19	25	17	10	7	8	23	12	12
20	13	13	19	8	1	7	4	6	6	6	6	28	20	11	4	11	7	18	14	6
21	15	11	20	13	3	15	6	6	0	1	2	7	24	6	1	8	5	8	9	8
22	3	9	17	4	0	14	0	8	0	1	0	8	10	4	2	4	4	9	10	4
23	1	7	4	3	0	12	4	8	0	0	0	2	9	0	0	0	2	2	1	0
24	1	3	3	0	1	11	3	9	0	0	0	3	3	0	0	0	0	1	6	2
25	1	1	1	0	1	7	0	4	0	0	0	1	1	0	0	0	0	1	1	0
26	0	0	1	0	0	4	3	2	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	1	6	0	1	0	0	0	0	0	0	0	0	1	0	1	0
28	0	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
>40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
n	172	100	141	108	132	160	106	103	124	170	123	236	232	124	100	175	183	205	107	131
Mean	16	16	17	15	10	20	16	17	12	13	15	16	17	17	14	14	14	16	18	13
SD	5	6	5	5	5	4	4	7	4	4	3	5	4	3	4	5	5	4	4	6
CL	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
% edible	1	1	1	0	2	14	3	10	0	0	0	0	0	0	0	0	1	1	2	0
Min	4	4	4	4	4	10	6	5	4	4	6	4	7	8	5	4	4	8	5	4
Max	25	25	26	23	27	30	26	29	20	22	21	23	25	22	22	22	27	25	27	24

Table A 4.4 Cockle Density (nb/m²)

Cell	Station	C1				C2				C3				C4				C5			
		Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26	Oct-24	Feb-25	Aug-25	Feb-26
1	1	1184	1600	816	976	60	160	136	56	1984	2720	1040	280	880	880	112	72	1296	1488	944	528
	2	1568	1104	496	752	468	504	352	216	3776	3200	960	668	2832	1104	368	624	1632	1792	768	496
	Cell Mean	**1376**	**1352**	**656**	**864**	**264**	**332**	**244**	**136**	**2880**	**2960**	**1000**	**474**	**1856**	**992**	**240**	**348**	**1464**	**1640**	**856**	**512**
2	3	1344	1056	944	896	352	616	360	168	1808	3648	832	896	2928	2248	1120	800	1440	1168	2000	400
	4	800	1568	672	560	24	64	104	272	2208	3504	1184	872	1536	1328	656	592	1840	1232	288	704
	Cell Mean	**1072**	**1312**	**808**	**728**	**188**	**340**	**232**	**220**	**2008**	**3576**	**1008**	**884**	**2232**	**1888**	**888**	**696**	**1640**	**1200**	**1144**	**552**
3	5	896	1776	464	1056	12	40	32	24	2576	1952	816	1416	3456	4400	736	464	2240	2288	416	832
	6	1408	1472	624	1056	32	72	0	8	3136	1280	480	952	1744	1664	368	1056	2336	1392	512	1040
	Cell Mean	**1152**	**1624**	**544**	**1056**	**22**	**56**	**16**	**16**	**2856**	**1616**	**648**	**1184**	**2600**	**3032**	**552**	**760**	**2288**	**1840**	**464**	**936**
4	7	912	848	784	560	156	216	40	8	2560	3808	672	584	1184	2384	416	112	2720	2768	384	368
	8	1152	1936	896	608	384	744	144	72	1264	3104	176	272	592	880	736	480	4368	1632	576	592
	Cell Mean	**1032**	**1392**	**840**	**584**	**270**	**480**	**92**	**40**	**1912**	**3456**	**424**	**428**	**888**	**1632**	**576**	**296**	**3544**	**2200**	**480**	**480**
5	9	1296	2512	816	1696	400	816	312	16	1936	2816	624	612	2080	1024	240	552	496	3888	1648	560
	10	1248	3344	832	736	92	216	640	736	1376	2816	416	648	1408	1776	912	472	560	2448	1104	672
	Cell Mean	**1272**	**2928**	**824**	**1216**	**246**	**516**	**476**	**376**	**1656**	**2816**	**520**	**630**	**1744**	**1400**	**576**	**512**	**528**	**3168**	**1376**	**616**
6	11	1696	1360	1040	1056	960	752	472	712	2272	3312	896	672	1488	2672	496	336	1456	2576	656	624
	12	2272	2672	672	240	40	304	536	272	1904	2496	976	632	1936	2640	704	544	1632	1488	576	576
	Cell Mean	**1984**	**2016**	**856**	**648**	**500**	**528**	**504**	**492**	**2088**	**2904**	**936**	**652**	**1712**	**2656**	**600**	**440**	**1544**	**2032**	**616**	**600**
7	13	1248	2096	1088	1008	340	288	256	168	3968	3568	1456	536	1776	1840	576	256	1952	3152	6000	480
	14	688	2496	912	768	236	200	256	200	3056	1840	864	448	1552	1120	784	448	2304	2096	1584	720
	Cell Mean	**968**	**2296**	**1000**	**888**	**288**	**244**	**256**	**184**	**3512**	**2704**	**1160**	**492**	**1664**	**1480**	**680**	**352**	**2128**	**2624**	**3792**	**600**
8	15	960	1216	736	592	180	488	240	184	2480	2144	624	256	672	1216	608	528	1472	2352	1344	368
	16	912	1232	1072	400	492	744	248	136	816	1072	1104	152	528	288	176	96	1472	1264	2080	192
	Cell Mean	**936**	**1224**	**904**	**496**	**336**	**616**	**244**	**160**	**1648**	**1608**	**864**	**204**	**600**	**752**	**392**	**612**	**1472**	**1808**	**1712**	**280**
9	17	2160	1408	656	832	908	216	224	448	448	560	240	16	320	656	32	40	2224	2016	1104	448
	18	848	1744	848	464	116	216	160	128	96	96	192	208	304	0	32	8	2096	2624	1040	304
	Cell Mean	**1504**	**1576**	**752**	**648**	**512**	**216**	**192**	**288**	**272**	**328**	**216**	**112**	**312**	**328**	**32**	**24**	**2160**	**2320**	**1072**	**376**
10	19	880	1392	976	944	368	1432	328	272	800	832	432	52	304	768	160	16	2016	2336	2000	688
	20	1200	1776	704	736	124	760	352	536	1328	1984	368	508	752	448	112	280	1216	1888	864	752
	Cell Mean	**1040**	**1584**	**840**	**840**	**246**	**1096**	**340**	**404**	**1064**	**1408**	**400**	**280**	**528**	**608**	**136**	**148**	**1616**	**2112**	**1432**	**720**
11	21	944	2112	720	816	504	1416	608	472	2672	3552	512	204	1376	1584	368	560	1680	4864	672	704
	22	1760	2048	656	1040	1232	1448	448	432	1808	1552	608	816	944	1744	1584	872	312	216	784	400
	Cell Mean	**1352**	**2080**	**688**	**928**	**868**	**1432**	**528**	**452**	**2240**	**2552**	**560**	**510**	**1160**	**1664**	**976**	**716**	**996**	**2540**	**728**	**552**
12	23	1808	1728	864	1024	1716	1456	504	696	3296	0	384	156	1664	1808	704	576	432	848	176	224
	24	1536	496	896	928	720	1224	736	376	160	2176	384	0	1168	144	48	64	0	784	400	656
	Cell Mean	**1672**	**1112**	**880**	**946**	**1218**	**1340**	**620**	**536**	**1728**	**1088**	**384**	**78**	**1416**	**976**	**376**	**320**	**216**	**816**	**288**	**440**
Site Mean		**1280**	**1708**	**799**	**823**	**413**	**600**	**312**	**275**	**1989**	**2251**	**677**	**494**	**1393**	**1451**	**502**	**410**	**1664**	**2069**	**1163**	**555**
Site SD		428	634	166	296	427	483	199	228	1069	1157	338	350	841	987	381	287	883	973	1173	199
Site CI		171	254	70	118	171	193	84	91	428	463	143	140	336	395	161	115	353	389	495	80

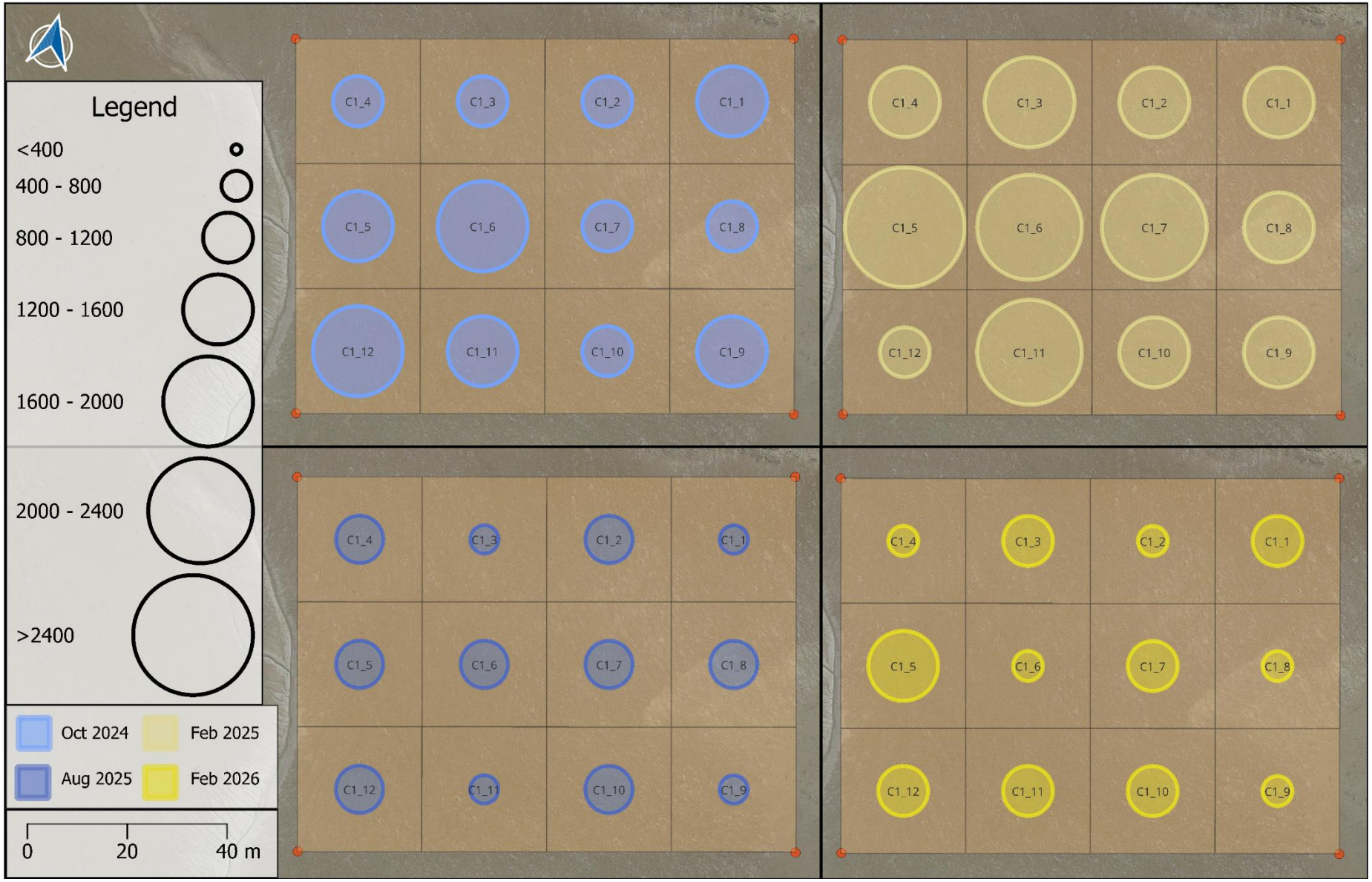


Figure A 4.1 Cockle abundance across monitoring area of Site C1

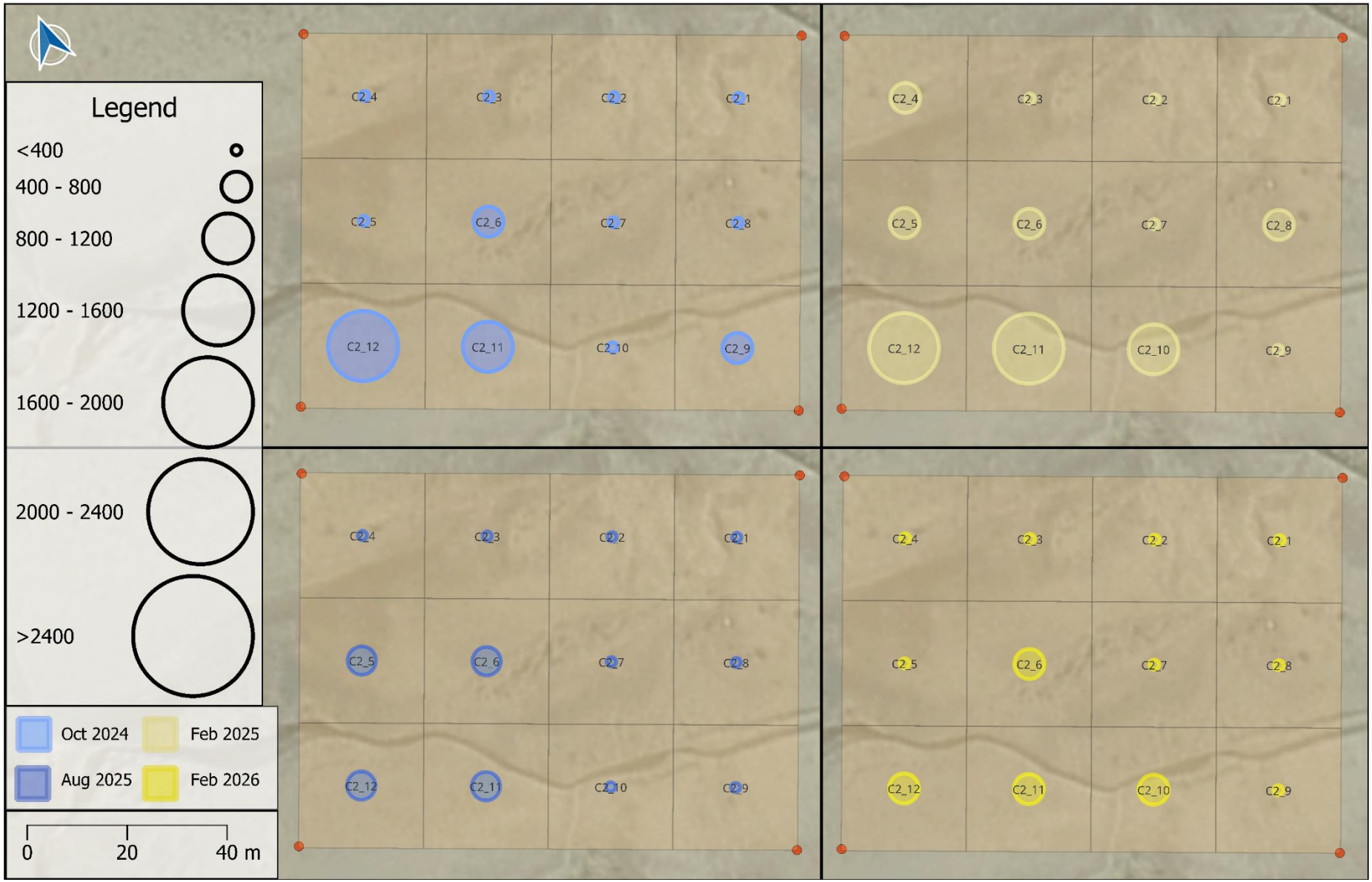


Figure A 4.2 Cockle abundance across monitoring area of Site C2



Figure A 4.3 Cockle abundance across monitoring area of Site C3

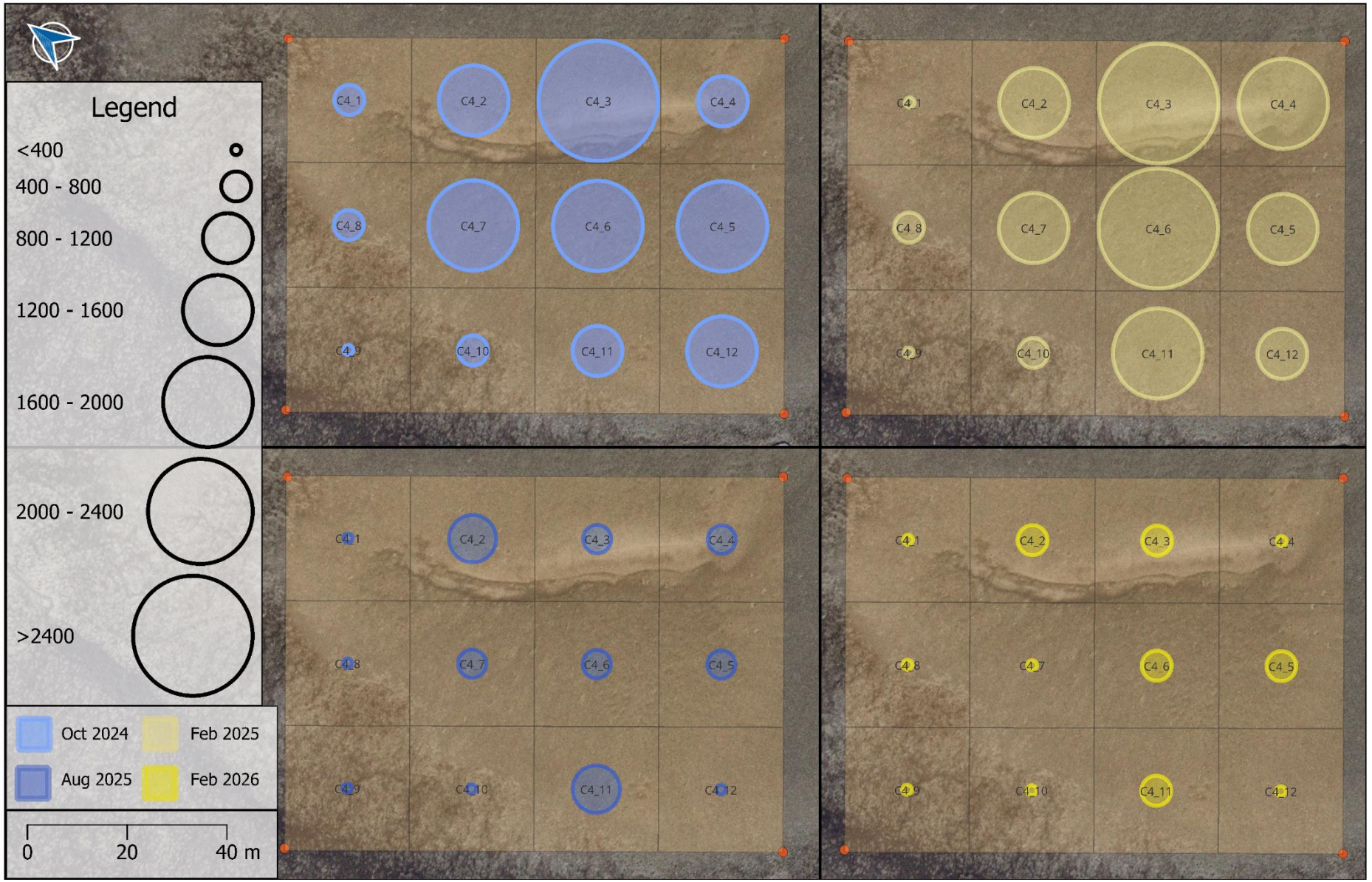


Figure A 4.4 Cockle abundance across monitoring area of Site C4



Figure A 4.5 Cockle abundance across monitoring area of Site C5

Applicability and Limitations

Restrictions of Intended Purpose

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Insert cockles density by site.

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WATERCARE SERVICES SOUTHWEST MANUKAU

WATER QUALITY AND BENTHIC ECOLOGY BASELINE MONITORING 2025–2026



COAST & CATCHMENT

ENVIRONMENTAL CONSULTANTS

WATERCARE SERVICES SOUTHWEST MANUKAU

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Shane Kelly

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August 2026

Client report for Watercare Services Ltd

Report Number: 2026-14

Reviewed by: Andy Jordan

Cover photo: Benthic ecological survey of the Rauau North site.

Disclaimer

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1 CONTENTS

2 PARAMETER ABBREVIATIONS 5
3 EXECUTIVE SUMMARY 6
4 BACKGROUND 10
5 WATER QUALITY 11
5.1 METHODS 11
5.1.1 MONITORING PERIOD AND SITES 11
5.1.2 WATER QUALITY SAMPLING METHODS 11
5.1.3 DISSOLVED OXYGEN SAMPLING 13
5.1.4 PHYTOPLANKTON 13
5.2 WATER QUALITY RESULTS 13
5.2.1 GENERAL WATER QUALITY 13
5.2.2 DISSOLVED OXYGEN 27
5.2.3 PHYTOPLANKTON 28
6 BENTHIC ECOLOGY AND SEDIMENT QUALITY 38
6.1 METHODS 38
6.1.1 MONITORING SITES 38
6.1.2 RANDOMISATION OF SAMPLES 41
6.1.3 ECOLOGICAL SAMPLING AND SAMPLE PROCESSING 41
6.1.4 SEDIMENT QUALITY ANALYSIS 41
6.1.5 DATA ANALYSES 42
6.1.6 HEALTH INDICES 44
6.2 RESULTS 46
6.2.1 SEDIMENT QUALITY 46
6.2.2 MACROFAUNA 51
6.2.3 BIVALVES 60
6.2.4 BENTHIC HEALTH SCORES AND GENERAL SITE OBSERVATIONS 61
7 BIOGENIC HABITATS 62
7.1 METHODS 62
7.2 RESULTS 63
8 CONCLUSIONS 72
9 ACKNOWLEDGEMENTS 76
10 REFERENCES 76
11 APPENDICES 77
11.1 SITE COORDINATES 77
11.2 GENERAL WATER QUALITY DATA 79

11.3 SEDIMENT QUALITY DATA 85
11.4 BENTHIC MACROFAUNA MEAN COUNTS 90

2 PARAMETER ABBREVIATIONS

Abbreviation	Full name	Notes
DO	Dissolved oxygen	Two units of measurement are used for DO readings: percent saturation (%) and concentration (mg/L).
NH_x-N	Total ammoniacal-N (NH_3-NH_4^+-N)	The sum of ammonia and ammonium. A toxic form of nitrogen that is also immediately available for uptake by algae and other plants.
TON	Total oxidised nitrogen (NO_2-NO_3-N)	The sum of nitrite nitrogen and nitrate nitrogen. These oxidised forms of nitrogen are immediately available for uptake by algae and other plants.
TIN	Total inorganic nitrogen	The sum of NH_x-N & TON
TN	Total nitrogen	The sum of organic and inorganic forms of nitrogen. Organic forms need to be broken down before they are available for uptake by algae and other plants.
DRP	Dissolved reactive phosphorus	Soluble forms of phosphorus which are immediately available for uptake by algae and other plants
TP	Total phosphorus	The sum of all forms of phosphorus, including forms that are not immediately available for uptake by algae and other plants.
TSS	Total suspended solids	A measure of particulates, such as sediments and organic matter, in water samples.

3 EXECUTIVE SUMMARY

Watercare Services Ltd (Watercare) have consent for the construction of a new wastewater outfall in Waiuku Channel, Manukau Harbour, and for the discharge of treated wastewater. Watercare is required by the conditions of consent to carry out baseline monitoring of the coastal receiving environment for at least two years prior to the commencement of discharges from the new outfall.

Two years of baseline monitoring were carried out between June 2024 and June 2026 that included:

- monthly sampling for general water quality at 10 sites, and phytoplankton at six sites;
- 24-hour monitoring of dissolved oxygen at a site below the newly consented outfall site in December 2024, March, May and December 2025, and March and May 2026;
- sampling and characterisation of intertidal benthic macroinvertebrate communities at nine intertidal sites arranged along a gradient from above the outfall, to central harbour areas on both sides of the Waiuku Channel;
- sampling and analysis of sediment characteristics and quality at the nine intertidal sites where ecological samples were collected;
- 50 underwater video transects between Tokaroa Reef and the Taihiki Creek confluence, for the analysis of biogenic and physical features.

Water quality

Results show that water quality at the remote Whatapaka (WQ 8) reference site[1] was much poorer than in all other sites. The WQ 8 site had higher concentrations of NH_x-N, TN, TP, TSS and turbidity. Occasional large spikes in TON, TIN, chlorophyll *a*, enterococci, and faecal coliforms were also observed at that site.

Concentrations of all forms of nitrogen (NH_x-N, TON, TIN, and TN) were similar among all other sites (hereafter referred to as "Clarks Beach sites"), and temporal patterns in each form were highly correlated. NH_x-N concentrations were commonly below detection limits between June 2024 and April 2025. Increases between May and December 2025 and February to June 2026 resulted in higher NH_x-N concentrations in the 2025–26 monitoring year than the 2024–25 year.

Total oxidised nitrogen concentrations were considerably higher than NH_x-N concentrations, and therefore, had the greatest influence on TIN concentrations. Cyclical patterns were apparent in TON and TIN, with low summer and high winter concentrations, including a particularly strong peak in July–August 2025, which led to higher pooled concentrations in the 2025–26 year. Total nitrogen also displayed a strong peak around the same time, but clear cyclical patterns were not apparent.

All the Clarks Beach sites had similar DRP concentrations, and temporal patterns were highly correlated among the sites. Cyclical patterns were evident in DRP concentrations, but the

[1] Situated at the mouth of Clarks Creek, that leads to Kingseat.

periodicity differed slightly from that of TON and TIN, with lowest concentrations occurring in late spring and highest concentrations in autumn. Total phosphorus concentrations were also similar among sites.

There was little difference in pooled chlorophyll *a* concentrations among most of the Clarks Beach monitoring sites. However, the 1 km North (WQ 6) site was unusual in that chlorophyll *a* concentrations never exceeded 0.003 mg/L. Concentrations at other Clarks Beach sites, including the 3 km North (WQ 7) site, were more variable and all displayed a strong spike in chlorophyll *a* concentrations in November 2025, which reached 0.013 to 0.017 mg/L.

Temporal variation in TSS concentrations and turbidity were correlated, with little difference among the Clarks Beach sites. Slight increasing trends in median DO saturation, salinity, and pH levels were apparent along the spatial gradient from southern to northern Clarks Beach sites, but site differences in DO concentrations and temperature were negligible.

In 2025–26, enterococci concentrations exceeded the Alert level guideline for contact recreation once at the Taihiki (WQ 10) site and twice at the Whatapaka (WQ 8) site, and exceeded the Action level guidelines once at the Whatapaka (WQ 8) site.

Diurnal variation in dissolved oxygen

Temporal variation in dissolved oxygen over the 24-hour sampling period was much greater than variation among sampling depths. A pronounced diurnal pattern in DO saturation and concentration was recorded in December 2025, with oxygen levels increasing during the day and declining overnight. Increases in daytime oxygen levels were also recorded in March and May 2025, but levels fluctuated overnight.

Phytoplankton

Overall, a total of 99 phytoplankton taxa from 12 phyla or other general high-order groups were identified in samples collected in 2025–26. The top 10 genera by cell concentration included two genera from the flagellates-unicells group, five diatom genera, and three dinoflagellate genera. For cell volume, the top 10 genera included two genera from the flagellates-unicells group, six diatom and two dinoflagellate genera. Seasonal cycles were apparent in total phytoplankton taxa, and cell concentrations and biovolumes with: highest biovolumes in spring–early summer (Nov–Dec); highest cell concentrations in mid to late summer (Feb–Mar), and low taxa diversity in winter.

In 2025–26, potentially toxic filamentous cyanobacteria (*Anabaena* sp.) were detected at all phytoplankton sampling sites in December 2025. Other known toxic species obtained in 2025–26, included *Alexandrium minutum, Gymnodinium catenatum*, and *Prorocentrum lima.* It is possible that other potentially toxic taxa from the *Alexandrium, Karenia, Pseudo-nitzschia, Gymnodinium* and *Dinophysis* genera were also present, but those taxa were not identified to species levels.

Sediment quality

Sediments at the Ngahere site, on the eastern side of the main channel, had the highest proportion of mud (48%). On that side of the channel, a clear demarcation in sediment characteristics occurred around the entrance to Waiuku River (between Tokaroa and Karaka Points), with sediment mud content decreasing in the northern sites in the main body of the

harbour. A similar change occurred on the western side of the channel, with a marked difference occurring between the Rauau and Tokaroa North sites (Tokaroa North had the lowest proportion of mud of any site). However, mud content increased again between the Tokaroa North and Wairoa Point sites. All sites had moderate to high percentages of sand (51–99%), with the Tokaroa North and Clarks Beach sites having the highest percentage (95–96%).

Mud, TOC, TP and TN concentrations were highly correlated, and therefore all four parameters displayed similar spatial patterns to those described above for mud content.

Intertidal benthic macrofauna

A diverse assemblage of intertidal macrofauna was identified, with 18,735 individuals and 90 taxa collected from the nine monitoring sites. The abundance of individual taxa and results from four indicators of ecological diversity and abundance varied among sites. In summary:

- Twenty taxa comprised around 92% of all individuals collected, with the nut shell *Linucula hartvigiana* being the most abundant taxa, followed by cockles (*Austrovenus stutchburyi*), and the polychaete *Aonides trifida*.
- Clear spatial patterns were not apparent in any of the indicators of community diversity and abundance, apart from the Clarks West site appearing to have more within site variability than the other sites.
- Multivariate nMDS, cluster and SIMPROF analyses of the benthic community data showed that most sites could be differentiated from other sites based on their community composition. However, the following sites had communities that could be loosely grouped based on their positions on MDS plots:
    - sites on the outer, western side of the main channel (Tokaroa North and Wairoa Point);
    - the three Clarks sites from the outer, eastern side of the channel (Clarks West, Lower Clarks Beach, Clarks Beach);
    - Inner channel sites (Ohiku Creek, Rauau North, Waiau, and Ngahere) with the Ohiku Creek & Rauau North sites being most similar.
- Combined Health Scores of all sites, except Tokaroa North, were ranked as ‘fair’. The Tokaroa North site was ranked as ‘good’.

Shellfish

In October 2025, totals of 2918 cockles, 511 wedge shells (*Macoma liliana*) and five pipi (*Paphies australis*) were collected. The majority of cockles were very small, with 77% being less than 5 mm in length (c.f. 75% in 2024), and none were considered to be of ‘harvestable’ size (>30 mm). Similarly, the majority (65%) of wedge shells were less than 5 mm long in 2025 (c.f. 73% in 2024).

Subtidal habitats and biogenic features

Visibility in 2026 varied from exceptionally poor to reasonable, despite calm conditions and extended periods of dry weather prior to the survey dates. Hard substrates were the most

frequently observed substrate, with contiguous reef observed in 44% of the transects, patchy reef observed in 24% of the transects, gravelly rubble observed in 34% of the transects, and shell hash observed in 32% of the transects. Overall, hard substrates were found in 90% of transects, whereas primarily soft substrates were only found in 30% of transects. Soft substrates were generally found in the shallow areas at the edges of the channel, whereas hard substrates were more common in the deeper areas in the middle of the channel.

Sponges and bryozoans were the most common and widespread groups observed in video footage. Sponges were observed in 86% of the transects, followed by bryozoans (72%), scallops (36%) and macroalgae (26%). The percentage occurrences of sponges and bryozoans in 2026 were similar to those in 2025. Sponges were observed throughout the survey area, except for the southernmost section. The diversity and abundance of sponges on hard substrates were moderate. Bryozoans were also observed throughout the survey area in high abundance on hard substrates, but diversity appeared to be low. Ascidians were uncommon and limited to the outer part of the survey area. Similarly, scallops were restricted to certain areas. Macroalgae were found throughout the survey area but were uncommon. Ecological complexity was generally highest in the outer parts of the channel and lowest upstream. Complexity was typically highest on hard substrates (reef, rubble and shell hash).

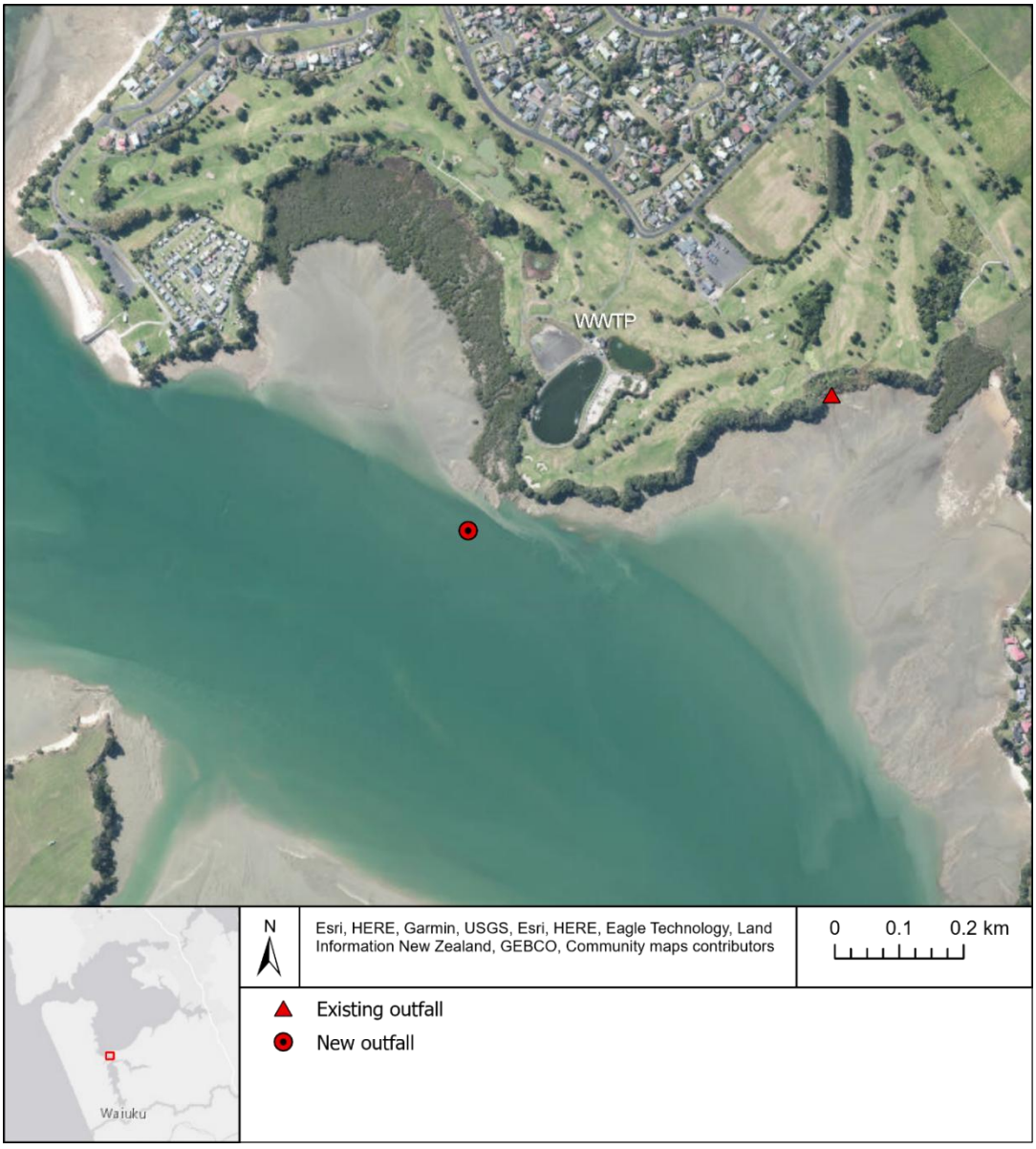
Overall, monitoring results from June 2024–June 2026 provide a baseline for detecting future changes in water and sediment quality, and benthic ecology. Importantly, none of the univariate and multivariate water quality and phytoplankton plots from sites upstream and downstream of the WWTP discharge displayed patterns indicative of the discharge having a marked adverse effect. Patterns in the ecological results appear consistent with the environmental gradient from tidal river to central harbour intertidal flats, and variation in subtidal seabed substrates.

4 BACKGROUND

Until recently, treated wastewater from the Clarks Beach Wastewater Treatment Plant (WWTP) has been discharged via a stormwater drain onto the Clarks Beach golf course, where it flowed through a series of reservoirs and wetlands before being discharged onto the intertidal zone of Waiau Beach. In late June 2026, discharges of treated wastewater were diverted through a new outfall in the Waiuku Channel (Figure 1).

Before discharges from the new outfall could commence, Watercare was required to conduct baseline monitoring of the coastal receiving environment for at least two years. This report presents the second year's monitoring results for water and sediment quality, and marine benthic ecology as specified in the certified Receiving Environment Monitoring Plan (REMP; Watercare 2024).

Figure 1. Location of the Clarks Beach WWTP, the existing outfall, and the new outfall.



5 WATER QUALITY

5.1 METHODS

5.1.1 MONITORING PERIOD AND SITES

Ten sites were monitored monthly for water quality between June 2024 and June 2026 (Figure 2). These included eight sites arranged along an approximately 7.5 km gradient from south of Glenbrook Beach to Kellys Landing in the central harbour, one site in the Taihiki River, and a remote reference site near the mouth of Whatapaka Creek:

- Upper Waiuku (WQ9);
- Taihiki (WQ10).
- 1 km south and north (upstream and downstream) of the outfall (WQ1 and WQ6);
- 250 m south and north (upstream and downstream) of the outfall (WQ2 and WQ5);
- 50 m south and north (upstream and downstream) of the outfall (WQ3 and WQ4);
- 3 km north (downstream) of the outfall (WQ7);
- A remote reference site, Whatapaka (WQ8).

Coordinates for the sites are given in Table 11 in the Appendices.

5.1.2 WATER QUALITY SAMPLING METHODS

All sites, except for WQ8, were sampled monthly by Coast and Catchment via boat. WQ8 was sampled by Auckland Council as part of their monthly helicopter run. Sampling was conducted within 1.5 hours of mid-tide, in accordance with the methods outlined in REMP. At each site:

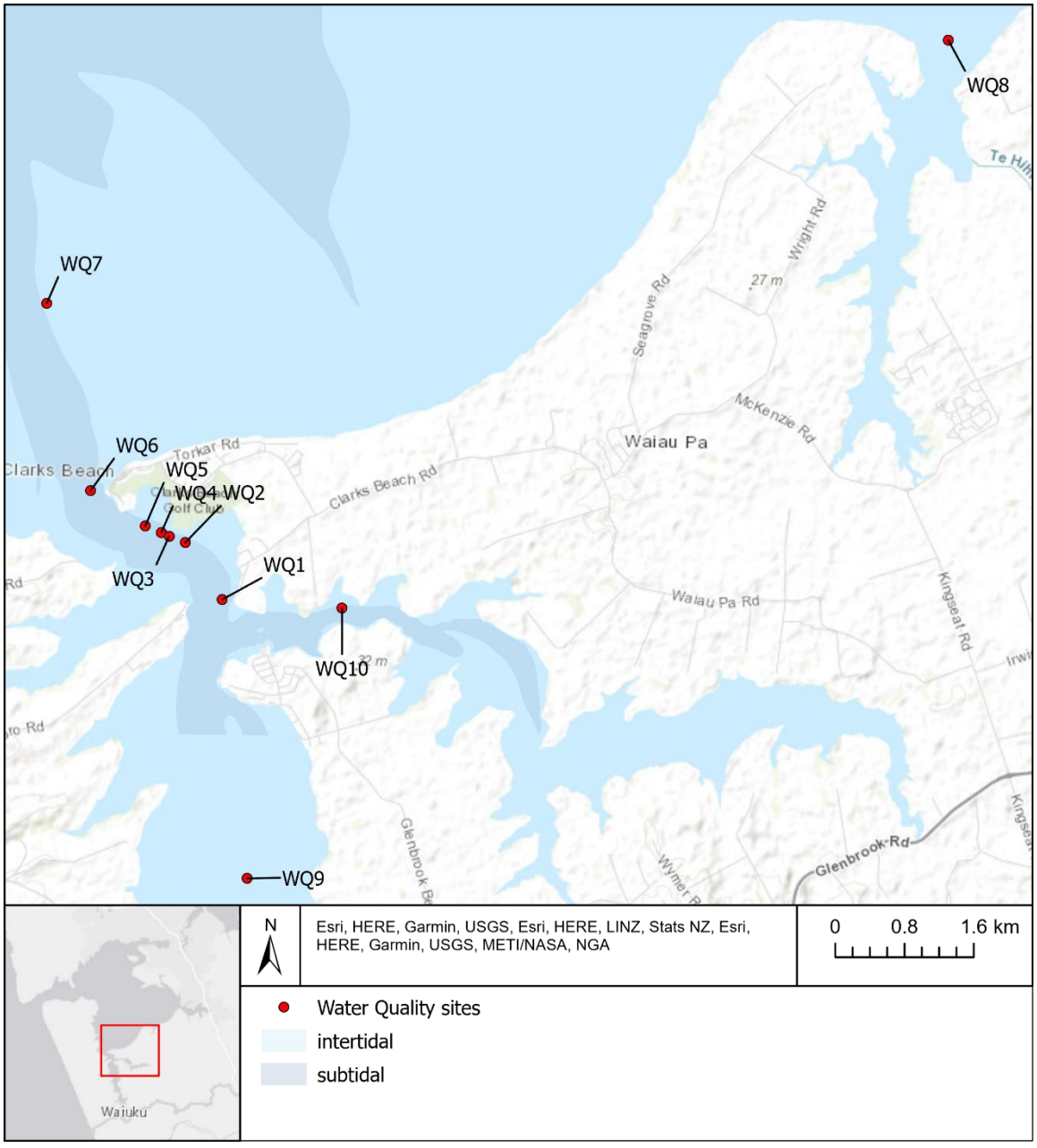
- Field measurements were taken for salinity, conductivity, dissolved oxygen, water temperature, and pH using calibrated YSI ProSolo and Pro 10 field meters.
- Water samples were collected, transferred to cooler bins, and transported to Watercare Laboratories on the day of collection. Samples were analysed for NH_x-N, TON, TIN, TN, DRP, TP, chlorophyll *a*, TSS, turbidity, enterococci, and faecal coliforms. Laboratory measurements of pH, salinity and conductivity were also made.
- General observations were made on:
    - the presence of any conspicuous oil or grease films, foam scums, or floating/suspended materials;
    - weather and water conditions;
    - any sampling issues;
    - date and time of sampling and tide time.

As the data only covered two years, statistical analyses were not conducted. Rather, water quality data from both years were plotted and spatial and temporal patterns were visually assessed. Plotting and visual analysis of water quality results were carried out using RStudio and the *tidyverse* package (Wickham et al. 2019).

5.1.2.1 LABORATORY ANALYTICAL CHANGES

From 1 March 2026, Watercare Laboratory Services transitioned Total Phosphorus (TP) and Dissolved Reactive Phosphorus (DRP) testing to new analytical instrumentation as part of a planned replacement of older equipment. Marine and brackish water samples are now analysed using the FIAlab method, which is the NEMS reference method for phosphorus analysis. While detection limits did not change, method validation identified a potential step change between the old and new instrumentation, meaning results after 1 March 2026 may not be directly comparable with historical data and any long-term trend assessments should take this change into consideration.

Figure 2. Location of the water quality monitoring sites.



5.1.3 DISSOLVED OXYGEN SAMPLING

Dissolved oxygen measurements were taken every two hours over a 24-hour period at a site with a low tide depth of approximately 12 m (beside the 250 m North (WQ 5) water quality site; see Figure 2). Monitoring was carried out on three occasions: 16–17 December 2025, 11–12 March 2026 and 11–12 May 2026. The sampling periods were chosen to cover times when chl *a* concentrations are typically highest (Dec–Mar) and lowest (May). Readings were taken using a hand-held YSI ProSolo dissolved oxygen meter with a 20 m sensor cable. The weighted sensor was clipped to, and fed down, a heavily weighted vertical line. Measurements were taken at every metre of depth. Dissolved oxygen data were plotted and visually assessed.

5.1.4 PHYTOPLANKTON

Monthly phytoplankton sampling was conducted at six sites (WQ2, WQ5, WQ6, WQ7, WQ9, WQ10). A depth-integrated water sample was taken from the top 5 m of the water column. Samples were transferred to dark containers, chilled, and transported to Earth Sciences New Zealand in Hamilton for analysis on the day of collection. Samples were analysed for:

- harmful microalgae;
- cyanobacteria;
- numerically dominant phytoplankton species.

For each site, maximum cell counts (cells/mL) of potentially harmful microalgae listed in Table 2 of the Regulated Control Scheme for Bivalve Molluscan Shellfish for Human Consumption (Ministry for Primary Industries 2024) were converted to cells/L and compared against trigger values for flesh testing on marine farms. Counts of potentially toxic cyanobacteria were also provided, along with information on where and when they were detected.

Variation in taxa diversity and the total cell counts of all phytoplankton, and the 12 taxa with the highest mean cell counts were plotted to examine variation over time and among sites. Finally, non-metric multidimensional scaling (MDS) was used to examine variation in phytoplankton community composition.

5.2 WATER QUALITY RESULTS

5.2.1 GENERAL WATER QUALITY

Spatial and temporal variation in monitored indicators of general water quality are provided in Figure 3 to Figure 20. As the data only covers two years, statistical analyses were not conducted. However, preliminary observations show that water quality at the Whatapaka (WQ 8) site is much poorer than all other sites (Figure 6 to Figure 20). The Whatapaka (WQ 8) site had higher concentrations of NH_x-N, TN, TP, TSS and turbidity. Occasional large spikes in TON, TIN, chlorophyll *a*, enterococci, and faecal coliforms were also observed at that site.

Plotted data indicated that the concentrations of all forms of nitrogen (NH_x-N, TON, TIN, and TN) were similar among the Clarks Beach sites, and that temporal patterns in each form were highly correlated among those sites (e.g. see Figure 21). Plots of NH_x-N concentrations were low (commonly below detection limits) between June 2024 and April 2025 (Figure 6).

However, a pulse of higher concentrations occurred between May and December 2025, with concentrations increasing again from February to June 2026. That pattern resulted in higher NH_x-N concentrations in the 2025–26 monitoring year than in 2024–25 (Figure 3).

Total oxidised nitrogen concentrations were considerably higher than NH_x-N concentrations, and therefore, had the greatest influence on TIN concentrations. Cyclical patterns were apparent in TON and TIN with low summer and high winter concentrations, including a particularly strong peak in July–August 2025 (Figure 7 & Figure 8), which led to higher pooled concentrations in 2025–26 (Figure 3). Total nitrogen also displayed a strong peak around the same time, but clear cyclical patterns were not apparent (Figure 3 & Figure 9).

Likewise, all the Clarks Beach sites had similar DRP concentrations, and temporal patterns were highly correlated among the sites (Figure 4, Figure 10 & Figure 22). Cyclical patterns were evident in DRP concentrations, but the periodicity differed slightly from that of TON and TIN, with lowest concentrations occurring in late spring and highest concentrations in autumn (Figure 10). Total phosphorus concentrations were also similar among sites (Figure 4). Cyclical patterns generally aligned with those of DRP in sites upstream of the 250 m North site, but temporal patterns were more variable at that site and the outer channel sites (Figure 11).

There was little difference in pooled chl *a* concentrations among most of the Clarks Beach monitoring sites (Figure 4). However, the 1 km North (WQ 6) site was unusual in that chl *a* concentrations never exceeded 0.003 mg/L. Concentrations at other Clarks Beach sites, including the 3 km North (WQ 7) site, were more variable and all displayed a strong spike in chl *a* concentrations in November 2025, which reached 0.013 to 0.017 mg/L. Except for one occasion at the Upper Waiuku (WQ 9 site), concentrations varied between 0.001 and 0.006 mg/L at other times (Figure 12). Concentrations at WQ 9 were 0.01 mg/L in December 2025 (Figure 12).

Temporal variation in TSS concentrations and turbidity were correlated, with little difference among the Clarks Beach sites (Figure 4, Figure 13 & Figure 14). Site variation in both parameters was also highly correlated. Boxplots show slight increasing trends in median DO saturation, salinity, and pH levels along the spatial gradient from southern to northern Clarks Beach sites, but site differences in DO concentrations and temperature were negligible (Figure 5).

Enterococci concentrations were mostly below detection limits, but the Alert level microbial guideline for contact recreation was exceeded once at the Taihiki (WQ 10) site and twice at the Whatapaka (WQ 8) site over the past two years. The Action level guideline was also exceeded once at the Whatapaka (WQ 8) site (Figure 19). Faecal coliform concentrations at the Clarks Beach sites varied from below detection limits (41% of samples) to 64 cfu/100 mL, which was recorded at the 50 m South (WQ 3) site in June 2025 (Figure 20).

Figure 3: Boxplots showing annual concentrations of the various forms of nitrogen obtained from monitoring sites upstream (south) and downstream (north) of the new outfall location. Boxes show medians and 25th to 75th percentile ranges, whiskers are 10th and 90th percentiles, points are outliers.

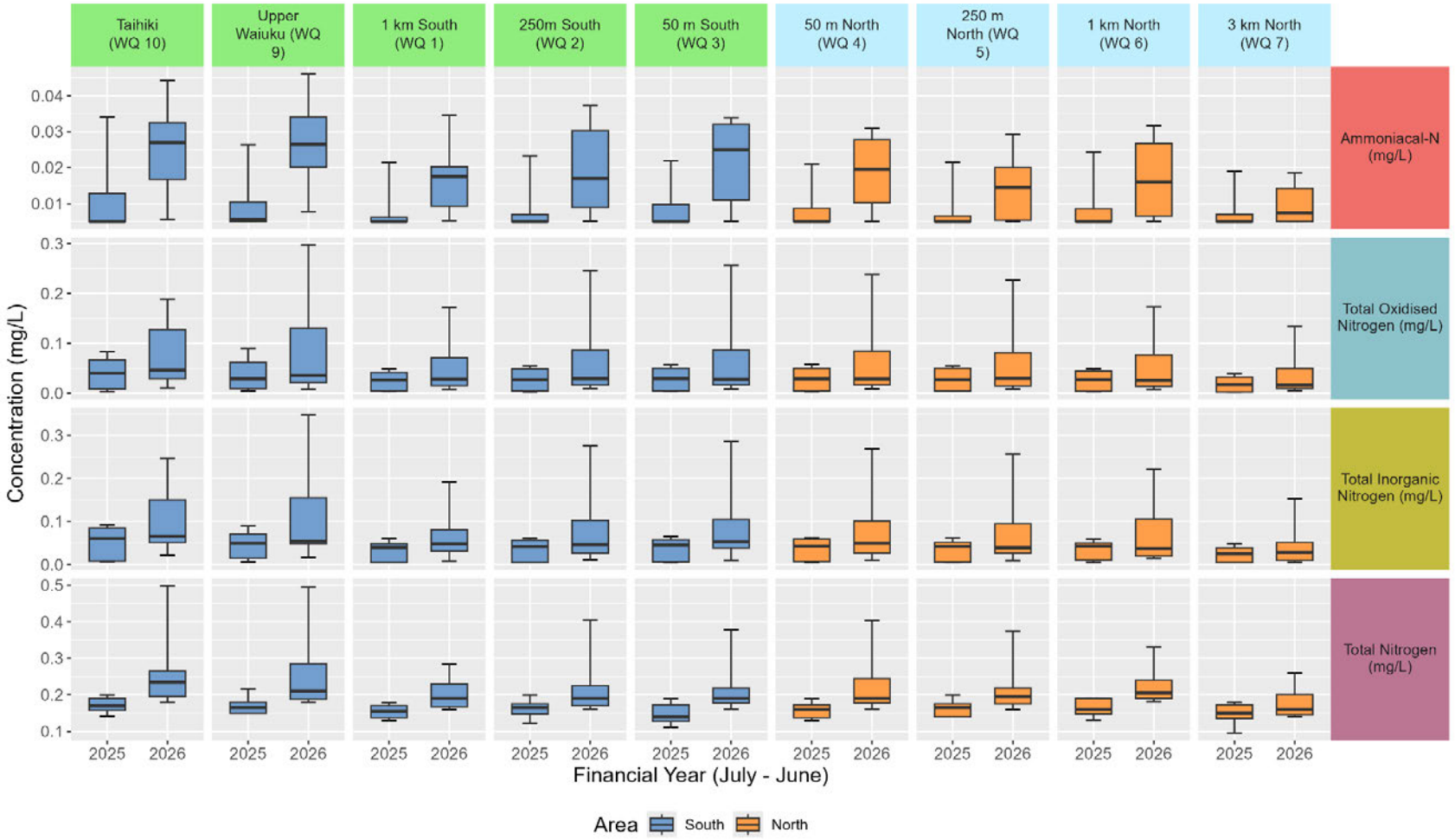


Figure 4: Boxplots showing annual concentrations of dissolved reactive and total phosphorus, chlorophyll *a*, and total suspended solids obtained from monitoring sites upstream (south) and downstream (north) of the new outfall location. Boxes show medians and 25th to 75th percentile ranges, whiskers are 10th and 90th percentiles, points are outliers.

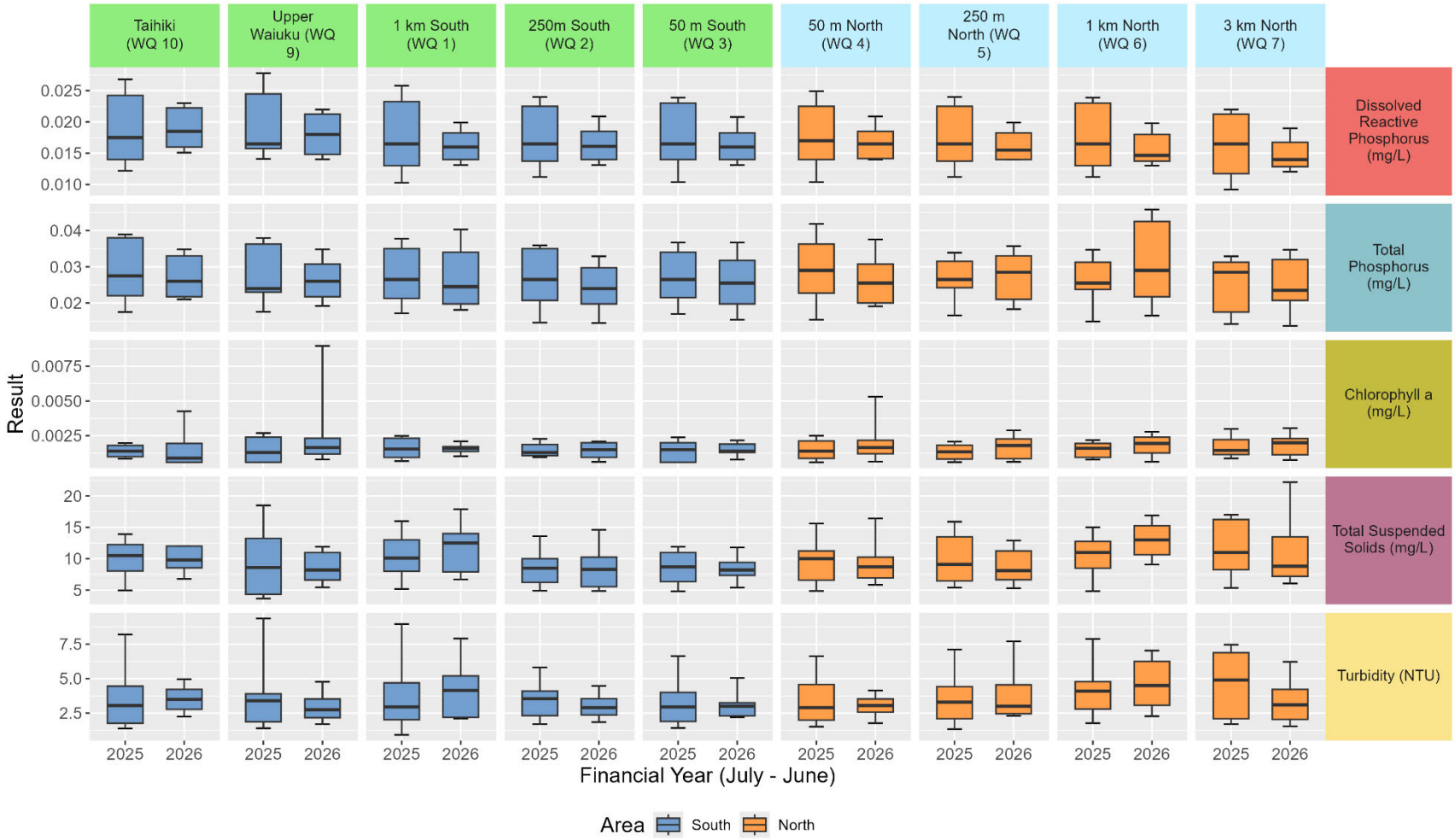


Figure 5: Boxplots showing annual field measurements obtained from monitoring sites upstream (south) and downstream (north) of the new outfall location. Boxes show medians and 25th to 75th percentile ranges, whiskers are 10th and 90th percentiles. Outliers are excluded.

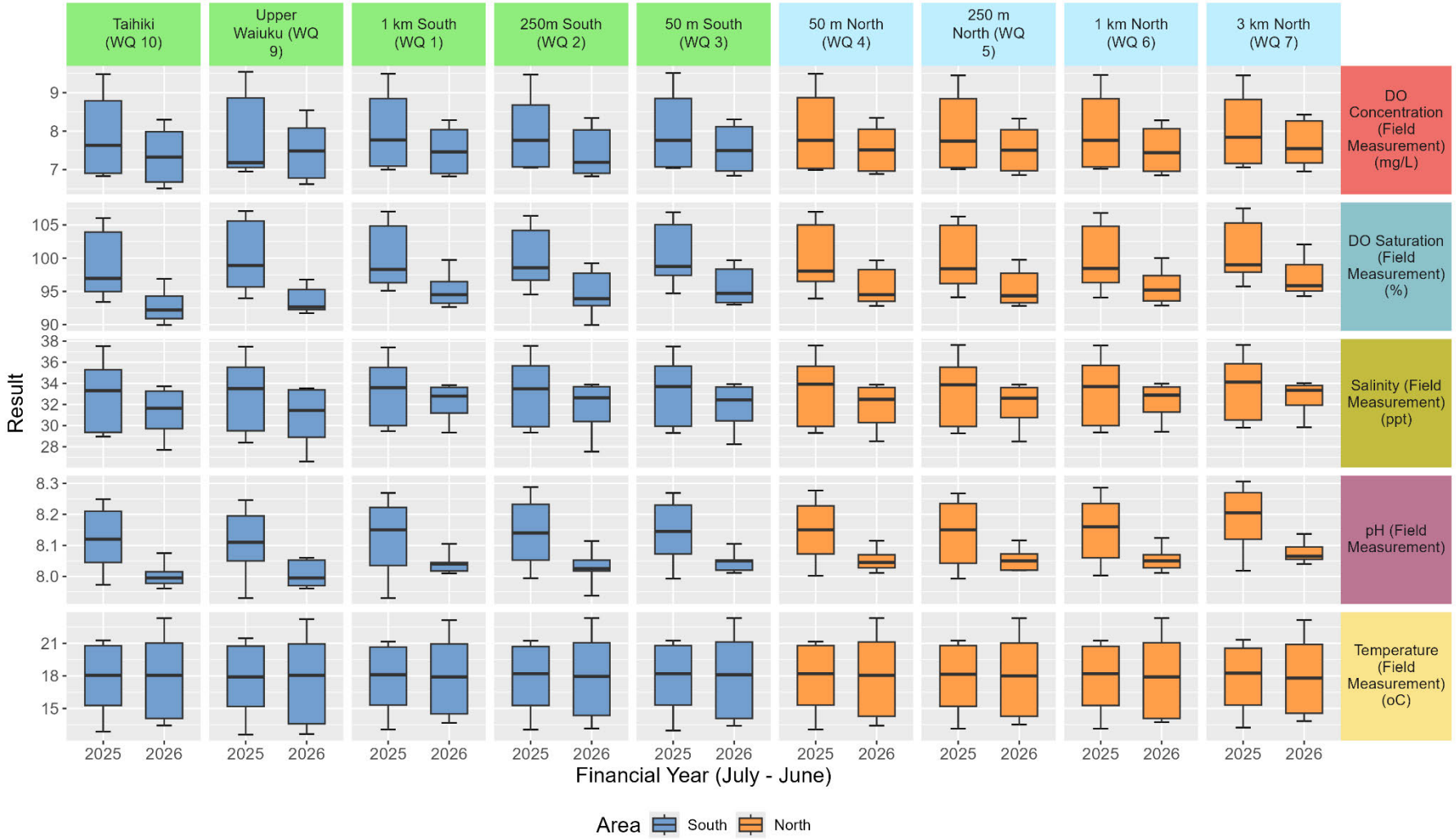


Figure 6: Temporal variation in total ammoniacal-N. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

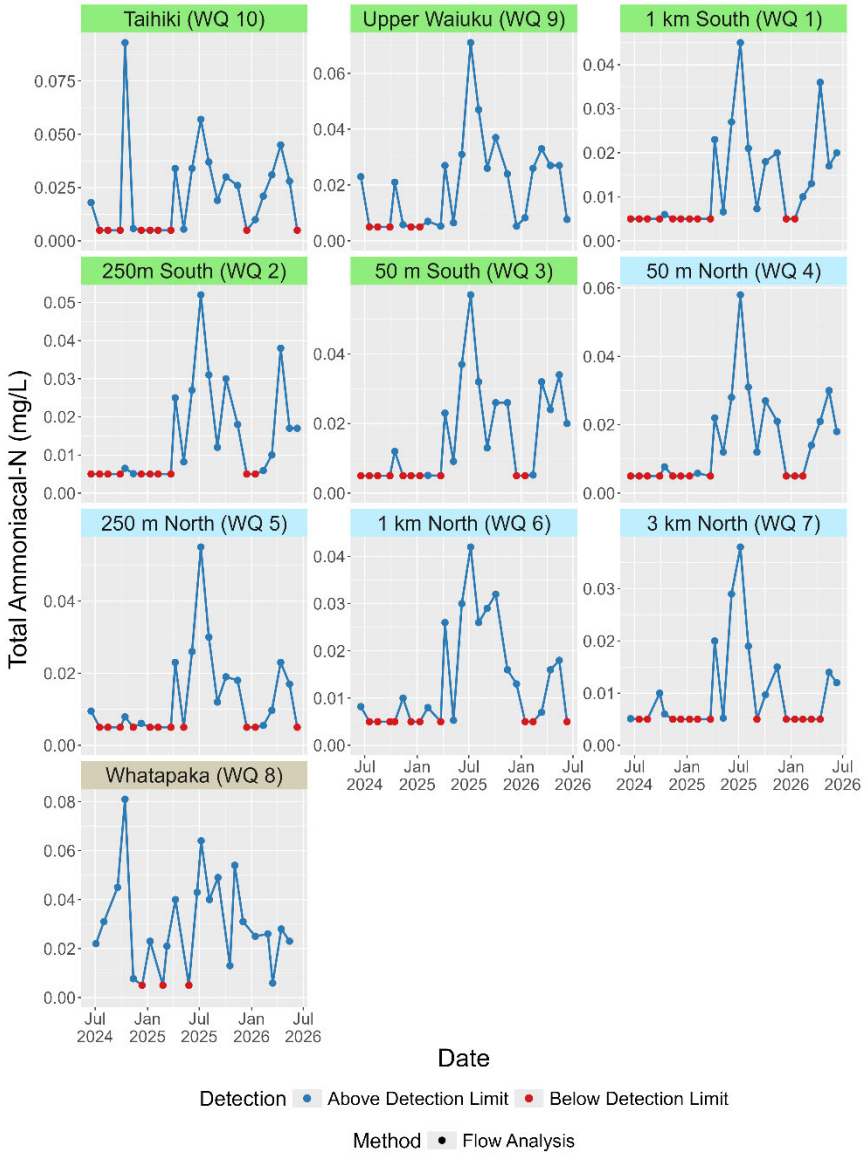


Figure 7: Temporal variation in total oxidised nitrogen. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

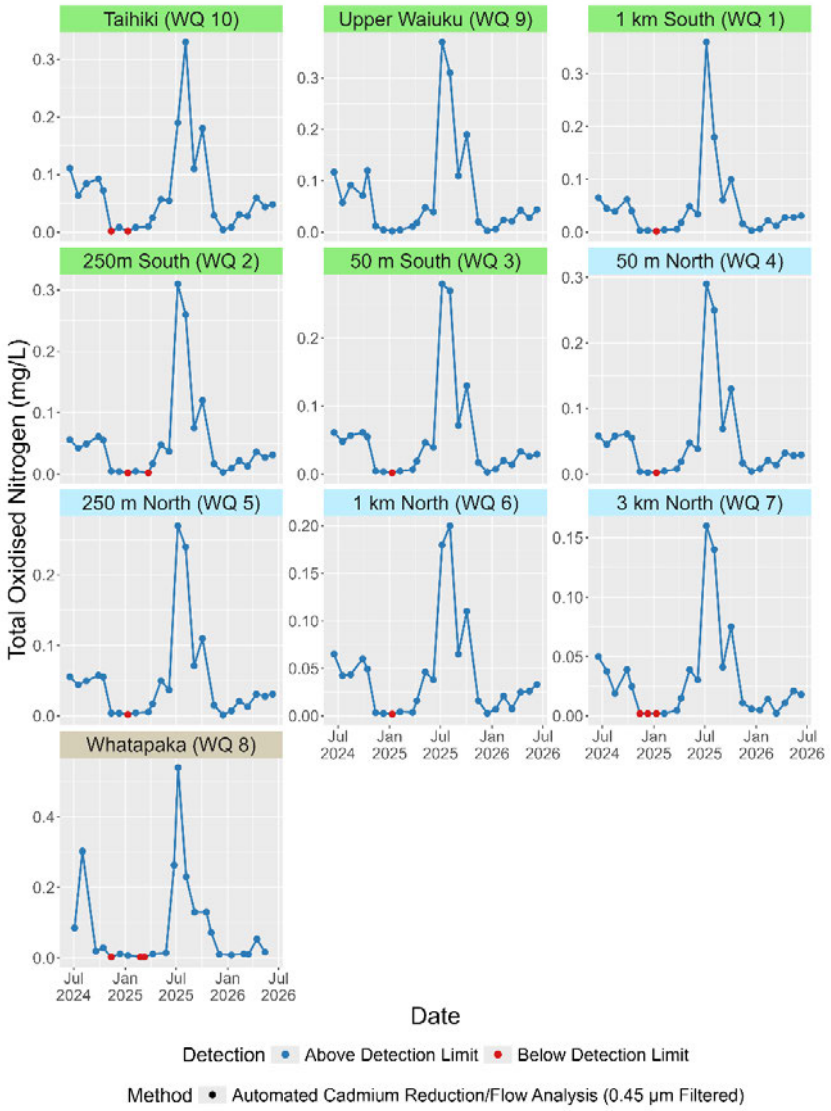


Figure 8: Temporal variation in total inorganic nitrogen. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

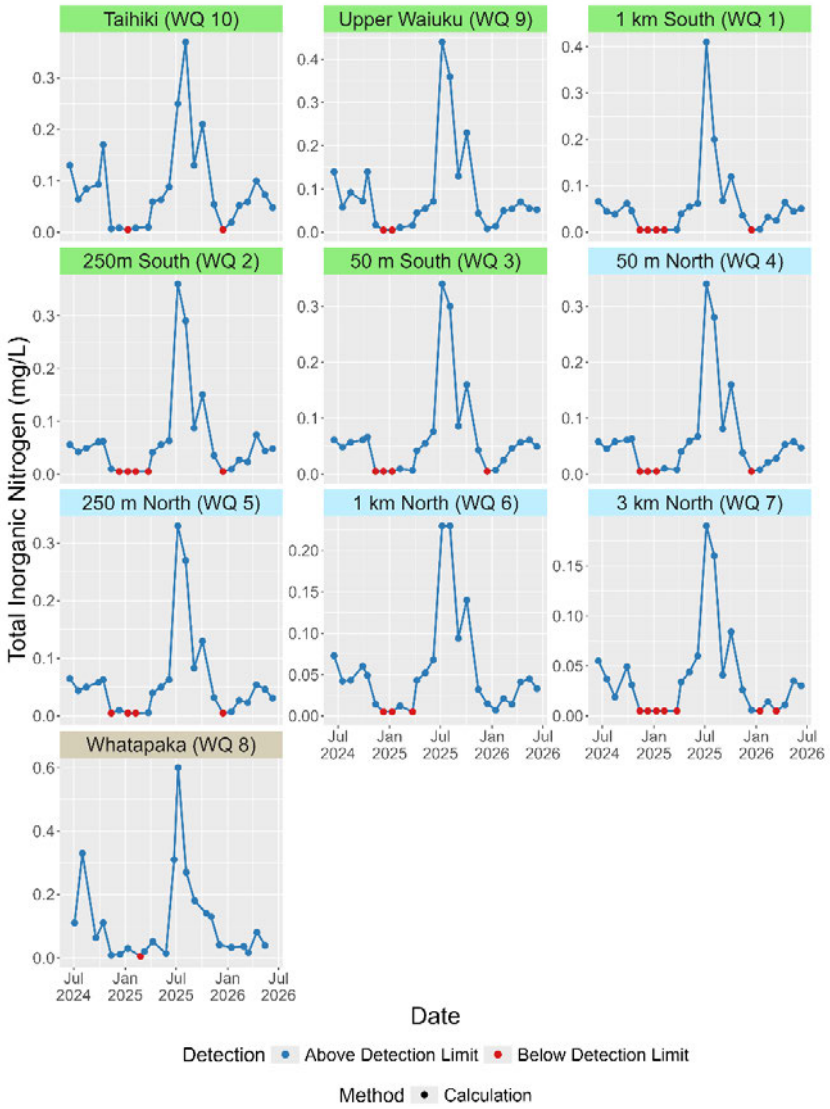


Figure 9: Temporal variation in total nitrogen. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

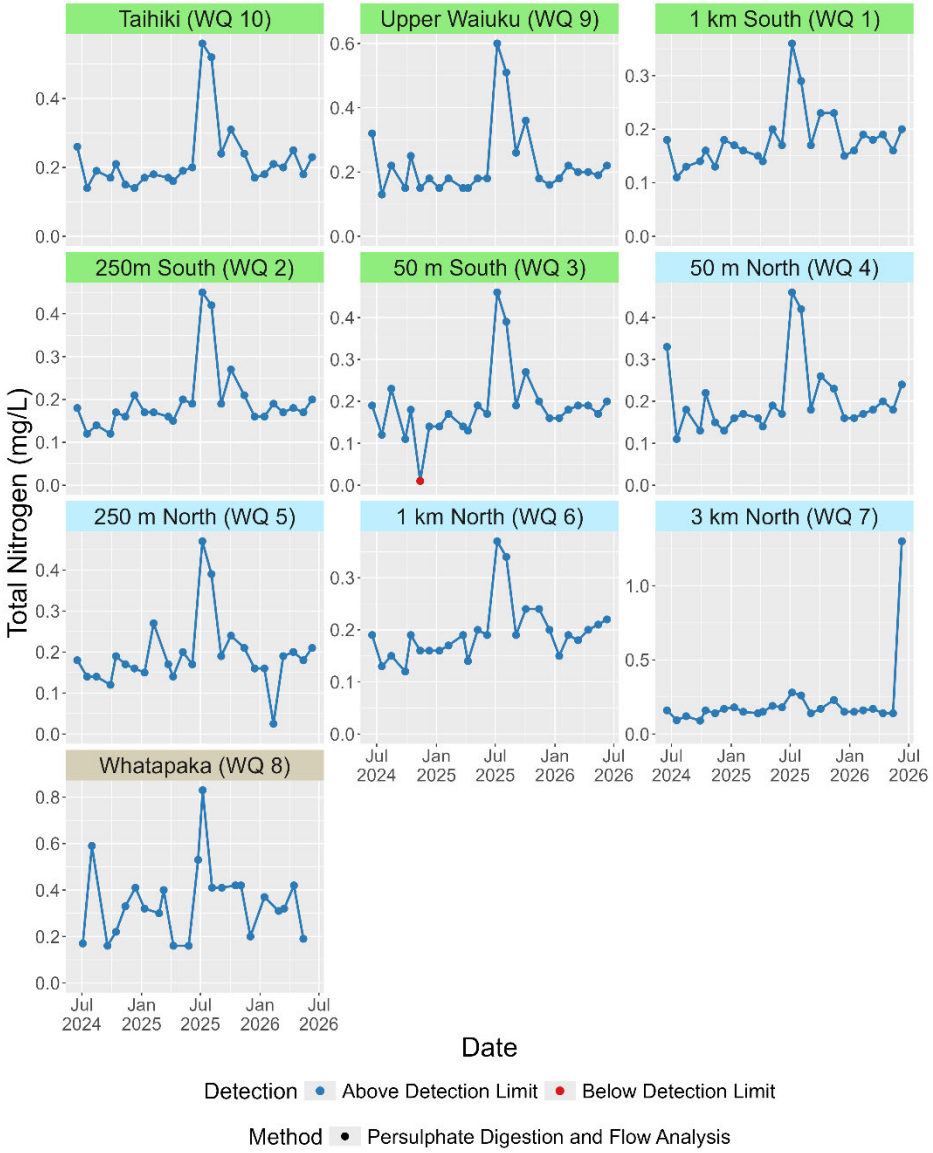


Figure 10: Temporal variation in dissolved reactive phosphorus. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

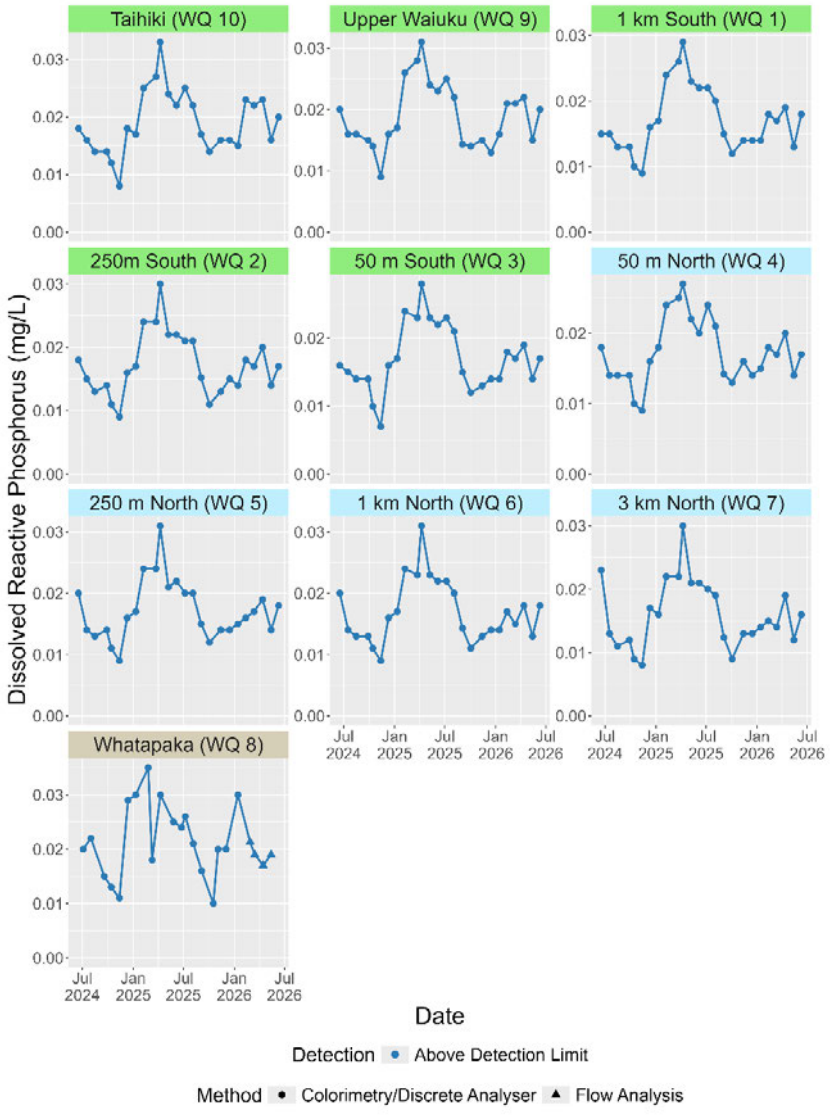


Figure 11: Temporal variation in total phosphorus. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

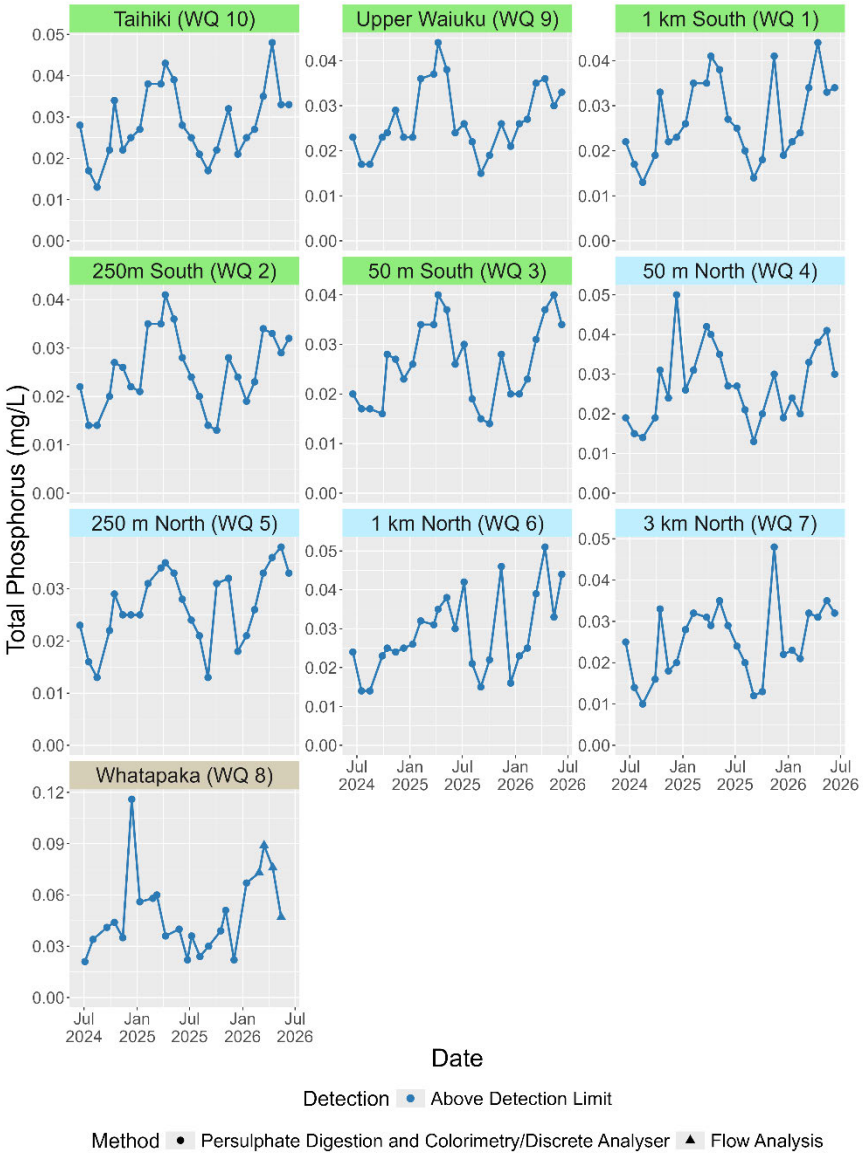


Figure 12: Temporal variation in chlorophyll *a*. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

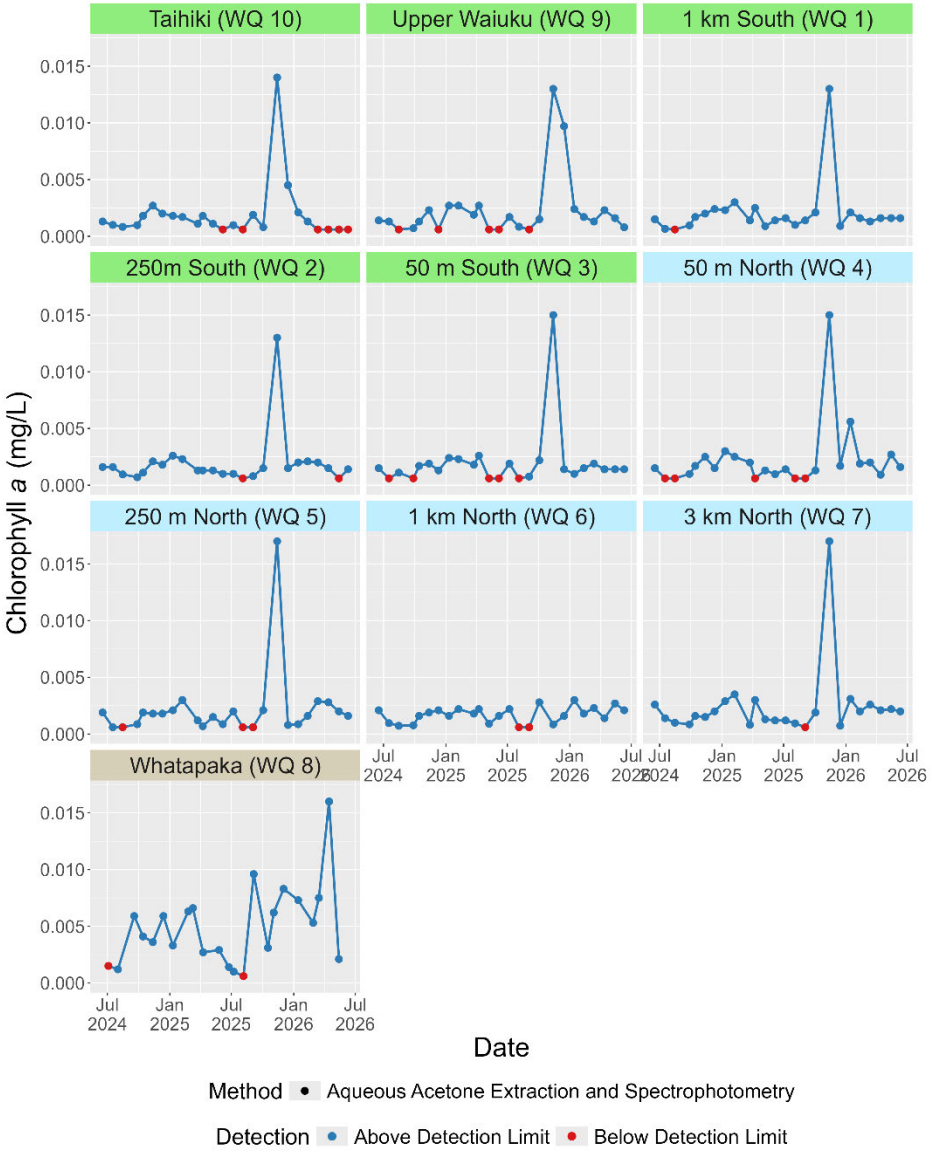


Figure 13: Temporal variation in total suspended solids. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

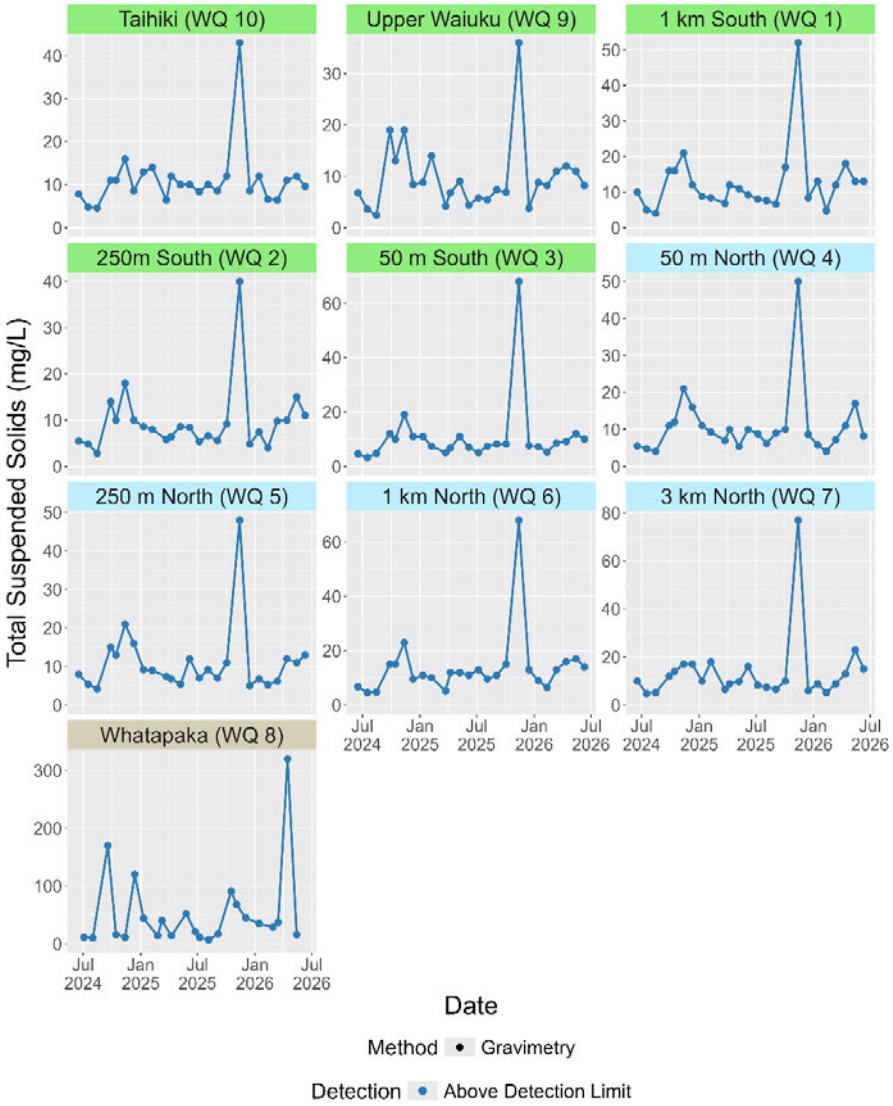


Figure 14: Temporal variation in turbidity. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

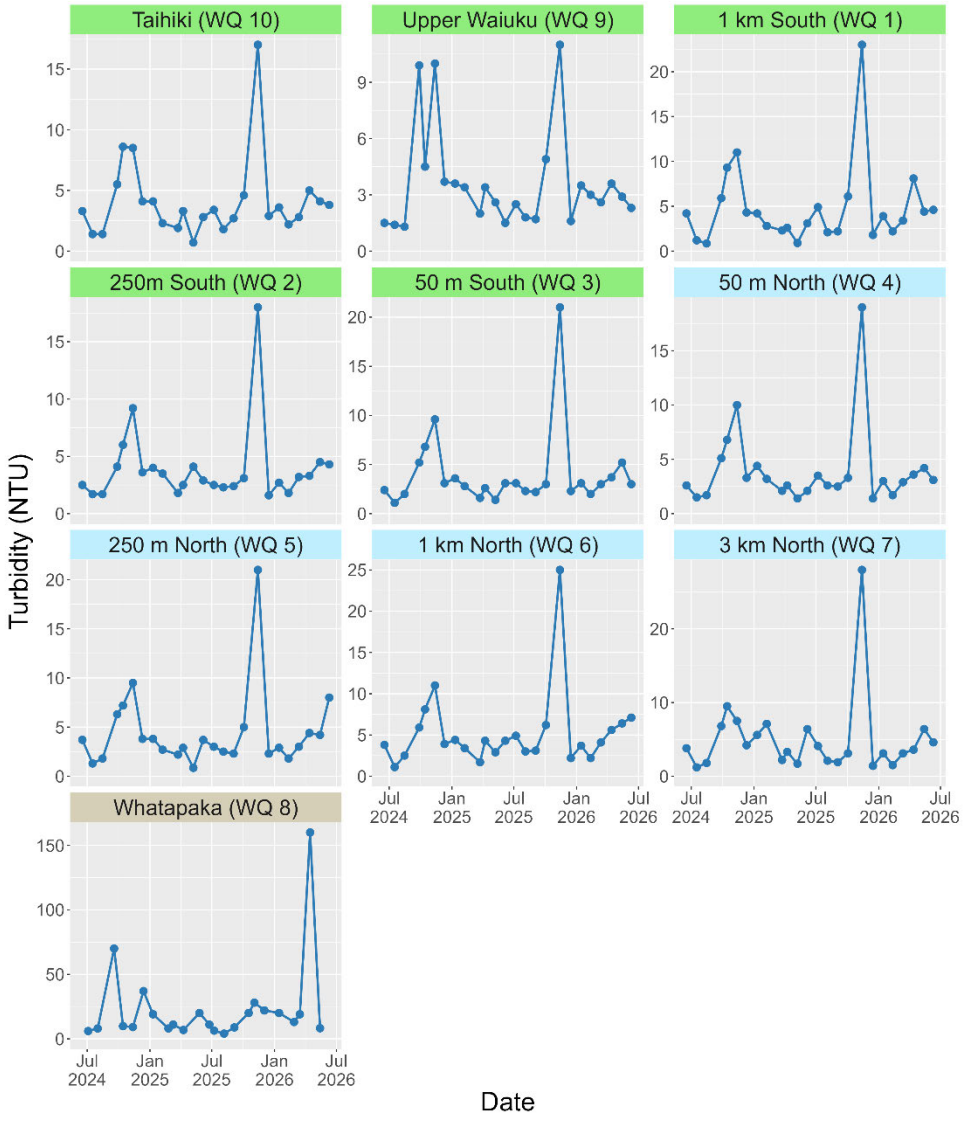


Figure 15: Temporal variation in pH. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

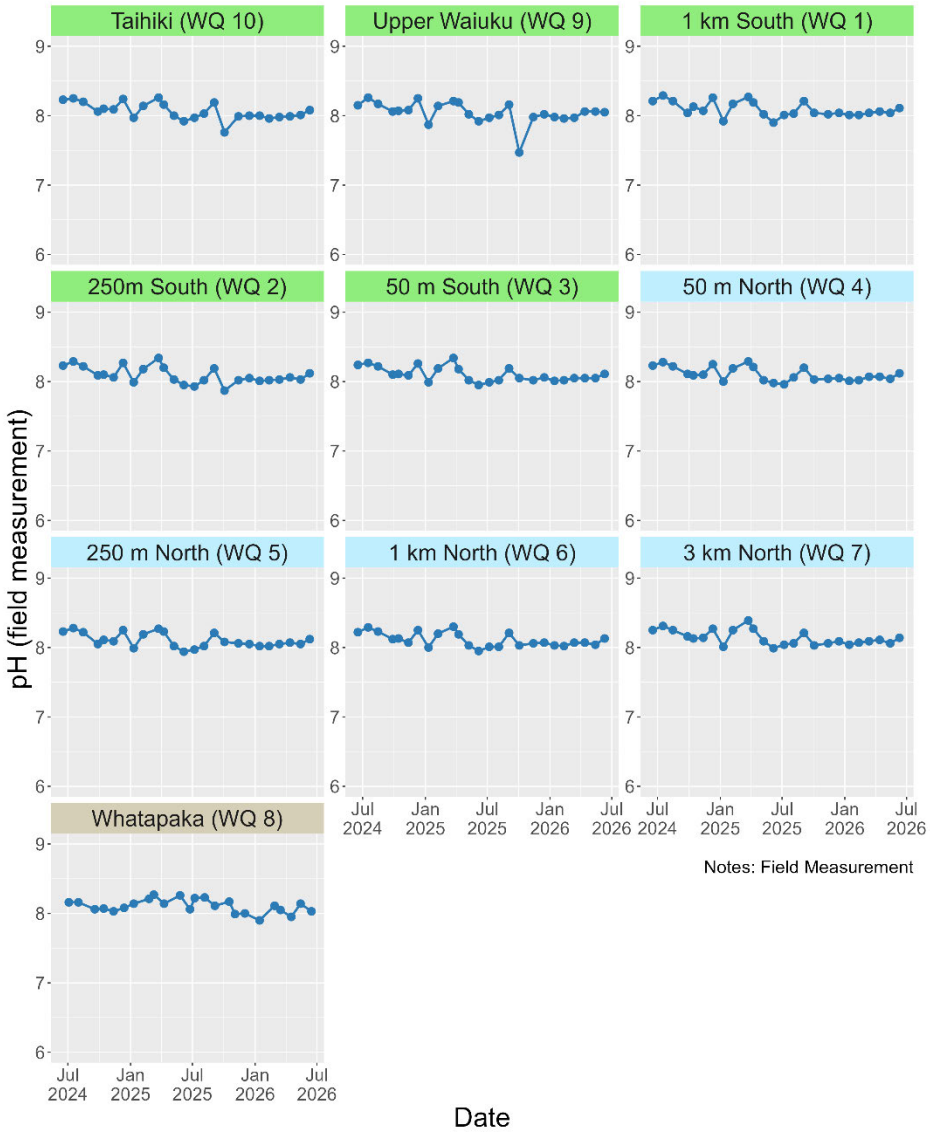


Figure 16: Temporal variation in dissolved oxygen saturation. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

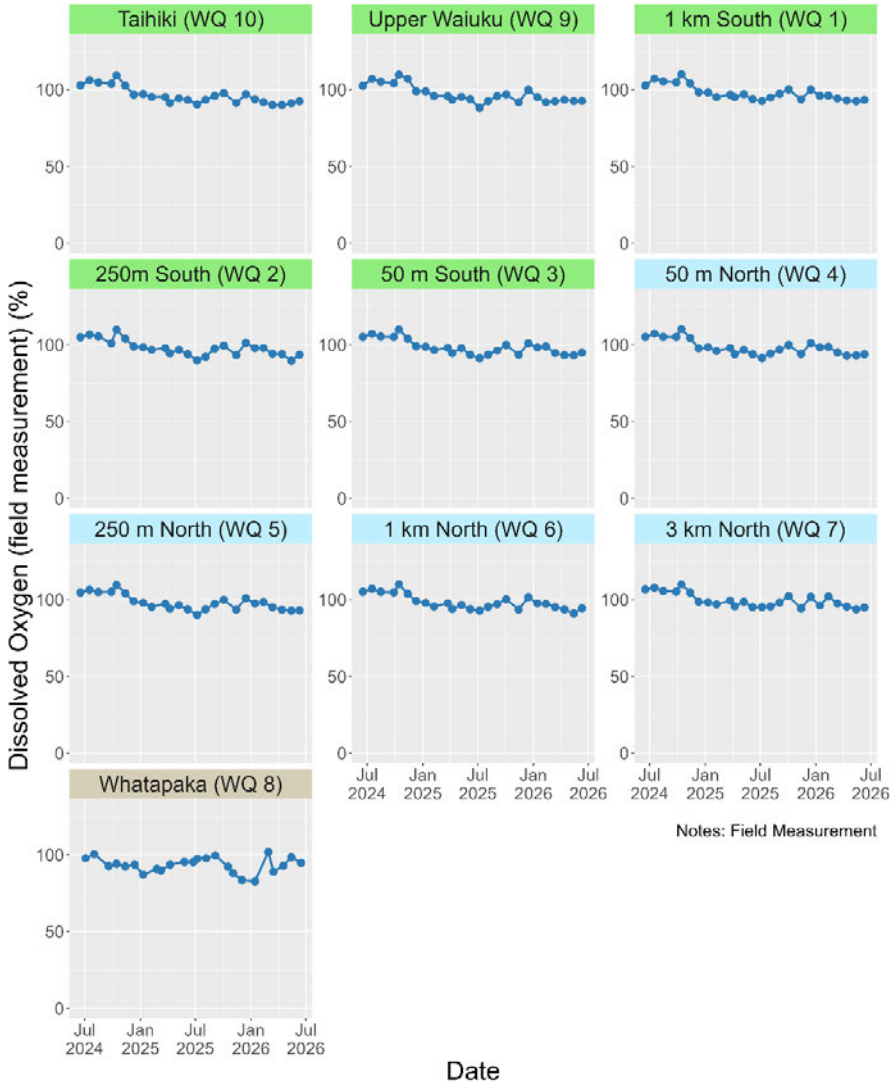


Figure 17: Temporal variation in salinity measured in the field. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

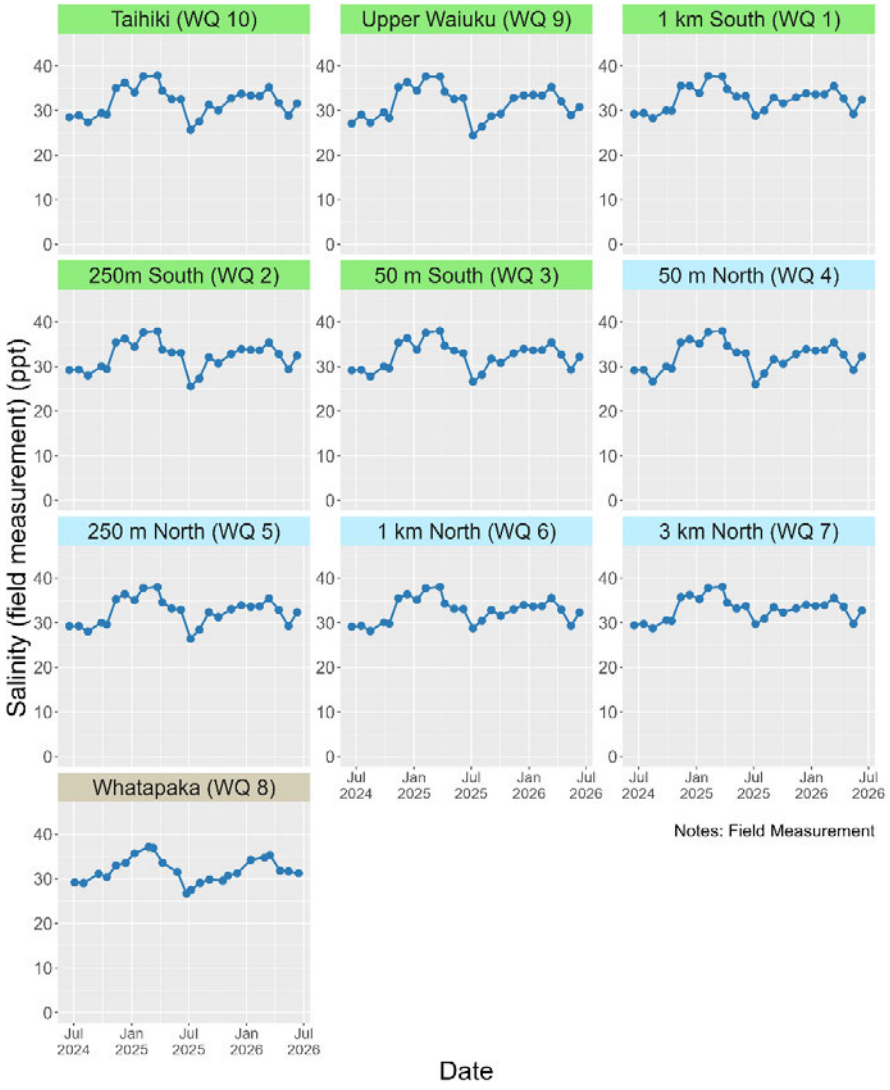


Figure 18: Temporal variation in water temperature. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

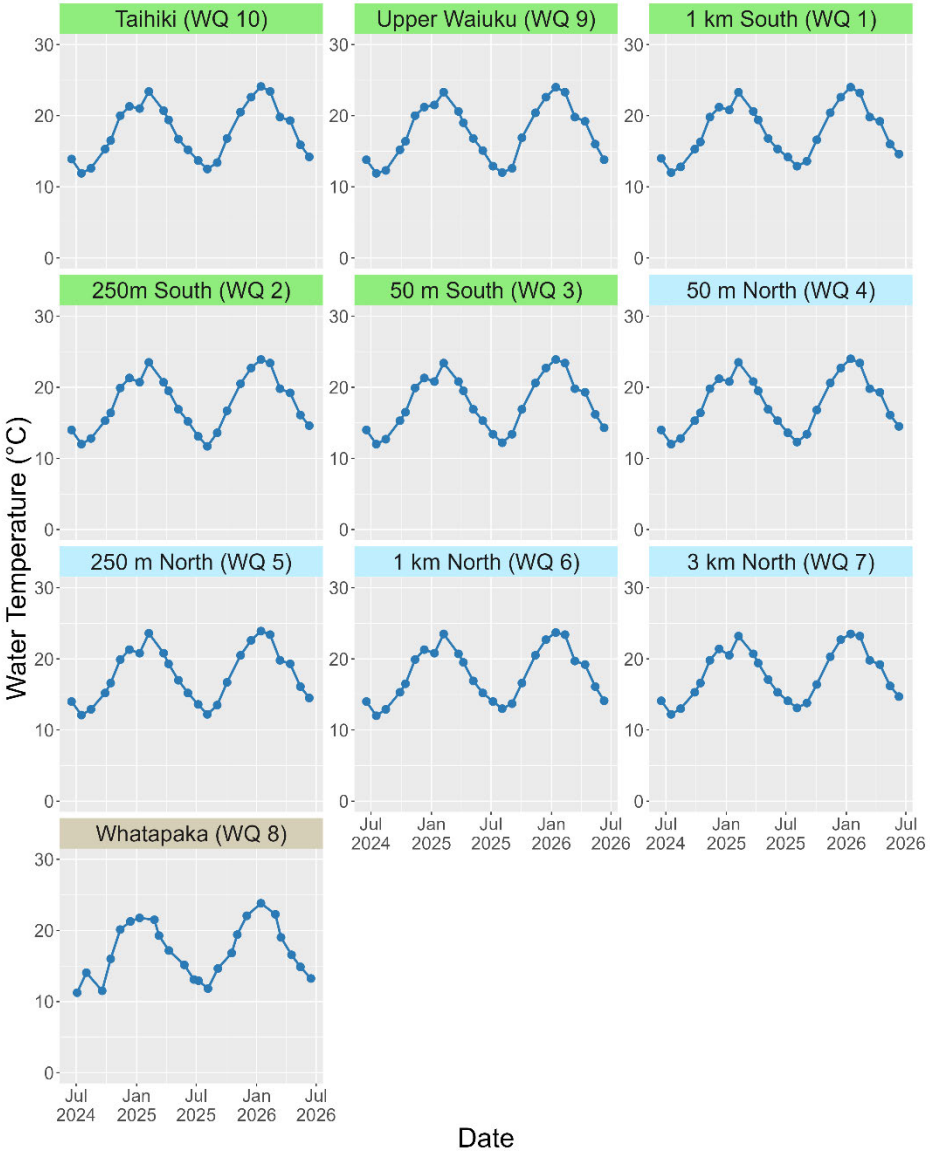


Figure 19: Temporal variation in enterococci. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

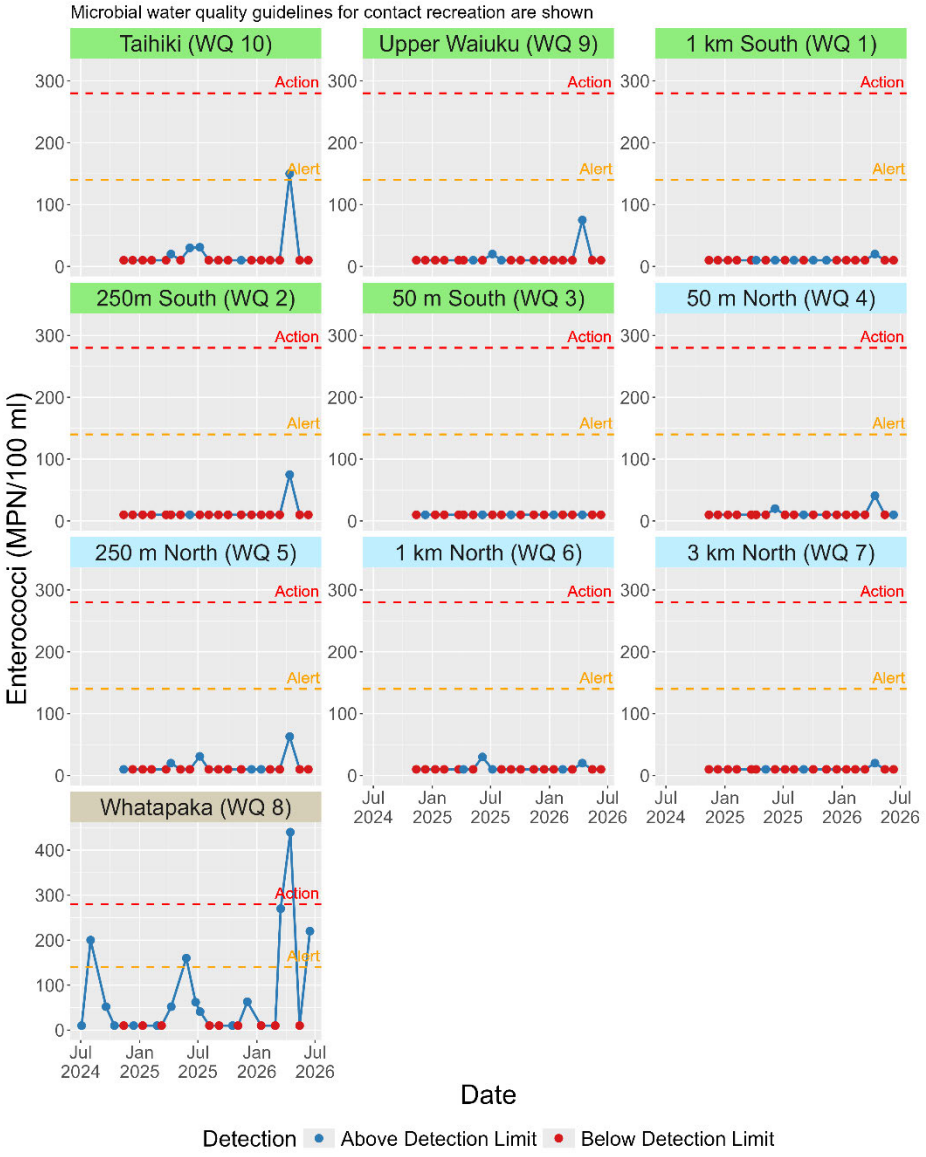


Figure 20: Temporal variation in faecal coliforms. Sites are ordered from upstream to downstream, with those above the consented outfall having green headers and those below having blue headers. The remote Whatapaka site is coloured khaki.

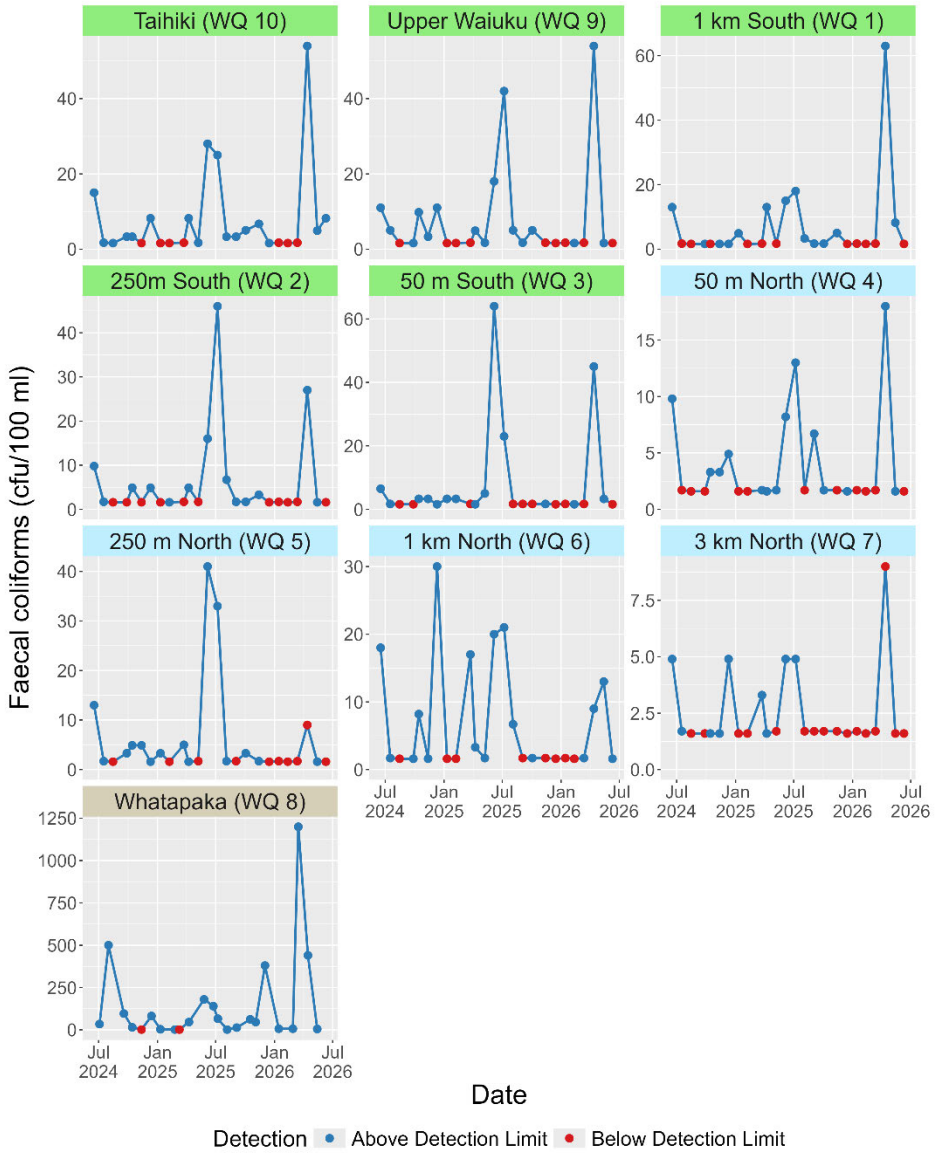


Figure 21: Correlation matrix showing the relationships between total inorganic nitrogen concentrations obtained from the Waiuku Channel and Taihiki monitoring sites.

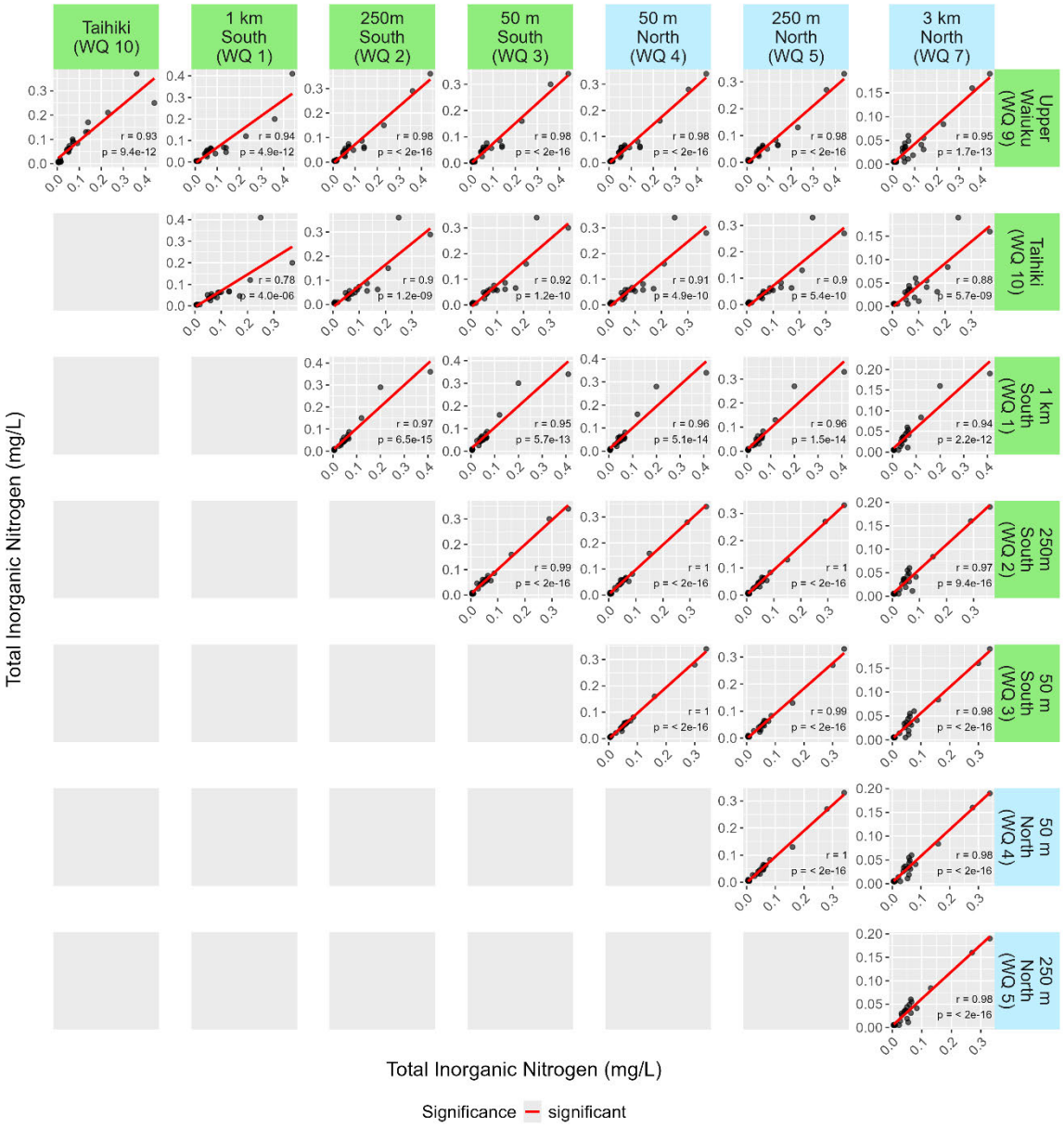
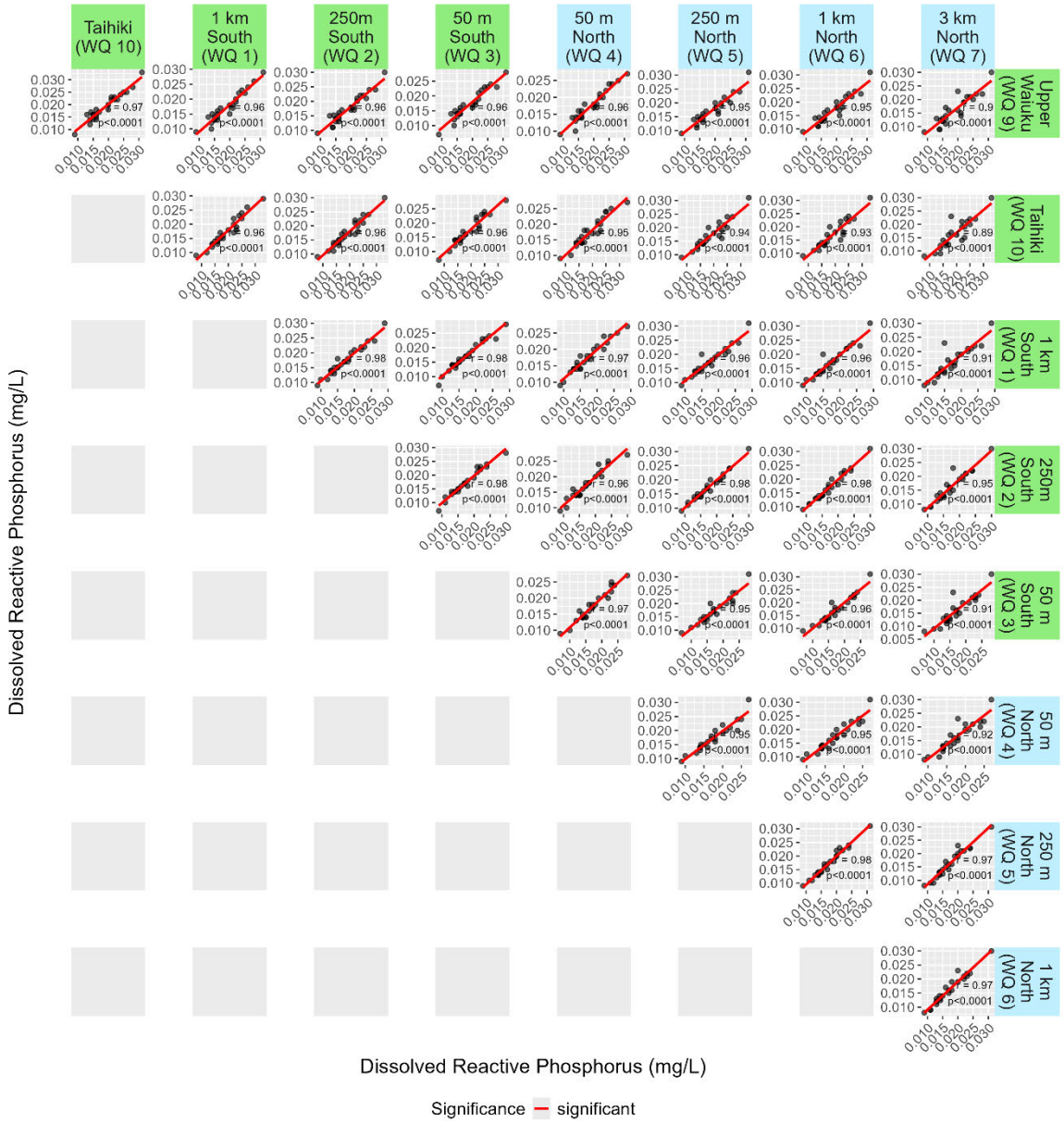


Figure 22: Correlation matrix showing the relationships between dissolved reactive phosphorus concentrations obtained from the Waiuku Channel and Taihiki monitoring sites.

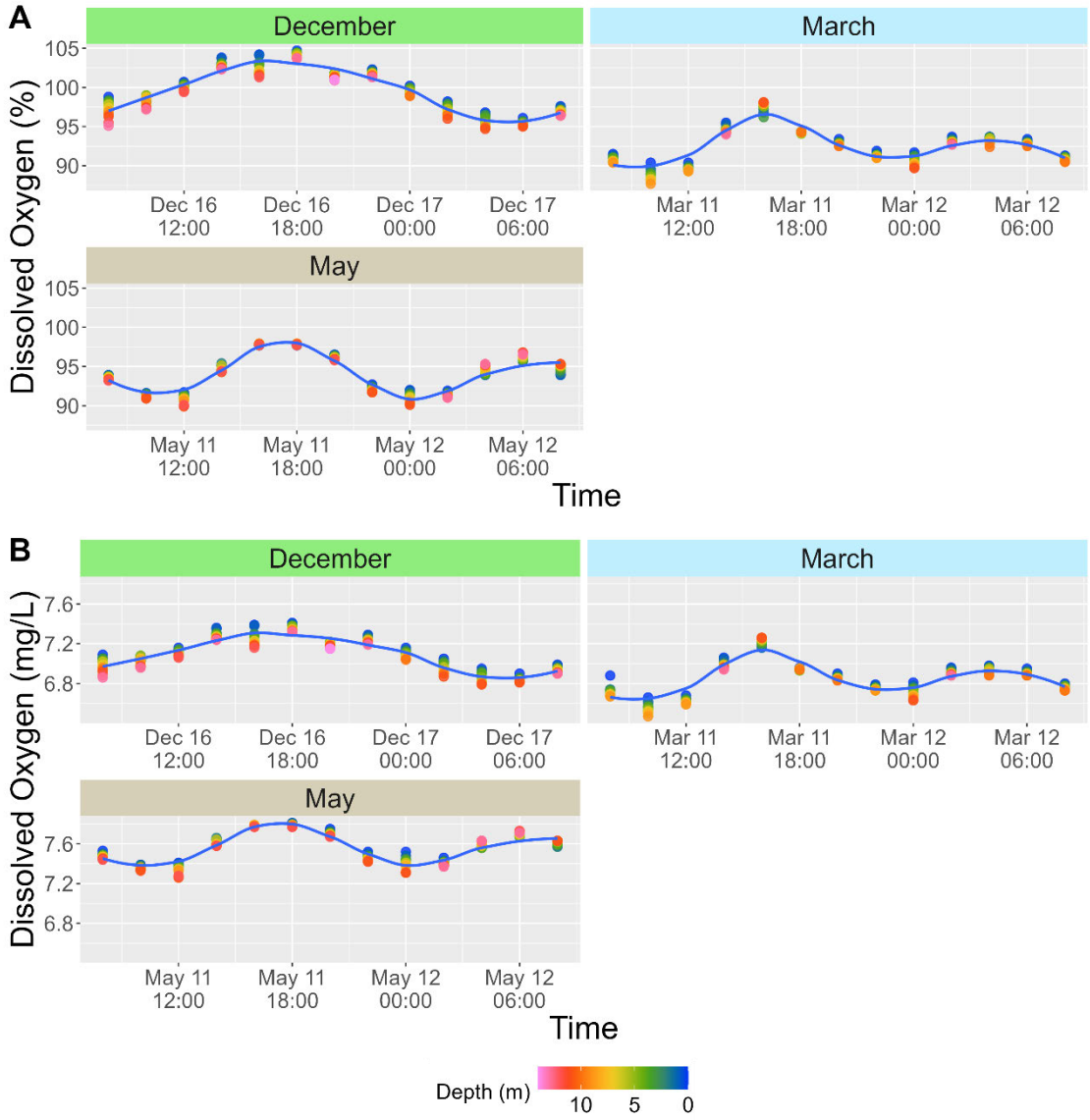


5.2.2 DISSOLVED OXYGEN

Depth profiles in dissolved oxygen saturation and concentrations were monitored for 24 hours in December 2025, March 2026, and May 2026. In all three months, variation over the 24 hours was much greater than variation among sampling depths. In December, a pronounced diurnal pattern in oxygen levels was recorded with DO saturation and concentration increasing during the day and declining overnight. Increases in daytime oxygen levels were also recorded in March and May, but levels fluctuated overnight.

Dissolved oxygen saturation was highest in summer (December), while concentrations were highest in late autumn when water temperature was cooler (May) (Figure 23). Oxygen saturation and concentrations also tended to be highest at the surface and decline slightly with depth.

Figure 23: Twenty-four-hour depth profiles of dissolved oxygen: A. saturation; and, B. concentration from December 2025, March 2026, and May 2026.



5.2.3 PHYTOPLANKTON

Fourteen potentially toxic phytoplankton taxa[2] have been recorded since monitoring began in July 2024: *Alexandrium minutum, Alexandrium ostenfeldii, Alexandrium pacificum, Alexandrium* sp., *Alexandrium* spp., *Anabaena* sp., *Azadinium* sp._analogue, *Dinophysis* spp., *Gymnodinium catenatum, Gymnodinium* sp., *Gymnodinium* spp., *Karenia* sp., *Pseudo-nitzschia* sp. and *Pseudo-nitzschia* spp.

In 2025–26, potentially toxic filamentous cyanobacteria from the *Anabaena* genus were detected at all phytoplankton sampling sites in December 2025. Other known toxic species obtained from phytoplankton samples in 2025–26 included: *Alexandrium minutum, Gymnodinium catenatum*, and *Prorocentrum lima.* Other potentially toxic taxa from the

[2] Taxa within a genus that contains toxic species, but were only identified to genus level were regarded as potentially toxic.

Alexandrium, Karenia, Pseudo-nitzschia, Gymnodinium and *Dinophysis* genera were also present, but were not identified to species level (Table 1).

Plots show seasonal cycles in total phytoplankton taxa, and cell concentrations and biovolumes with: highest biovolumes in spring–early summer (Nov–Dec); highest cell concentrations in mid to late summer (Feb–Mar), and low taxa diversity in winter (Figure 25). Diatoms (Bacillariophyceae), dinoflagellates (Dinoflagellata), flagellates/unicells were consistently present in water quality samples, while other higher-order phyla/taxa groups were rarely to occasionally present (Figure 26). Overall, a total of 99 phytoplankton taxa from 12 phyla or other general high-order groups[3] were identified in samples collected in 2025–26.

The top 10 genera by cell concentration included two genera from the flagellates-unicells group, five diatom genera, and three dinoflagellate genera (Figure 25). For cell volume, the top 10 genera included two genera from the flagellates-unicells group, six diatom genera and two dinoflagellate genera (Figure 26).

On average, the two dominant taxa groups by cell count were flagellates-unicells, and small flagellates-unicells, which contributed 78% of the total number of cells/ml (42% and 36%, respectively). Other taxa of note were the cyanobacteria *Anabaena* sp., which contributed an average of 5% to the average number of cells (although that was related to very high numbers on a single occasion—Dec 2025), and the diatoms *Chaetoceros curvisetus* + *Chaetoceros* spp., which together contributed 3%. However, those five taxa combined only contributed 5% towards the average biovolume, with flagellates-unicells, and small flagellates-unicells providing 3.5%. All other taxa made average contributions of less than 1% to total cell counts.

Average biovolumes were dominated by the contributions of five taxa, which together contributed >70%: the diatoms, *Trieres chinensis* (32%), *Coscinodiscus granii* (13%), *Rhizosolenia styliformis* (12%), *Guinardia striata* (5%), and the dinoflagellate *Noctiluca* sp. (8%). Six other taxa had average contributions of more than 1%: the diatoms *Pseudosolenia* sp. (3%) and *Rhizosolenia pungens* (3%), the dinoflagellate *Alexandrium frateculus* (2%), Flagellates/Unicells <5 µm (2%), Small Flagellates Unicells (2%), and the ciliophoran *Myrionecta rubra* (2%). All other taxa made average contributions of less than 1% to total biovolumes. Multidimensional scaling showed that similar temporal shifts in overall community composition occurred at all sites (Figure 29). Importantly, none of the univariate and multivariate plots from sites upstream and downstream of the WWTP discharge displayed patterns that indicate phytoplankton cell concentrations or biovolumes were affected by the discharge.

[3] Diatoms (Bacillariophyceae), Dinoflagellates (Dinoflagellata), Flagellates/Unicells, Autotrophic ciliate, Flagellates, Silicoflagellate, Raphidophytes, Blue greens (Cyanobacteria), Ciliophora (autotrophic), Eugleniods (Euglenozoa), Golden-brown algae (Chrysophyceae).

Table 1: Potentially toxic phytoplankton and blue-green algae (cyanobacteria) taxa detected in water quality samples obtained between July 2025 and June 2026. Action levels for listed phytoplankton taxa are taken from the Regulated Control Scheme for Bivalve Molluscan Shellfish for Human Consumption (Ministry for Primary Industries 2024), which requires flesh testing of farmed bivalves if exceedances occur. Taxa that were identified to genus level have been included because they may be, or may include, a listed species.

Taxa	Maximum count (cells/mL, adjusted to cells/L in brackets)	No. of samples where present	Action level (cells/L)	Sites where taxa detected	Action Level exceedances in past year	Notes
Alexandrium minutum	0.2 (200)	3	100	WQ 2, WQ 5, WQ 6	2	Species-specific action level.
***Alexandrium* sp.**	6.83 (6827)	11	Not provided	All sites	No Action Level	Identification not made to species level. Action level values are only applicable to listed species[4].
***Anabaena* sp.**	122 (122000)	5	Not provided	All sites	No Action Level	Blue-green algae.
***Dinophysis* spp.**	0.4 (400)	1	Not provided	WQ 2	No Action Level	Identification not made to species level. Action level values are only applicable to listed species[5].
Gymnodinium catenatum	1 (1000)	2	100	WQ 2, WQ 5	2	Species-specific action level.
***Gymnodinium* spp.**	6.83 (6827)	65	250,000	All sites	0	Action level applies to species within the *Karenia / Karlodinium / Gymnodinium* Group.
***Karenia* sp.**	4.55 (4551)	35	1,000–250,000	All sites	0	Identification not made to species level. Action level values vary among listed *Karenia* species[6], and species within the *Karenia / Karlodinium / Gymnodinium* Group.[7]. Exceedances relate to the action level of the latter group.
Prorocentrum lima	0.1 (100)	1	500	WQ 2	0	Species-specific action level.
***Pseudo-nitzschia* sp.**	6.83 (6827)	38	100,000–1,000,000	All sites	0	Identification not made to species level. Action Level values vary among listed species[8]. Counts never exceeded any of the action level values.

[4] *Alexandrium minutum, Alexandrium ostenfeldii, Alexandrium catenella, Alexandrium pacificum, Alexandrium tamarense*

[5] *Dinophysis acuta, Dinophysis acuminata*

[6] *Karenia brevis, Karenia brevisculata*

[7] *Karenia/Karlodinium/Gymnodinium* Group includes *Karenia bidigitata, Karenia mikimotoi, Karenia papilionacea, Karenia selliformis, Karlodinium micrum* and *Gymnodinium impudicum*

[8] *Pseudo-nitzschia australis, Pseudo-nitzschia pungens, Pseudo-nitzschia multiseries, Pseudo-nitzschia multistriata, Pseudo-nitzschia fraudulenta, Pseudo-nitzschia delicatissima, Pseudo-nitzschia pseudodelicatissima*

Figure 24: Plots of cell counts for toxic or potentially toxic taxa, with action levels for listed species in the Regulated Control Scheme for Bivalve Molluscan Shellfish for Human Consumption (Ministry for Primary Industries 2024) provided for reference. Sites are ordered from up-river to down-river, with those above the consented outfall coloured green and those below coloured blue.

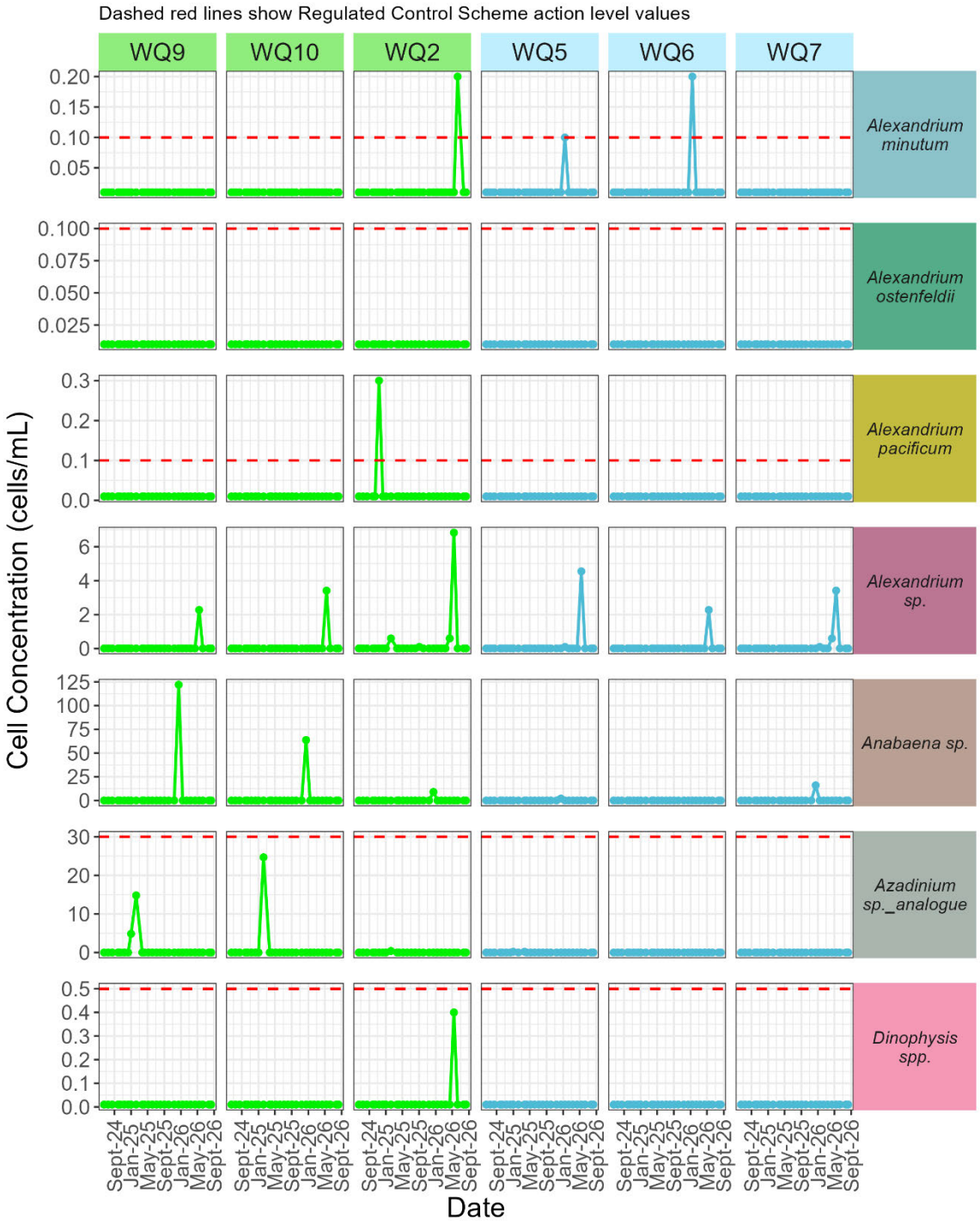


Figure 24: Plots of cell counts for toxic or potentially toxic taxa, with action levels for listed species in the Regulated Control Scheme for Bivalve Molluscan Shellfish for Human Consumption (Ministry for Primary Industries 2024) provided for reference. Sites are ordered from up-river to down-river, with those above the consented outfall coloured green and those below coloured blue. continued: Plots of cell counts for toxic or potentially toxic taxa, with action levels for listed species in the Regulated Control Scheme for Bivalve Molluscan Shellfish for Human Consumption (Ministry for Primary Industries 2024) provided for reference. Sites are ordered from up-river to down-river, with those above the consented outfall coloured green and those below coloured blue.

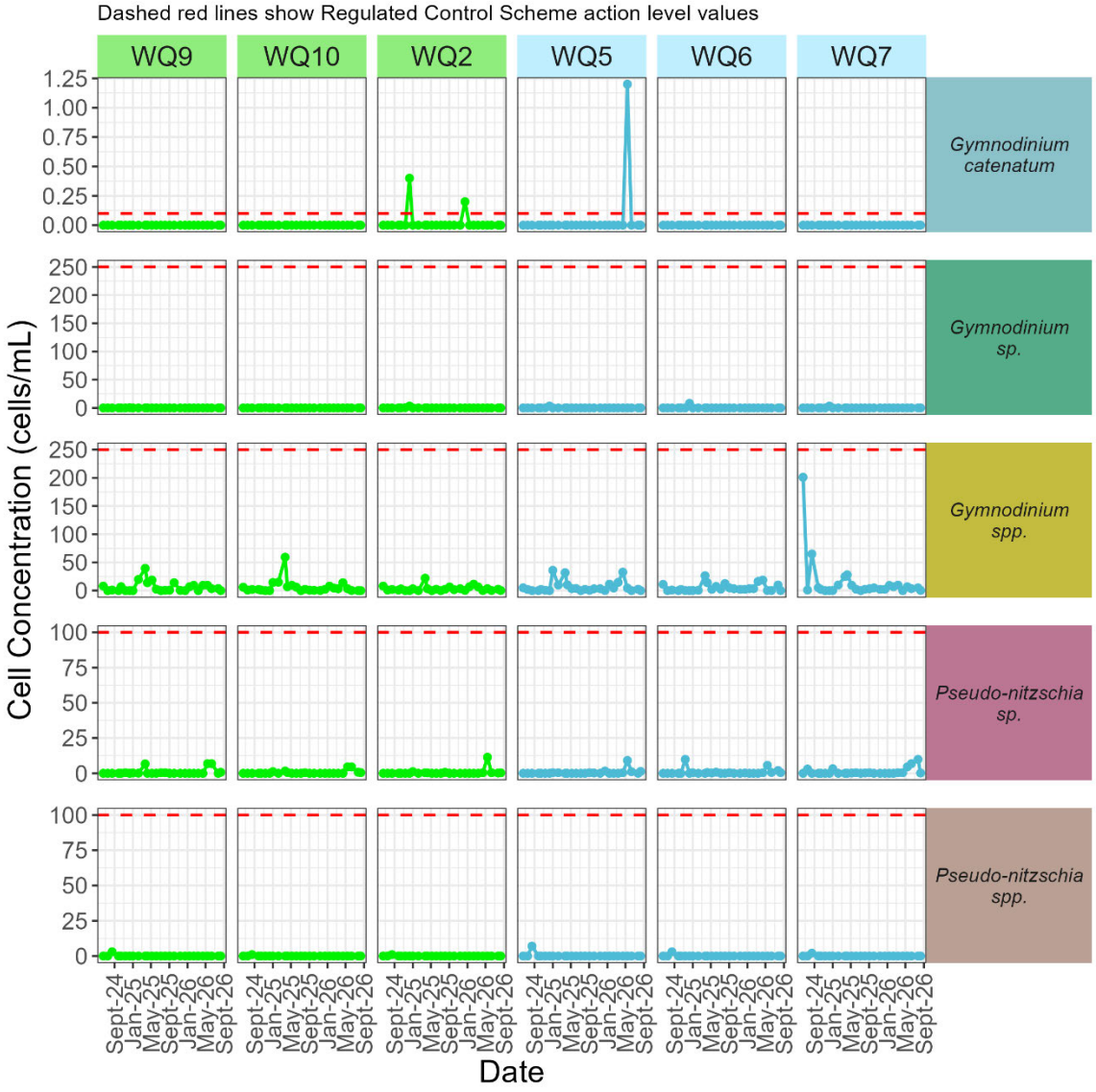


Figure 25: Variation in total phytoplankton taxa, cell concentrations and biovolumes among sites and over time. Sites are ordered from up-river to down-river, with those above the consented outfall coloured green and those below coloured blue.

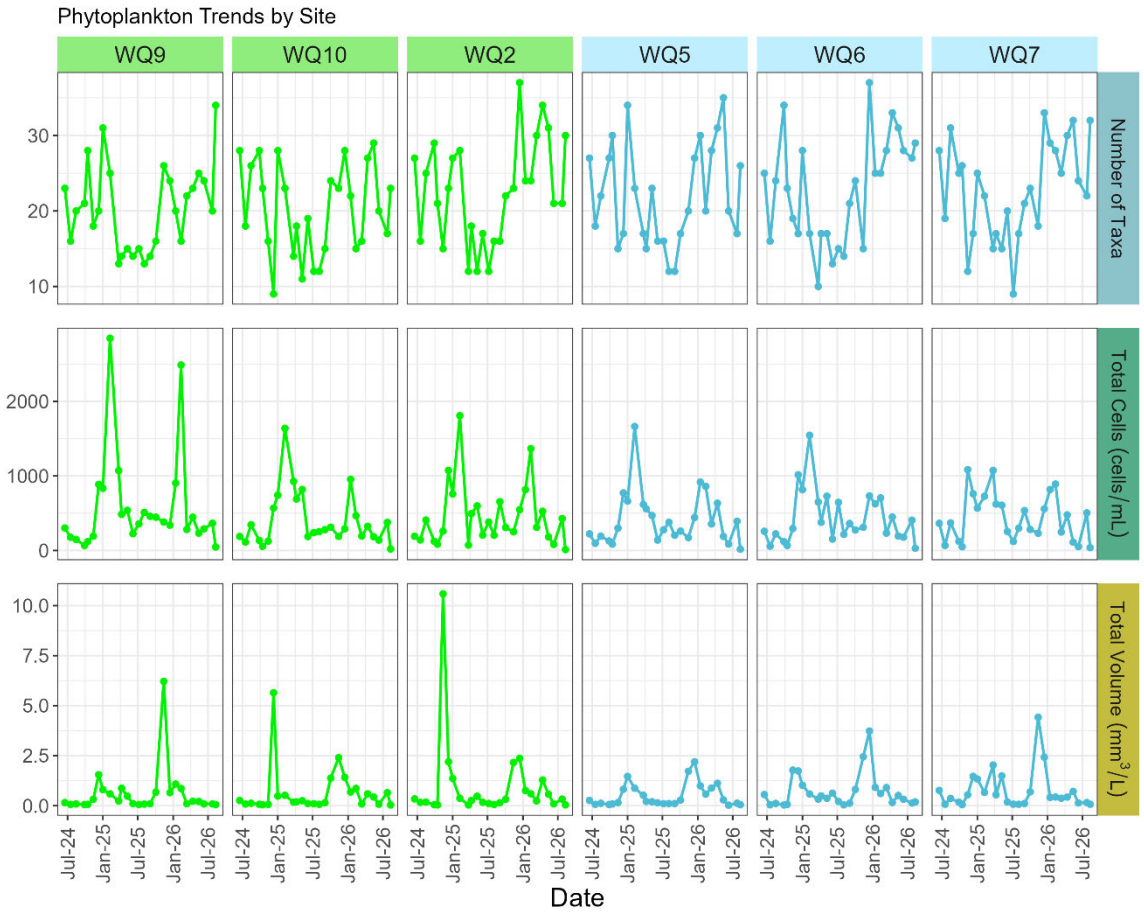


Figure 26: Variation in total biovolumes of phyla/taxa groups by site and date. Sites are ordered from up-river to down-river, with those above the consented outfall coloured green and those below coloured blue.

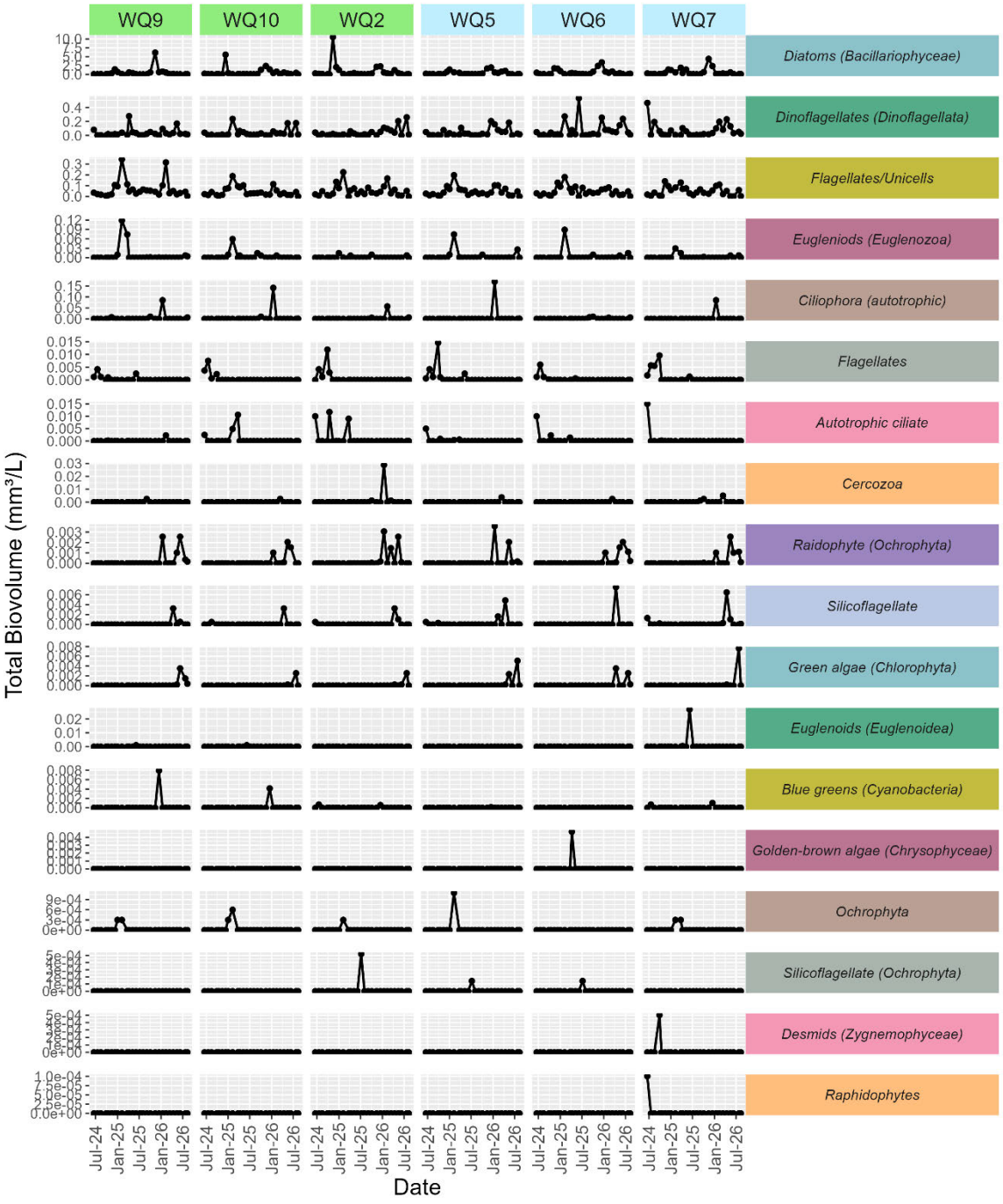


Figure 27 Variation in total cell concentrations of the top 10 genera/taxa groups by site and date. Sites are ordered from up-river to down-river, with those above the consented outfall coloured green and those below coloured blue.

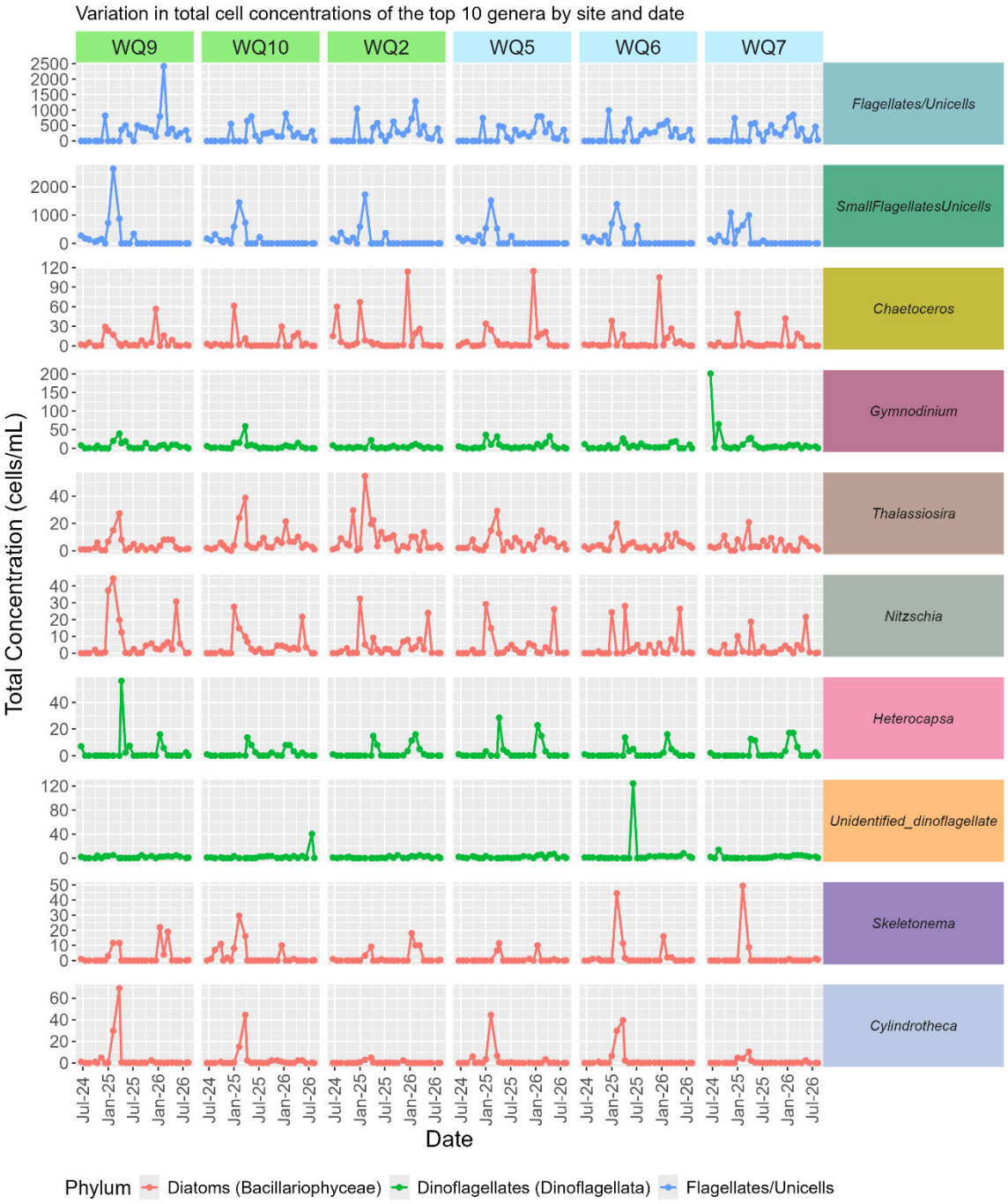
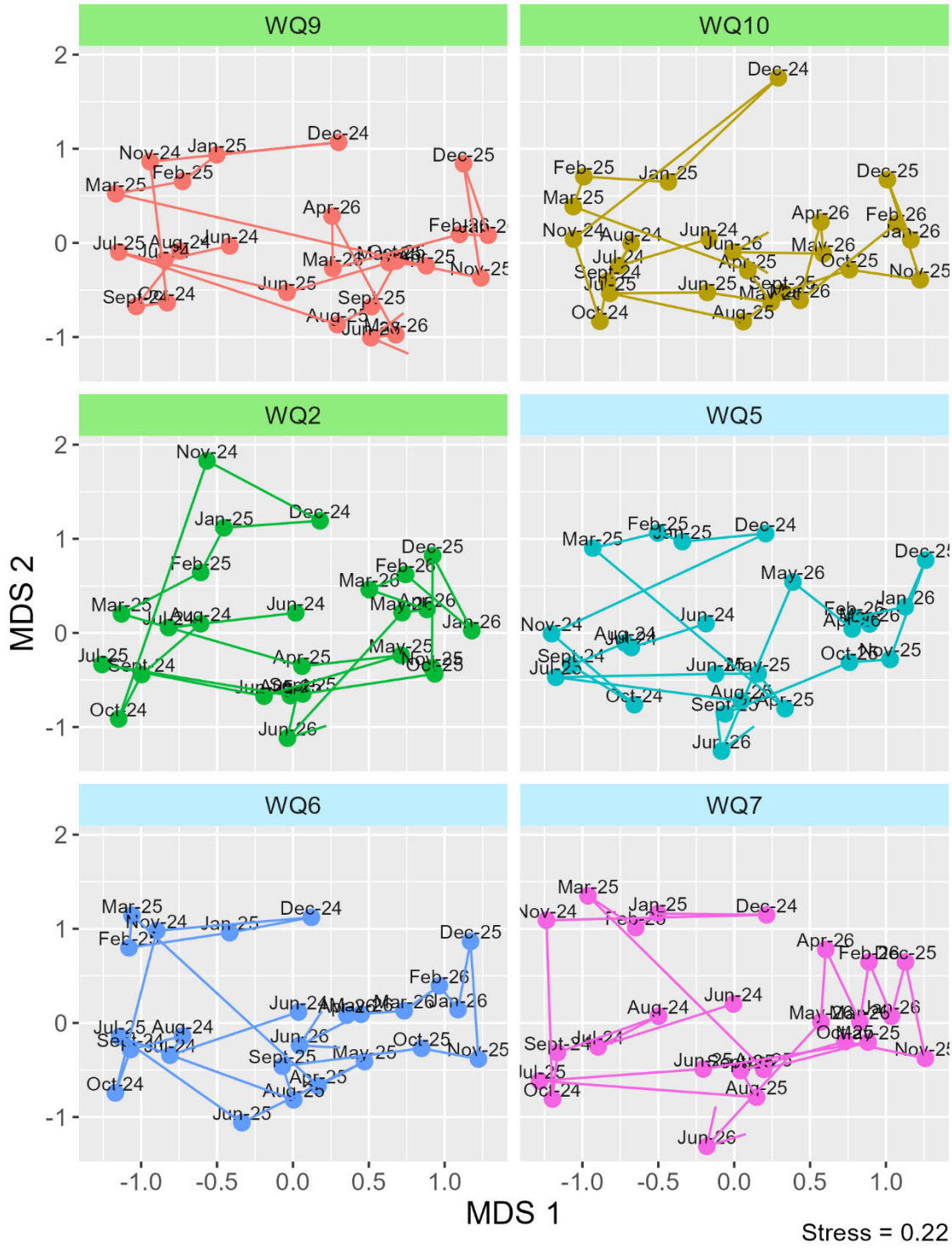


Figure 28: Variation in the total biovolumes of the top 10 genera/groups by site and date. Sites are ordered from up-river to down-river, with those above the consented outfall coloured green and those below coloured blue.



Figure 29: MDS showing variation in microalgal community composition, based on monthly total microalgae biovolumes grouped by taxa (mm³/L) at the six SW Manukau water quality monitoring sites. Note that the MDS was carried out on all sites combined, but sites have been plotted separately for clarity. Sites are ordered from up-river to down-river, with those above the consented outfall having green headers and those below having blue headers.



6 BENTHIC ECOLOGY AND SEDIMENT QUALITY

6.1 METHODS

6.1.1 MONITORING SITES

Benthic macrofaunal and sediment quality sampling is carried out at eight intertidal, sand/mudflat sites, including four sites on the eastern side of Waiuku Channel and four sites on the western side of the channel (Figure 30). The sites are arranged to cover the gradient from above the outfall to central harbour areas on both sides of Waiuku Channel. In addition, data from Auckland Council's Clark Beach monitoring site is used to provide information from a remote reference site. Coordinates for the monitoring sites are provided in Table 11 in the Appendices. Images of each site are provided in Figure 31 and Figure 32.

Figure 30. Amendments to the originally proposed site locations and perimeter shapes.

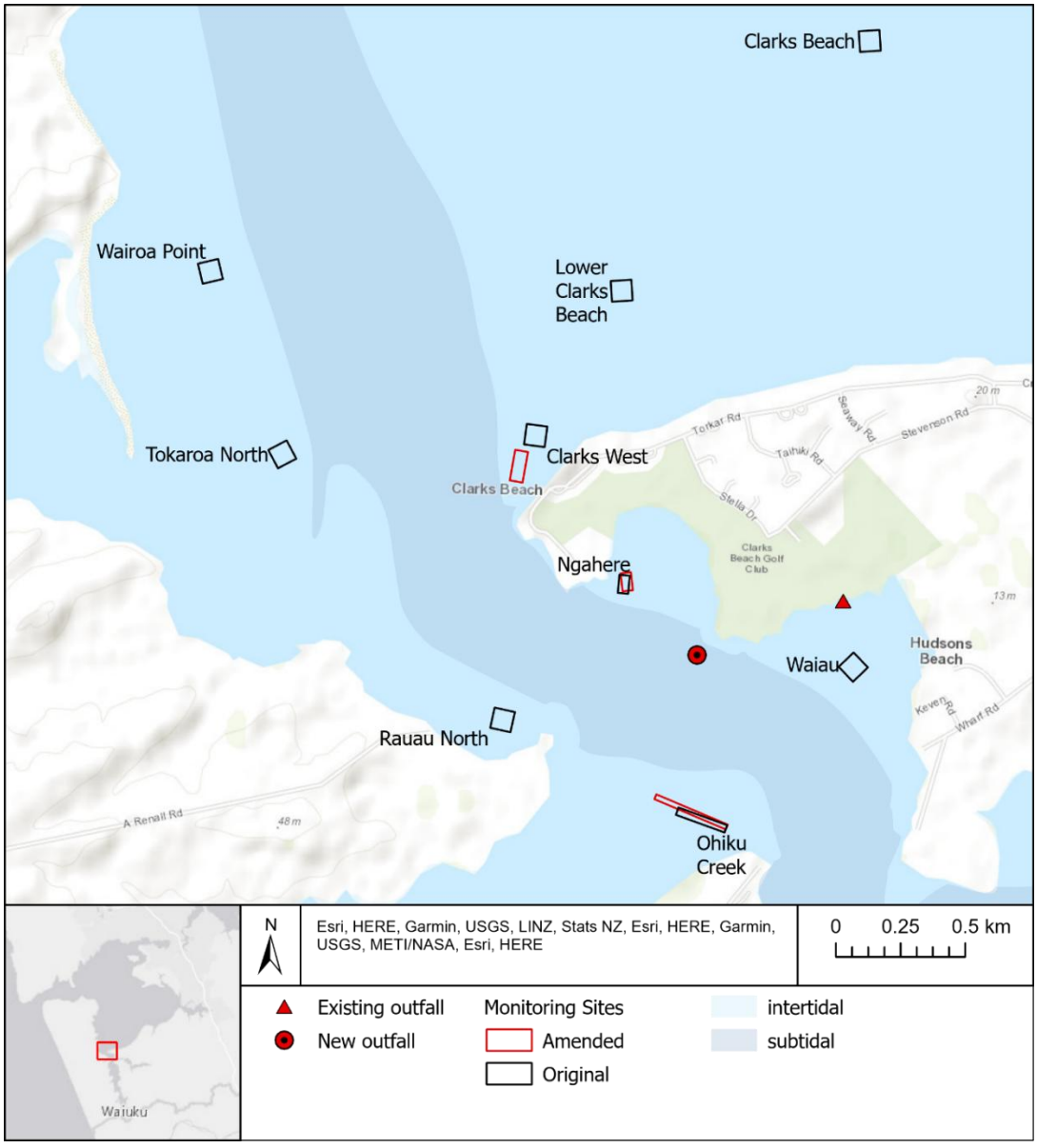


Figure 31: Images of the benthic ecological monitoring sites on the western side of Waiuku Channel.

Ohiku Creek



Rauau North



Tokaroa North



Wairoa Point



Figure 32: Images of the benthic ecological monitoring sites on the eastern side of Waiuku Channel.



6.1.2 RANDOMISATION OF SAMPLES

Randomised sample stations were generated for each site using ARCGIS Pro. Each site was subdivided into 12 near-equal-sized areas using the "subdivide polygon" tool. One random station per subdivision (with the minimum distance between stations set to 20 m) was then generated in QGIS using the "Random points in polygons" tool.

6.1.3 ECOLOGICAL SAMPLING AND SAMPLE PROCESSING

Sampling was conducted on 6–10 October 2025, in accordance with the methods outlined in the REMP. That is:

- Each monitoring site was located on the mid to lower shore and contained relatively uniform habitat. Each site was divided into 12 equal sectors (see Section 6.1.2), with one macrofaunal core (13 cm diameter by 15 cm deep) collected from a random position within each sector.
- Adjacent to every second macrofaunal core:
    - two sediment cores (2 cm deep, 2 cm diameter) were collected, with one added to a composite sample for the determination of grain size and the analysis of organic content (matter), and the other added to a composite sample for the determination of chl *a* concentrations (each 'final' sample is the composite of six pooled cores);
    - one surface sediment sample (2 cm deep) was collected using a plastic scoop for the analysis of heavy metals, polyaromatic hydrocarbons (PAH), TN, TP and total organic carbon;
- Macrofaunal cores were sieved through a 500 µm mesh, and the retained fauna was preserved with 100% isopropyl alcohol and sent to Earth Sciences New Zealand Hamilton for sample sorting, taxa identification, and enumeration in accordance with Auckland Council monitoring protocols.
- Sediment samples were obtained from the Clarks Beach site for the analysis of heavy metals, polyaromatic hydrocarbons (PAH), TN, TP and total organic carbon, but macrofaunal and other sediment data were provided by Auckland Council.
- Common bivalves (cockles (*Austrovenus stutchburyi*), pipi (*Paphies australis*) and wedge shells (*Macomona liliana*)) were measured (longest shell dimension) and assigned to size classes (<5 mm, 5–10 mm, 10–15 mm, 15–20 mm, 20–30 mm, 30–40 mm, 40–50 mm and >50 mm).
- Photos and site notes were taken of each site, e.g., presence of birds, plants, benthic microalgae, and epifaunal species.

6.1.4 SEDIMENT QUALITY ANALYSIS

The refrigerated sediment samples were transported to Watercare Laboratory Services within 24 hours of collection. Three replicates per site were sieved to 500 µm, freeze-dried, and homogenised, then analysed for TN, TP, heavy metals, and total organic carbon in accordance with Auckland Council methods (note that samples were not analysed for PAHs in 2025).

The analyses of sediment samples for total organic matter, grain size and chl *a* concentration were carried out by Earth Sciences New Zealand, using Auckland Council's standard procedures, as outlined below:

- Total organic matter (as ash-free dry weight): approximately 5 g of sediment was placed in a dry, pre-weighed tray and dried at 60°C until a constant weight is achieved (sample weight is taken after ~40 hours and then again after 48 hours). Samples were then ashed for 5.5 hours at 400°C (Mook & Hoskin 1982) and reweighed.
- Grain-size: samples were homogenised and a subsample of approximately 5 g of sediment taken. Subsamples were digested in 6% hydrogen peroxide until all organic matter was removed and sampled by wet sieving and pipette analysis (Gatehouse 1971). Pipette analysis was used to separate the sediment into seven size fractions: gravel (>2 mm), coarse sand (500–2000 µm), medium sand (250–500 µm), fine sand (125–250 µm), very fine sand (62.5–125 µm), silt (3.9–62.5 µm) and clay (<3.9 µm).
- Chlorophyll *a*: sediment samples were freeze-dried, weighed, then homogenised and subsampled (~0.5 g) for analysis. Chlorophyll *a* was extracted by boiling the sediment in 90% ethanol, and the extract was processed using a spectrophotometer (Sartory & Grobbelaar 1984).

6.1.4.1 ANALYTICAL CHANGES

From 10 November 2025, Watercare switched from using discrete analyser testing for TN in solids to an upgraded CNS elemental analyser instrument. The new instrument provides a more robust analysis method, with improved minimum detection limits and enhanced accuracy, which ensures better alignment with other nitrogen species. Its increased efficiency also means faster turnaround times for samples.

6.1.5 DATA ANALYSES

6.1.5.1 SEDIMENT QUALITY

Sediment quality data were analysed in the following manner:

1. Data were plotted and visually assessed for spatial patterns.
2. Heavy metals and high molecular weight PAH (HMW-PAH) data were compared to the Threshold Effects Level (TEL) guidelines[9], and the ANZG (2018) low-level default guideline values (DGVs) (see Table 2). However, for arsenic, Allen (2024) notes that "*The application of more conservative guidelines (such as the TEL/PEL) for the metalloid arsenic are not deemed suitable for Auckland, as guideline values can sit below what is found to occur naturally or as 'background' concentrations in the region. As such, arsenic is compared with ANZG guidelines only*." For Auckland marine sediments, a background concentration of 12.06 mg/kg has been proposed (80th percentile probability; Allen 2023a).

[9] TEL guidelines are used as the Green-Amber threshold in Auckland Council's Environmental Response Criteria (ERC).

Only four sediment samples from three sites had PAH concentrations that exceeded detection limits. For those sites (Clarks West, Ohiku Creek and Wairoa Point), the concentrations of High Molecular Weight (HW) PAH were calculated as the sum of benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and pyrene concentrations (as defined in ANZECC 2000). Those concentrations were normalised to a sediment organic carbon content of 1% before being compared against sediment quality guidelines.

Table 2: Commonly used sediment quality guidelines. TEL and DVG guidelines are referred to in this report.

Metal/Metalloid	Guideline value (mg/kg)					
	Macdonald et al. (1996)		Long and Morgan		ANZG (2018)	
	TEL	PEL	ERL	ERM	DGV	DGV-High
Cadmium	0.68	1.2	1.2	9.6	1.5	10
Chromium	52	160	81	370	80	370
Copper	18.7	108	34	270	65	270
Lead	30.2	112	47	218	50	220
Nickel	15.9	43	21	52	21	52
Zinc	124	271	150	410	200	410
HMWPAH	0.66	6.7	1.7	9.6	1.7	9.6

6.1.5.2 BENTHIC ECOLOGY

Benthic macrofaunal data were plotted and analysed using a combination of univariate and multivariate analyses. Data plots were produced using *ggplot* in R Studio and Primer-E.

Four univariate indicators of ecological diversity and abundance were analysed:

- number of taxa;
- total counts of individuals;
- Shannon's Diversity;
- Pielou's Evenness.

Shannon's Diversity takes into account both the number of species (or taxa) and how evenly individuals are spread among those species (or taxa). It is a measure of the uncertainty associated with correctly predicting which species a randomly selected specimen belongs to. That uncertainty decreases as the number of taxa and evenness decrease. If nearly all individuals belong to a single species, Shannon Diversity approaches zero (it equals zero if there is only one species). Conversely, Shannon Diversity increases as the number of taxa and evenness increase, with the maximum value achieved when each taxon has the same number of individuals (the maximum value possible equals the log of the number of species). Shannon Diversity values are sensitive to sampling effort and the logarithm base used. Therefore, results should only be compared among studies with similar sampling designs and for results using the same logarithm base (Clarke & Warwick 2001; Pla et al. 2012).

Pielou's Evenness is a measure of how even (i.e., similar) the abundances of individual species are at a site. Low index values indicate that the site is dominated by a single, or a few, species which occur in high abundance(s). The remaining species occur in relatively low abundances. In contrast, high index values indicate that the abundances of all species are similar. Pielou's Evenness is derived from the Shannon Diversity value of a sample divided by the maximum possible Shannon Diversity value of that sample (Clarke & Warwick, 2001; Pla *et al.*, 2012).

One-way ANOVA and tests for Tukey's honestly significant differences (HSD) were used to compare results for the indicators of ecological diversity among the monitoring sites. When necessary, data were $\log_{10}$ transformed[10] to meet assumptions of equal variance and normally distributed residuals prior to analysis. Those analyses were carried out in R Studio.

Multivariate analyses were carried out using Primer-E, tests performed included:

- Principal Component Analysis (PCA) of normalised environmental data (composite samples or means) to investigate the differences in environmental variables among sites.
- Non-metric multidimensional scaling (MDS) of square-root transformed count data using Bray-Curtis similarity to look for differences in community composition among sites. MDS plots provide an easily interpretable representation of community data, with the composition of samples close together on an MDS plot being more similar than those further apart.
- CLUSTER and SIMPROF analyses, which allow similarity (and dissimilarity) among samples to be estimated and presented in dendrograms, showing both statistically significant and non-significant clusters.
- Similarity Percentages (SIMPER), which examines which taxa contribute the most to the similarities and differences among sites (using a 90% cut-off for the cumulative contributions of individual taxa).

6.1.6 HEALTH INDICES

6.1.6.1 BENTHIC HEALTH MODELS

Benthic Health Models assess the health of macrofaunal communities relative to metal stormwater contaminants (BHM_{metals}; sediment copper, lead and zinc) and sediment mud content (BHM_{mud}). The models are based on data from 95 intertidal sites (estuaries, harbours and tidal creeks), which had a range of contaminant concentrations and mud. Multivariate canonical analysis of principal coordinates (CAP) was used to rank the health of macrofaunal communities, in accordance with Auckland Council's benthic health models. Health was ranked from 1 (very low impact) to 5 (very high impact – Table 3) (see Anderson et al. 2006; Hewitt & Ellis 2010 for more details).

[10] $\log_{10}$ transformation was used for count data.

Table 3. Conversion of BHM scores into health groups. The groups are given an assigned value for their combination into Combined Health Scores.

Group	Meaning	BHM_{mud} score	BHM_{metals} score	Value
1	Very low impact	≤-0.12	≤-0.134	0.2
2	Low impacts	≤-0.05	≤-0.067	0.4
3	Moderate impacts	≤0.02	≤0.023	0.6
4	High impacts	≤0.1	≤0.1	0.8
5	Very high impacts	>0.1	>0.1	1.0

6.1.6.2 TRAITS-BASED INDEX

This index uses macrofaunal characteristics/traits e.g., feeding mode, mobility, size, living habit, to categorise them into groups. The Traits-Based Index (TBI) is based on species richness that exhibits seven traits that are important for benthic ecosystem function:

1. Living in the top 2 cm of the sediment.
2. Having an erect structure or tube.
3. Moving sediment around within the tube.
4. Being sedentary or only moving within a fixed tube.
5. Being a suspension feeder.
6. Being medium-sized.
7. Being worm-shaped.

The index calculation accounts for the number of cores collected, with values ranging from 0–1. A site with a high level of functional redundancy is considered 'healthy' as the community is more resilient to environmental change (Table 4; Lohrer & Rodil 2011; Hewitt et al. 2012).

Table 4. Ranking criteria for Trait-Based Index groups.

Group	Meaning	Score	Value
1	Good health and high functional redundancy/resilience	>0.4 to 1	0.33
2	Intermediate health and resilience	0.3 to ≤0.4	0.67
3	Unhealthy and low functional redundancy/resilience	≤0.3	1.0

6.1.6.3 COMBINED HEALTH SCORE

BHM and TBI values are combined into a single index, the Combined Health Score (see Hewitt et al. 2012 for more details). The index ranges from 0–1, with an increase in score representing a degradation in health (Table 5). Note that the scores for a particular site cannot be generalised to a whole estuary (Drylie 2021). All Health indices were calculated by Earth Sciences New Zealand.

Table 5. Combined Health Scores.

Value	Meaning
≤0.2	Excellent
0.2 to ≤0.4	Good
>0.4 to ≤0.6	Fair
>0.6 to ≤0.8	Marginal
>0.8	Poor

6.2 RESULTS

6.2.1 SEDIMENT QUALITY

Overall, sediments at the Ngahere site, on the eastern side of the main channel had the highest proportion of mud (48%). On that side of the channel, a clear demarcation in sediment characteristics occurred around the entrance to Waiuku River (between Tokaroa and Karaka Points), with sediment mud content decreasing in the northern sites in the main body of the harbour. A similar change occurred on the western side of the channel, with a marked difference occurring between the Rauau North and Tokaroa North sites (Tokaroa North had the lowest proportion of mud of any site). However, mud content increased again between the Tokaroa North and Wairoa Point sites (Figure 33). All sites had moderate to high percentages of sand (51–96%), with the Tokaroa North and Clarks Beach sites having the largest percentage (95–96% in 2024). Sediment grainsize distributions were fairly similar at each site between 2024 and 2025. However, a noticeable increase in sediment mud content occurred at the Ohiku Creek site in 2025 (increasing from 24% to 41%).

Mean arsenic concentrations were not compared to TEL guideline values, but were similar to, or less than, the majority of sites monitored by Auckland Council in the Auckland Region (Allen 2023b). All sites, except for Ngahere, had arsenic concentrations below the nominal background concentration of 12.06 mg/kg. All other heavy metals were well below the TEL guidelines at all monitored sites (Figure 35). Correlation analysis indicated that concentrations of chromium, copper, nickel and zinc were highly correlated (Figure 37).

Figure 33. Grainsize composition at monitoring sites on the western (green) and eastern (blue) sides of Waiuku Channel.

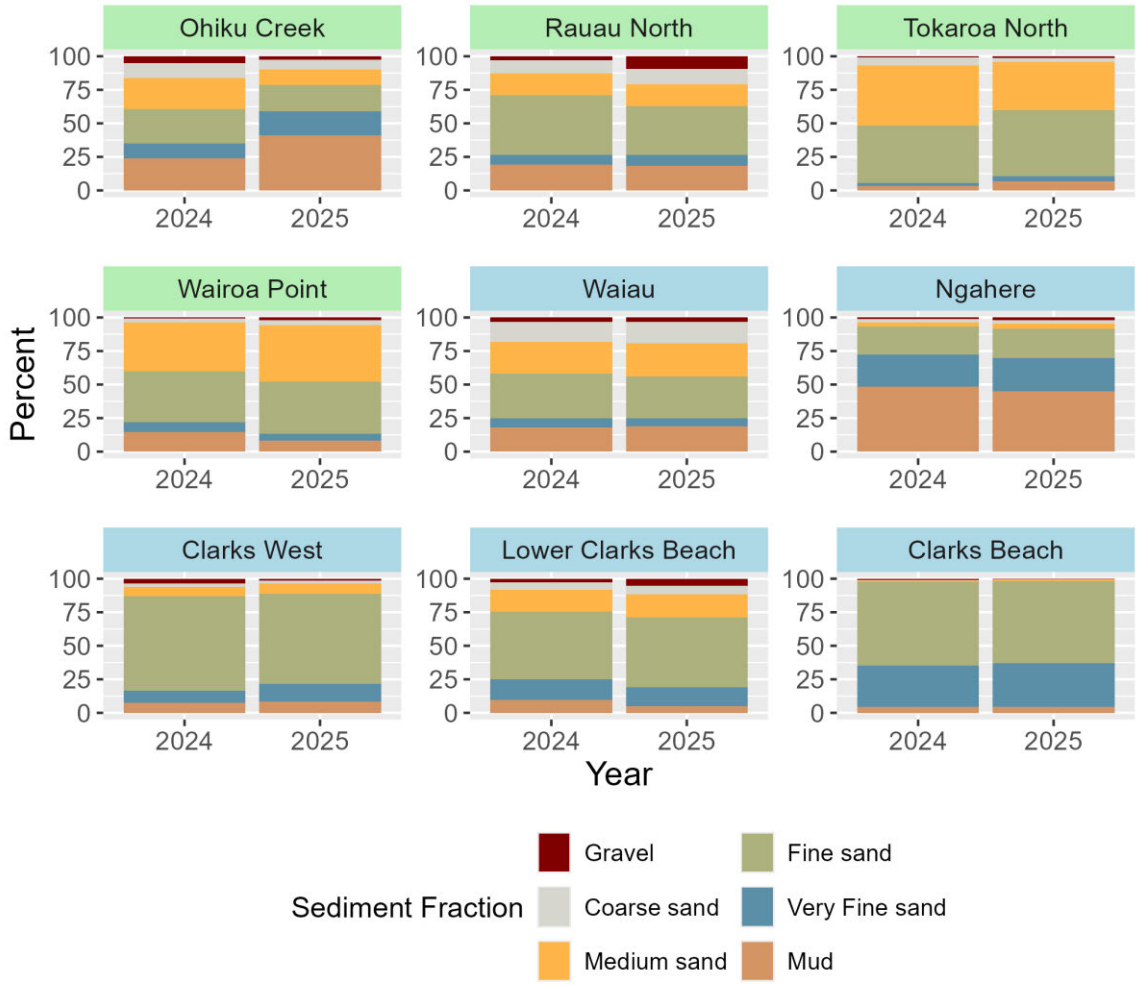


Figure 34. Total organic carbon, total organic matter, total nitrogen, total recoverable phosphorus, and benthic chlorophyll *a* concentrations at the monitored sites. Total organic carbon, total nitrogen, and total phosphorus values are means ± S.E. Total organic matter and chlorophyll *a* results are from a single composite sample per site. Sites are grouped by channel side and ordered from inner to outer harbour.

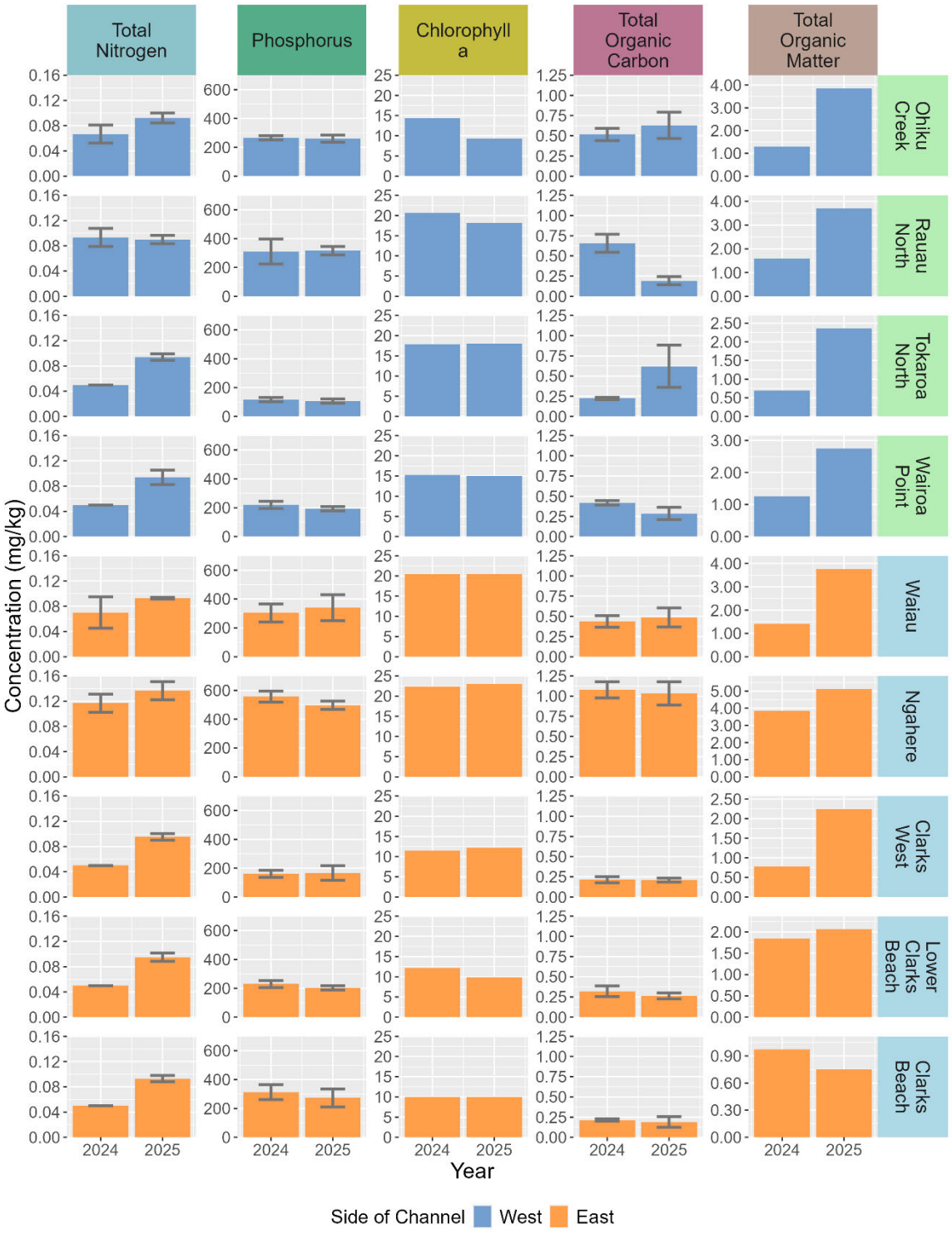


Figure 35. Mean (± 95% CI) sediment concentrations of total recoverable arsenic, cadmium, chromium and copper in the monitored sites. The red dotted line shows the TEL guideline values. Sites are grouped by channel side and ordered from inner to outer harbour.

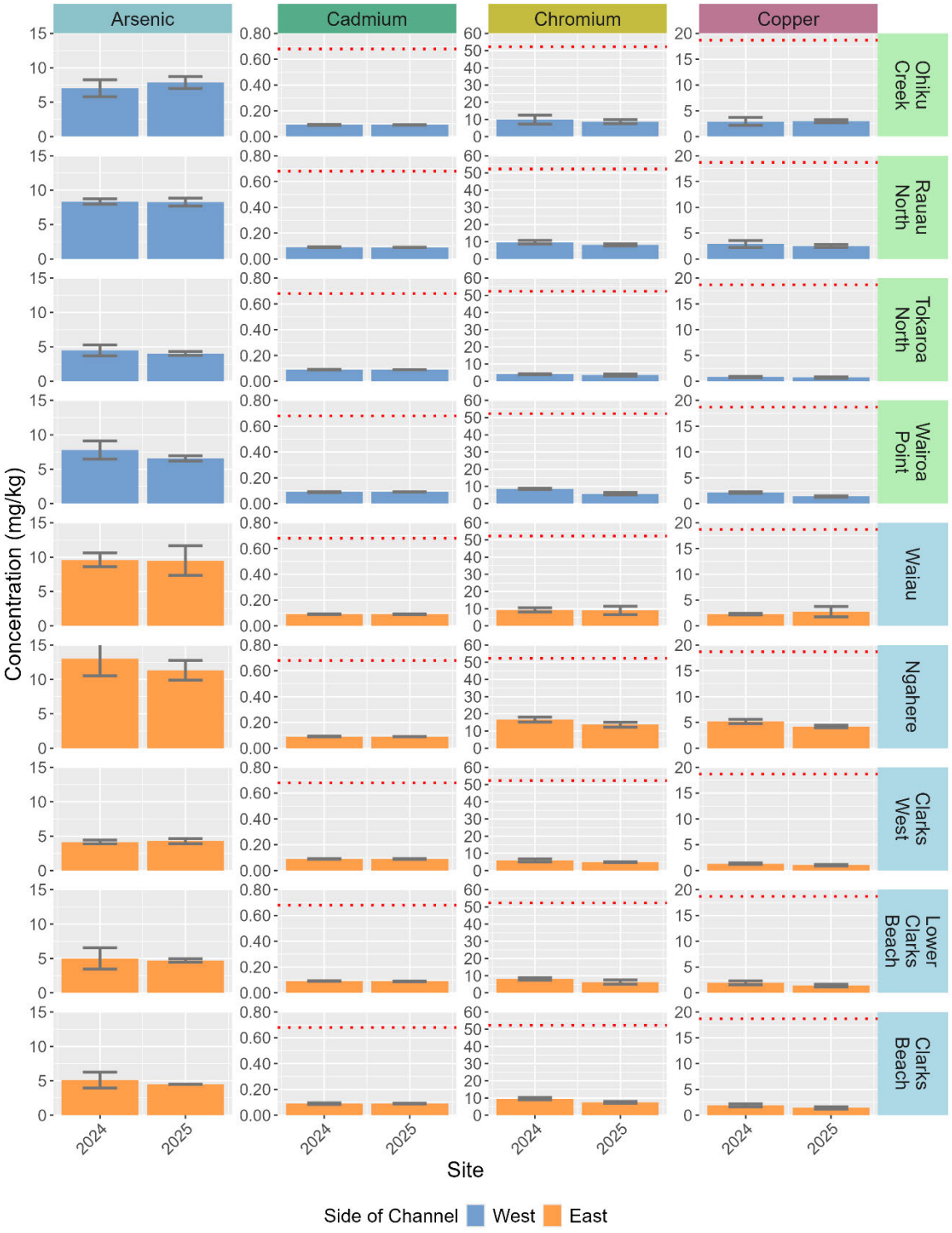


Figure 36. Mean (± 95% CI) sediment concentrations of total recoverable lead, mercury, nickel and zinc in the monitored sites. The red dotted line shows the TEL guideline values. Sites are grouped by channel side and ordered from inner to outer harbour.

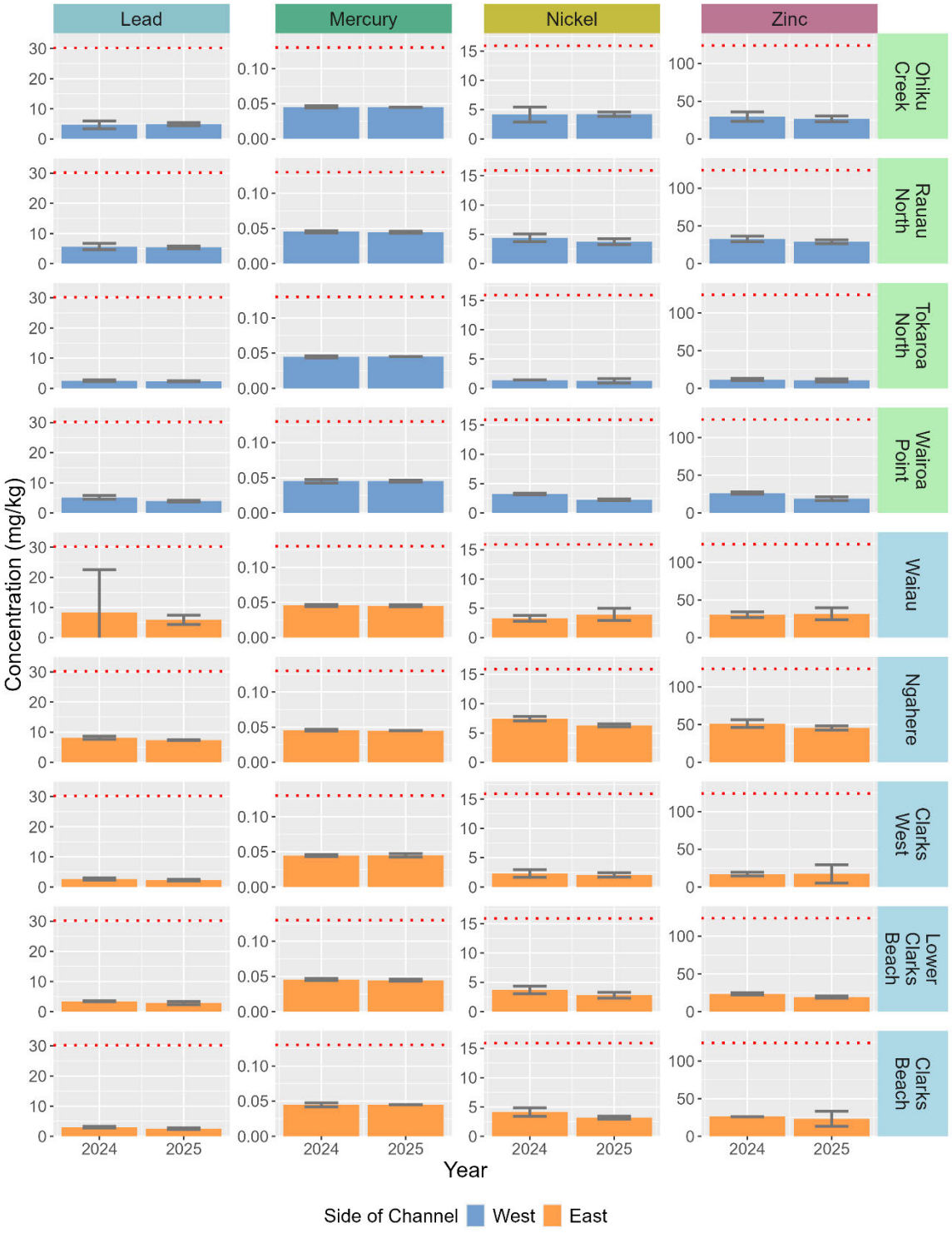
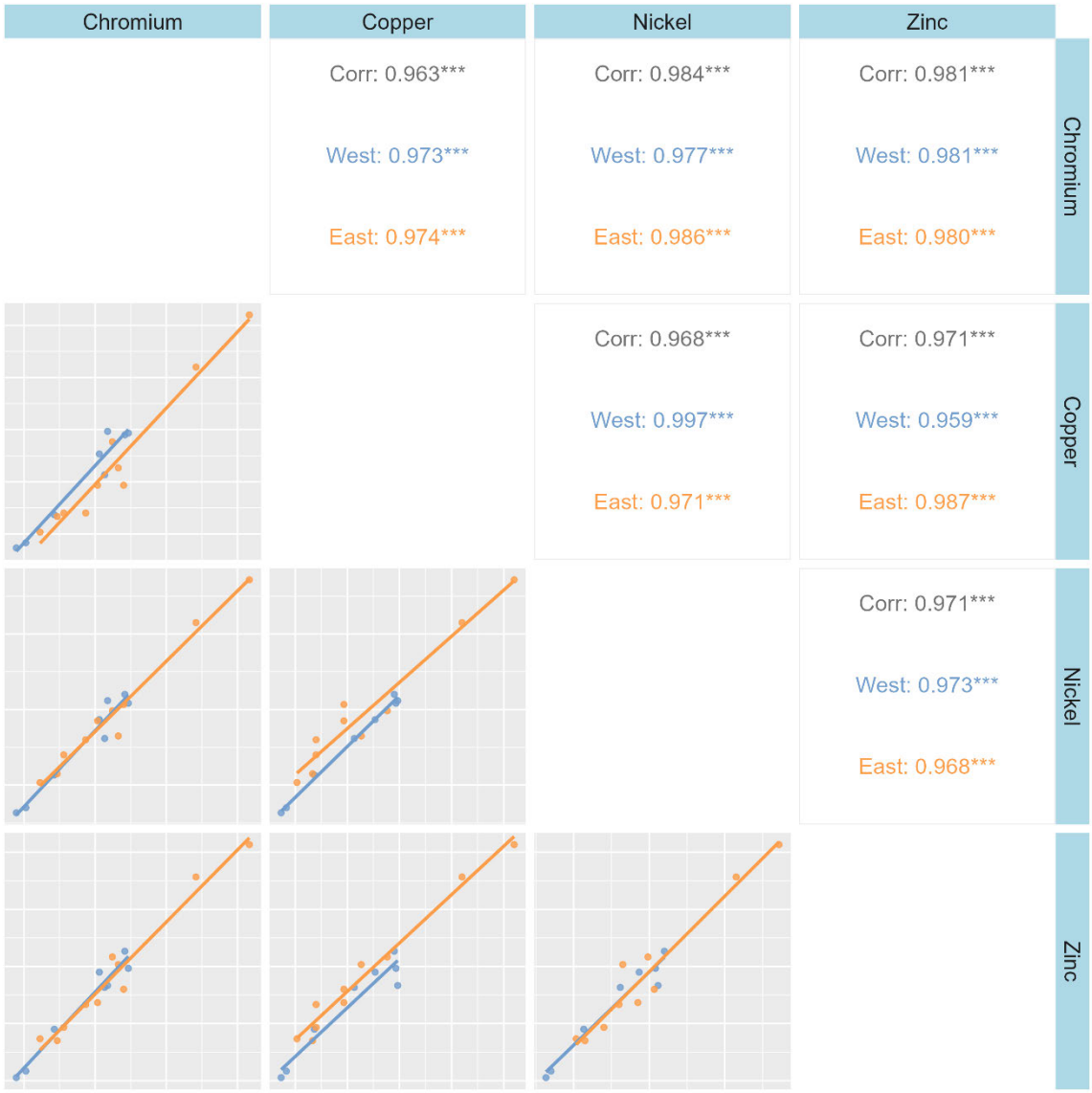


Figure 37: Correlation matrix showing the strength of relationships between heavy metal concentrations. Correlations are provided for pooled data, and for sites on the eastern and western sides of the channel.



6.2.2 MACROFAUNA

In total, 18,706 individuals and 95 taxa were collected from the benthic monitoring sites in October 2025 (c.f. 18,735 individuals and 91 taxa in 2024), with a combined 113 taxa obtained over the two years of sampling (Table 6). Twenty taxa comprised around 92% of all individuals collected, with the nut shell *Linucula hartvigiana* being the most abundant species by a large margin (22% of all counts), followed by cockles (*Austrovenus stutchburyi*, 16%), and the polychaete *Aonides trifida* (9%) (Table 7).

However, the numbers of individuals within each taxa varied considerably among sites, and in some cases, years (see Figure 38 & Figure 39 for variation in the 20 most abundant taxa). For instance, in 2025 total *L. hartvigiana* numbers varied from 35 at the Ngahere site to 1214 at the Lower Clarks Beach sites on the eastern side of the main channel, while cockle

numbers varied from 548 at Ngahere to 4 at the Clarks Beach site. Other taxa of note included the polychaete *A. trifida*, which occurred in high numbers at the Clarks West site in 2024 and 2025, and low to moderate numbers elsewhere. Counts of the amphipod *Torridoharpinia hurleyi,* and the polychaetes *Macroclymenella stewartensis* and *Boccardia syrtis* were also higher at the Lower Clarks Beach and Clarks Beach sites. Clear spatial patterns were not apparent in any of the indicators of community diversity and abundance, apart from the Clarks West site having more within site variability than the other sites.

Multivariate nMDS, cluster and SIMPROF analyses of the benthic community data showed that most sites could be differentiated from other sites based on their community composition (Figure 41). Communities from the outer, western side of the main channel (Tokaroa North and Wairoa Point) were plotted toward the upper right of the MDS plot, while the three Clarks sites from the outer, eastern side of the channel were spread around the left side of the plot. Inner channel sites were plotted toward the bottom right of the MDS plot, with the Ohiku Creek and Rauau North sites clustered together beside the Waiau site, and the Ngahere site towards the right. Results from 2024 and 2025 clustered together at every site except Wairoa Point, where the 2025 results clustered with those from Tokaroa Point. SIMPER analysis of all sample data from that site showed that the abundances of 10 taxa at that site explained around 50% of the dissimilarity between the two years[11].

SIMPER analysis showed that differences between clusters were mainly associated with small contributions of multiple taxa to dissimilarity. Overall, only 11 taxa contributed more than 5% towards the overall dissimilarity between clusters. MDS bubble plots showing variation in the abundance of the six taxa, which on average made the largest contributions to dissimilarity, are provided in Figure 42. The plots illustrate that drivers include both high and low counts of particular species at specific sites. For instance:

- high counts of the polychaete *Aonides trifida* at Clarks West, and low to moderate elsewhere;
- high counts of the Asian date mussel *Arcuatula senhousia* at Tokaroa North and Wairoa Point, and low elsewhere;
- high counts of mysid shrimps and the polychaete *Cossura consimilis* at the Waiau and Ngahere sites and low elsewhere;
- low counts of cockles, *Austrovenus stutchburyi* at the Clarks Beach site and moderate to high elsewhere;
- low counts of the nut shell *Linucula hartvigiana* at Ngahere and moderate to high elsewhere.

[11] *Linucula hartvigiana, Austrovenus stutchburyi, Arcuatula senhousia, Magelona dakini, Colurostylis lemurum, Paracalliope novizealandiae, Aonides trifida, Arthritica bifurca, Paradoneis lyra, Torridoharpinia hurleyi.*

Table 6: Summary of total numbers of taxa and individuals by site and year. Sites are grouped by side of channel (green =west, blue =east) and ordered from inner to outer harbour.

Macroinvertebrate Summary Table

Number of taxa and individuals across years and western (green) and eastern (blue) sites

Site	Metric	2024	2025	Site Total	Overall Total
Ohiku Creek	Taxa	43	48	**57**	-
Ohiku Creek	Individuals	1,976	1,564	**3,540**	-
Rauau North	Taxa	45	47	**56**	-
Rauau North	Individuals	2,790	2,231	**5,021**	-
Tokaroa North	Taxa	42	45	**56**	-
Tokaroa North	Individuals	1,316	2,427	**3,743**	-
Wairoa Point	Taxa	49	40	**56**	-
Wairoa Point	Individuals	776	1,348	**2,124**	-
Waiau	Taxa	41	44	**50**	-
Waiau	Individuals	1,901	2,126	**4,027**	-
Ngahere	Taxa	36	43	**47**	-
Ngahere	Individuals	2,438	1,423	**3,861**	-
Clarks West	Taxa	52	55	**68**	-
Clarks West	Individuals	3,246	2,523	**5,769**	-
Lower Clarks Beach	Taxa	56	56	**67**	-
Lower Clarks Beach	Individuals	2,790	3,276	**6,066**	-
Clarks Beach	Taxa	52	54	**65**	-
Clarks Beach	Individuals	1,502	1,788	**3,290**	-
Grand Totals By Year	**Taxa**	**91**	**95**	-	**113**
Grand Totals By Year	**Individuals**	**18,735**	**18,706**	-	**37,441**

Table 7: Total counts of the top 20 taxa by site in 2025, and their percent contribution to the total counts of all taxa. Sites are grouped by side of channel (green =west, blue =east) and ordered from inner to outer harbour.

Top 20 Macroinvertebrate Taxa (2025)

Taxon counts, relative contribution, and cumulative catchment abundance running totals

Taxon	Ohiku Creek	Rauau North	Tokaroa North	Wairoa Point	Waiau	Ngahere	Clarks West	Lower Clarks Beach	Clarks Beach	Taxon Total	Overall Contribution (all taxa)	Cumulative Contribution
Linucula hartvigiana	525	633	241	203	484	35	193	1,214	524	**4,052**	**21.7%**	**21.7%**
Austrovenus stutchburyi	313	354	416	201	491	548	222	369	4	**2,918**	**15.6%**	**37.3%**
Aonides trifida	80	255	95	24	117	1	1,118	6	0	**1,696**	**9.1%**	**46.3%**
Heteromastus filiformis	136	83	199	124	175	86	135	141	182	**1,261**	**6.7%**	**53.1%**
Arcuatula senhousia	2	1	873	301	1	2	1	3	-	**1,184**	**6.3%**	**59.4%**
Prionospio aucklandica	89	251	25	16	232	146	52	137	14	**962**	**5.1%**	**64.5%**
Notoacmea scapha	110	234	3	0	53	6	7	344	41	**798**	**4.3%**	**68.8%**
Arthritica bifurca	56	60	71	24	63	33	59	130	44	**540**	**2.9%**	**71.7%**
Paradoneis lyra	13	7	46	33	92	82	13	84	143	**513**	**2.7%**	**74.4%**
Macomona liliana	58	37	59	74	44	33	98	59	49	**511**	**2.7%**	**77.2%**
Torridoharpinia hurleyi	13	22	9	29	39	34	87	149	123	**505**	**2.7%**	**79.9%**
Macroclymenella stewartensis	9	4	8	5	20	0	38	154	182	**420**	**2.2%**	**82.1%**
Colurostylis lemurum	7	3	113	113	9	15	143	8	2	**413**	**2.2%**	**84.3%**
Oligochaeta	4	2	38	13	69	88	20	16	33	**283**	**1.5%**	**85.8%**
Paracalliope novizealandiae	9	11	10	28	48	14	59	53	20	**252**	**1.3%**	**87.2%**
Cossura consimilis	0	0	1	20	33	163	3	0	-	**220**	**1.2%**	**88.4%**
Magelona dakini	5	0	49	55	5	8	36	9	23	**190**	**1.0%**	**89.4%**
Anthopleura aureoradiata	39	73	30	10	5	0	15	0	0	**172**	**0.9%**	**90.3%**
Boccardia syrtis	1	1	0	0	2	0	13	93	42	**152**	**0.8%**	**91.1%**
Pseudopolydora paucibranchiata	2	9	1	1	4	4	18	53	36	**128**	**0.7%**	**91.8%**

Figure 38. Boxplots showing site variation in the number of individuals collected for the 10 most abundant taxa in 2025. Sites are grouped by channel side (green =west, blue =east) and ordered from inner to outer harbour.

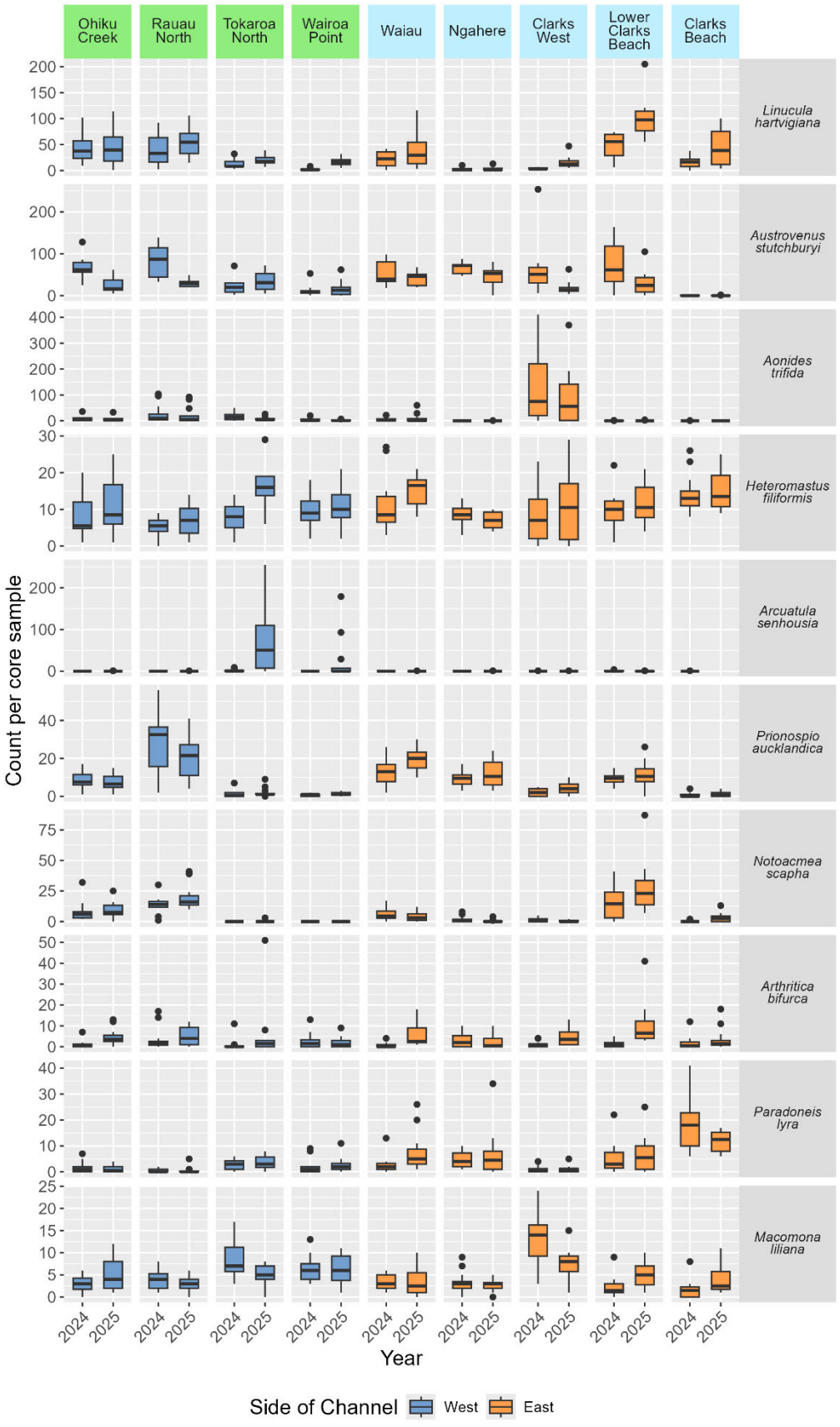


Figure 39. Boxplots showing site variation in the number of individuals collected for the 11th to 20th most abundant taxa in 2025. Sites are grouped by the side of channel (green =west, blue =east) and ordered from inner to outer harbour.

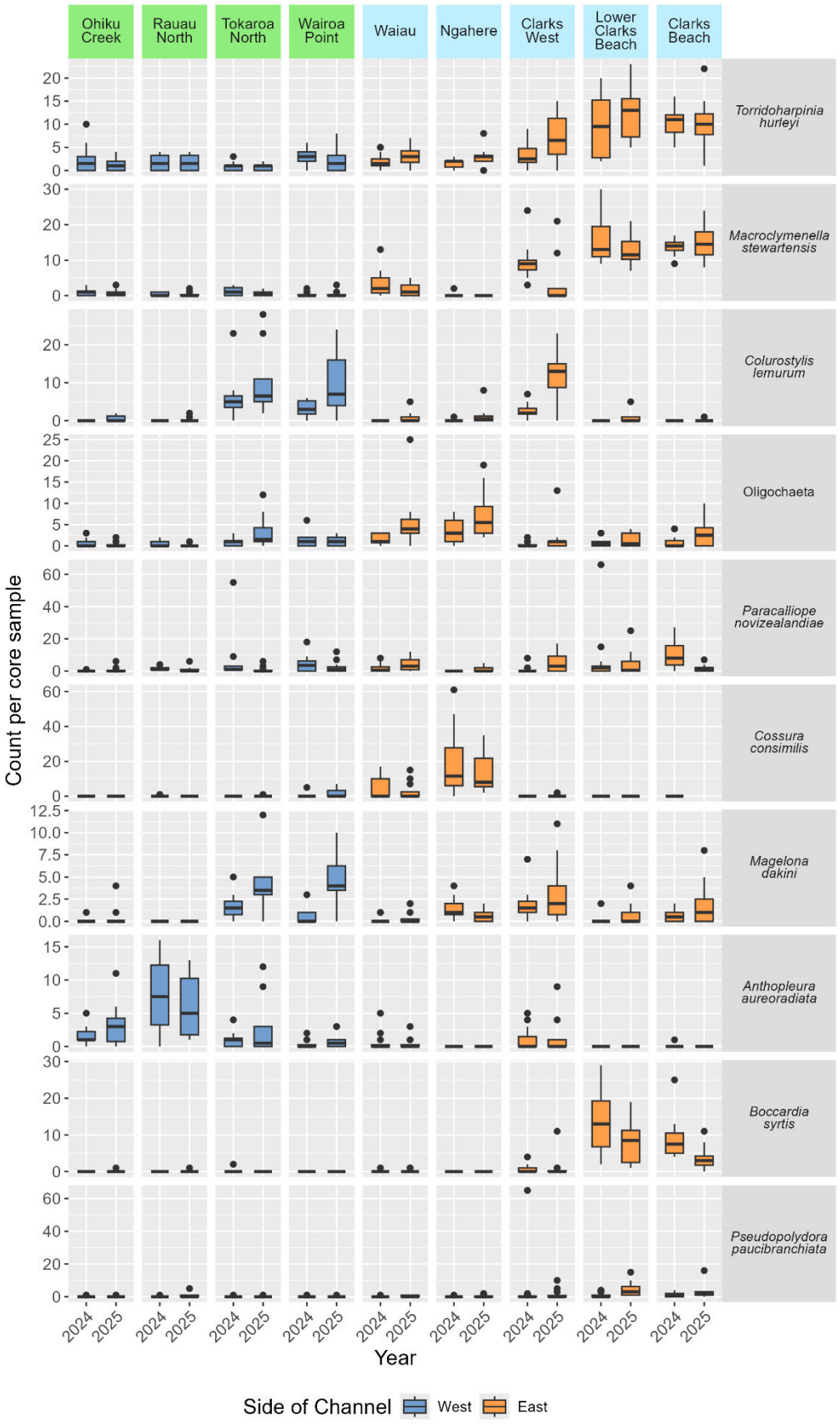


Figure 40. Boxplots showing the raw: A) number of individuals; B) number of taxa; C) Pielou's evenness; and D) Shannon diversity at the monitored sites in 2024 and 2025. Sites are grouped by side of channel (west = green headers, east = blue headers) , and ordered from inner to outer harbour areas.

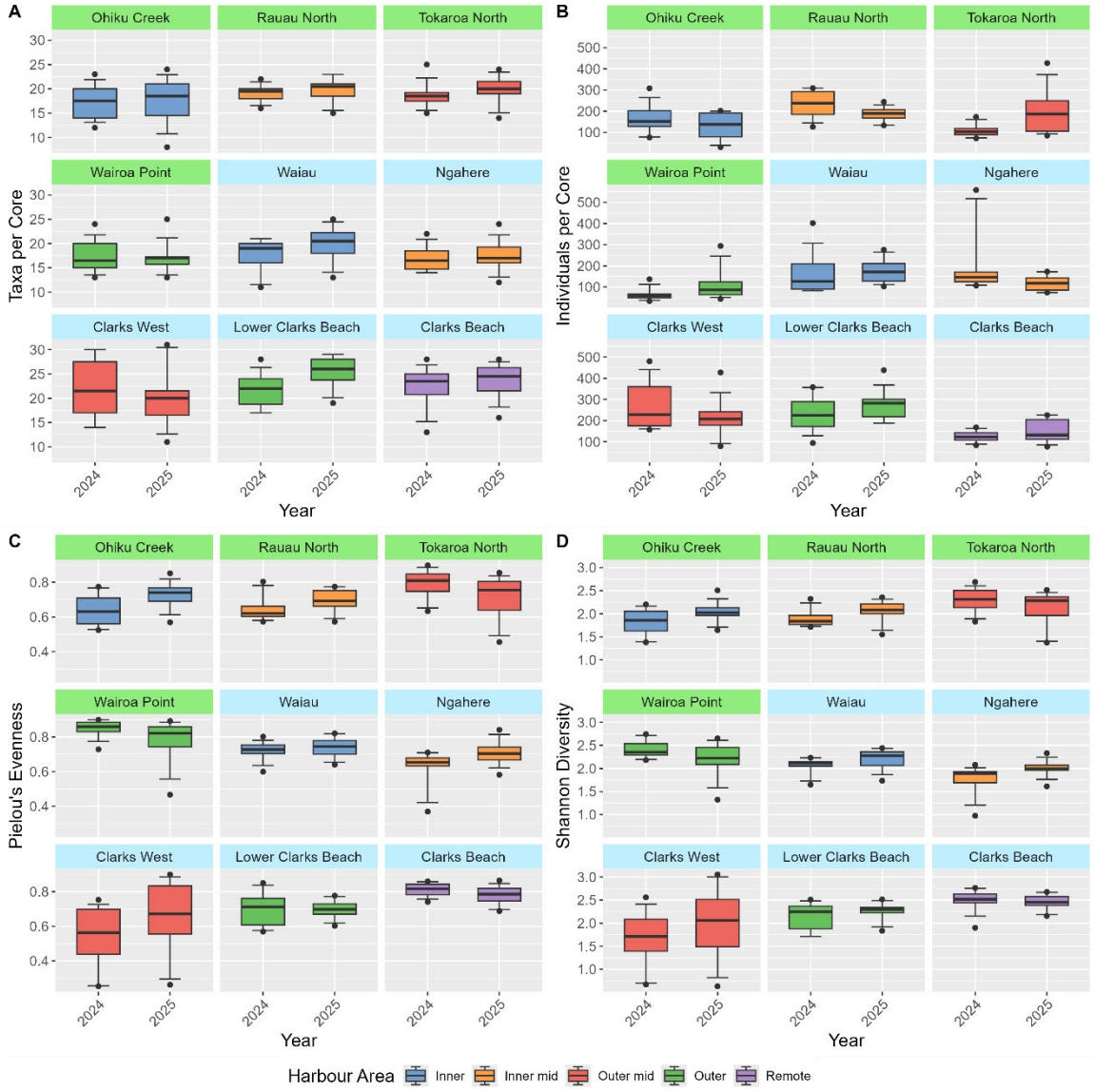


Figure 41. Non-metric multidimensional scaling plots of summed benthic macrofaunal data by site. Sites are coloured by A) side of Waiuku Channel, and B) the area along the channel running from inner to outer sections. Arrows show the trajectory of each site between 2024 and 2025.

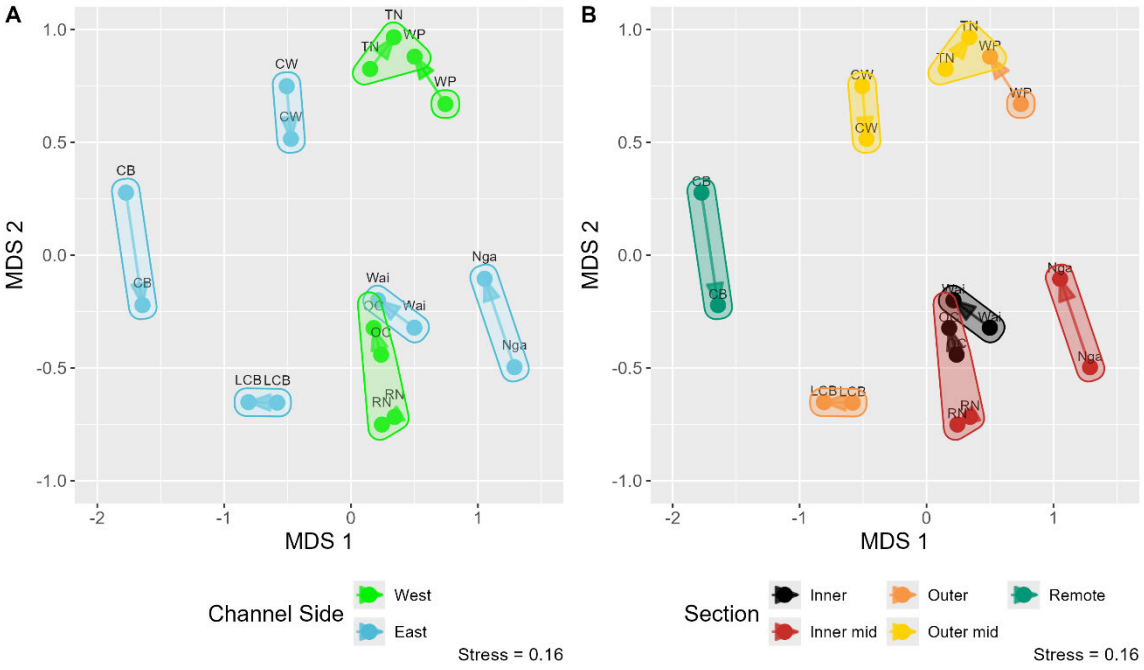
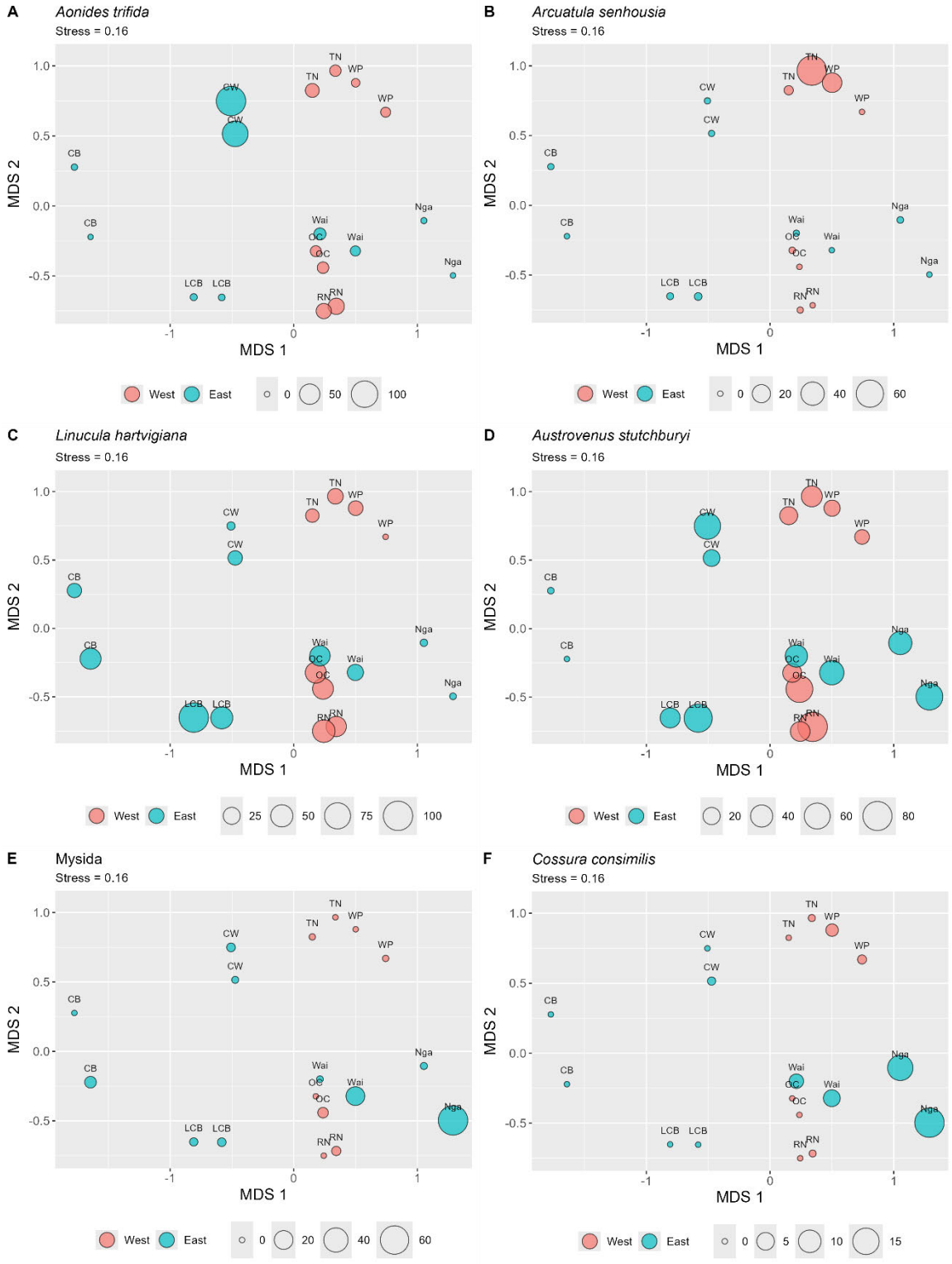


Figure 42: Examples of nMDS bubble plots showing differences in the relative abundances of taxa that explained > 5% of the dissimilarity between two or more sites using SIMPER. Bubble size is proportional to mean counts and bubble colour indicates the location of sites relative to Waiuku Channel. Site abbreviations are also provided.



6.2.3 BIVALVES

In total, 2918 cockles, 511 wedge shells and five pipi were collected in October 2025. Similar to 2024, the majority of cockles were very small, with 77% being less than 5 mm in length (c.f. 75% in 2024), and none were considered to be of 'harvestable' size (>30 mm) (Figure 43). The majority (65%) of wedge shells were also less than 5 mm long in 2025 (c.f. 73% in 2024) (Figure 44).

Figure 43. Total number of cockles from each size class collected from the monitoring sites.

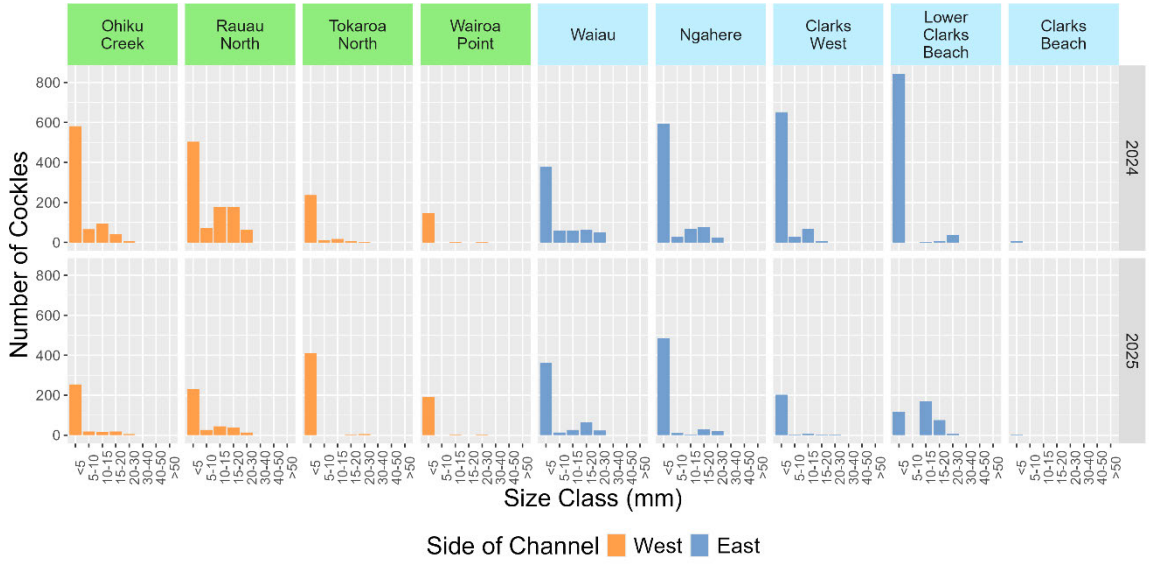
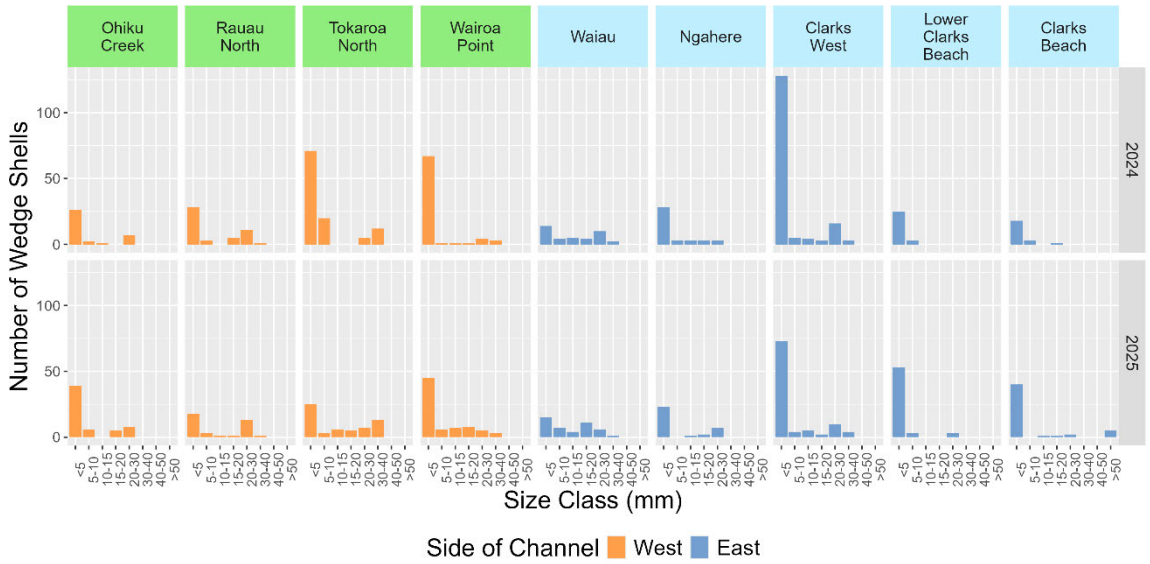


Figure 44. Total number of wedge shells from each size class collected from the monitoring sites.



6.2.4 BENTHIC HEALTH SCORES AND GENERAL SITE OBSERVATIONS

Groupings for Benthic Health Models (metals and mud), Trait-Based index, and the Combined Health Score for each site are given in Table 8. All sites had a 'fair' Combined Health Score, except for the Tokaroa North site, which had a 'good' Combined Health Score.

General observations from each site are provided in Table 9.

Table 8. Groupings for Benthic Health Models, Trait-Based Index and Combined Health Scores for the monitored sites in October 2025. Blue = excellent, green = good, yellow = fair, orange = marginal, red = poor.

Site	BHM_{metal} group	BHM_{mud} group	TBI group	Combined Health Score
Waiau	3	3	1	0.51
Ohiku Creek	3	3	1	0.51
Ngahere	3	4	1	0.58
Rauau North	3	3	1	0.51
Clarks West	3	2	1	0.44
Tokaroa North	2	2	1	0.38
Wairoa Point	3	3	1	0.51
Lower Clarks Beach	3	3	1	0.51
Clarks Beach	3	3	1	0.51

Table 9: Summary of general observations on substrates and other key features recorded at the benthic ecological monitoring sites.

Site	General observations
Waiau	Substrate of muddy sand to sand with numerous cockles with patches of sparse seagrass and small red algae.
Ohiku Creek	Substrate varied from soft mud to sand and dense cockle shell.
Ngahere	Substrate varied from soft mud to sand and dense cockle shell.
Rauau North	Substrate varied from soft mud to sand and dense cockle shell.
Clarks West	Substrate consisted of firm sand with patches of sparse to moderately dense seagrass (*Zostera muelleri*), and scattered *Solieria* sp.
Tokaroa North	Substrate consisted of firm sand with scattered *Gracilaria* sp. and patches of Asian date mussels (*Arcuatula senhousia*) present.
Wairoa Point	Substrate varied from firm sand to soft, fluid mud, with scattered *Solieria* sp. and *Ulva* sp. present. An extensive area of dense *Ulva* was present north of the site (Figure 45).
Lower Clarks	Substrate consisted of firm sand to mud, with dense cockle shell and dense seagrass.
Clarks	Substrate consisted of firm sand with seagrass throughout.

Figure 45: Extensive bed of dense *Ulva* sp. north of the Wairoa Point site.



7 BIOGENIC HABITATS

7.1 METHODS

Fifty 200 m subtidal video transects were taken during February and March 2026 within 1 km of the outfall. Transect start locations were predetermined using a stratified random design, and the direction of the video tow was decided according to wind and current directions. The video camera was 'flown' above the seabed to minimise the disturbance of biogenic features. Visual contact between the video and the seabed was maintained using a live video feed. Footage was recorded on a GoPro Hero 11, while video tracks were recorded using a Garmin handheld 78scGPS, fitted with a GA38 GPS/GLONAS external aerial. The time on the GoPro and GPS were synchronised to allow location coordinates to be generated for observed features.

Post-survey, the GPS data were imprinted on the video footage using Telemetry Overlay software. Video footage was analysed carefully and:

1. Habitats observed along each transect were categorised into 11 habitat types (bare mud, mud with burrows, sand, shelly sand, shell hash, gravelly rubble, boulders, patchy reef, contiguous reef, and biogenic habitat), with the percentage of the transect covered by each habitat recorded (Figure 46). Each habitat type was assigned a habitat score as per Table 10.
2. For each habitat type in a transect:
    a. the diversity of large epibenthic species was subjectively ranked from one (low) to three (high);
    b. the total abundance of large epibenthic species was subjectively ranked from one (low) to three (high);
    c. an overall ecological complexity score was calculated for each transect by multiplying the habitat score × abundance score × diversity score × percentage of the transect for each habitat present.

3. The presence of large epibenthic species and taxa groups was recorded (scallops, mussels, oysters, Asian date mussels, sponges, bryozoans, ascidians, anemones, macroalgae, cushion stars, tubeworms, crabs, snapper, trevally, rays).
4. Images of the key features observed were saved from video stills.

Table 10. Criteria used to rank ecological complexity.

Habitat	Habitat Score
Mud	1
Mud with burrows	1
Sand	2
Scattered shell	3
Shelly sand	3
Shell hash	4
Gravelly rubble	4
Boulders	5
Patchy reef	5
Contiguous reef	6
Biogenic habitat	6

7.2 RESULTS

Visibility varied from exceptionally poor to reasonable, despite calm conditions and extended periods of dry weather prior to the February and March survey dates. However, the video footage was sufficient to identify key substrates and large biological features.

Hard substrates were the most frequently observed substrate, with contiguous reef observed in 44% of the transects, patchy reef observed in 24% of the transects, gravelly rubble observed in 34% of the transects, and shell hash observed in 32% of the transects. Biogenic habitats and boulder habitats were not observed (Figure 48). Overall, hard substrates were found in 90% of transects, whereas primarily soft substrates were only found in 30% of transects. Soft substrates were generally found in the shallow areas at the edges of the channel, whereas hard substrates were more common in the deeper areas in the middle of the channel (Figure 47).

Various biological features were observed in the transect footage, including sponges (Figure 49), bryozoans, ascidians (Figure 50), macroalgae (Figure 51), scallops, and a variety of other species and taxa (Figure 52–Figure 53). Sponges and bryozoans were the most common and widespread groups observed. Sponges were observed in 86% of the transects, followed by bryozoans (72%), scallops (36%) and macroalgae (26%) (Figure 54). The percentage occurrence of sponges and bryozoans in 2026 was similar to that in 2025. Large differences between 2025 and 2026 were seen in ascidians (38 vs 6%), crabs (0 vs 10%), cushion stars (4 vs 20%) and scallops (6 vs 36%) (Figure 54).

Sponges were observed throughout the survey area, except for the southernmost section. The diversity and abundance of sponges on hard substrates were moderate (Figure 49 & Figure 55). Bryozoans were also observed throughout the survey area in high abundance on hard substrates, but diversity appeared to be very low. Ascidians were uncommon and limited to the outer part of the survey area (Figure 50 & Figure 55), while scallops were restricted to certain areas. Macroalgae were also uncommon, but were found throughout the survey area (Figure 51 & Figure 55).

Ecological complexity was generally highest at the outer parts of the channel and lowest at the upstream sites. Complexity was typically highest on hard substrates (reef, rubble and shell hash) (Figure 56).

Figure 46. Examples of the different substrates observed in the video transects: A) mud with burrows; B) shelly sand; C) scattered shell; D) shell hash; E) gravelly rubble; F) reef.

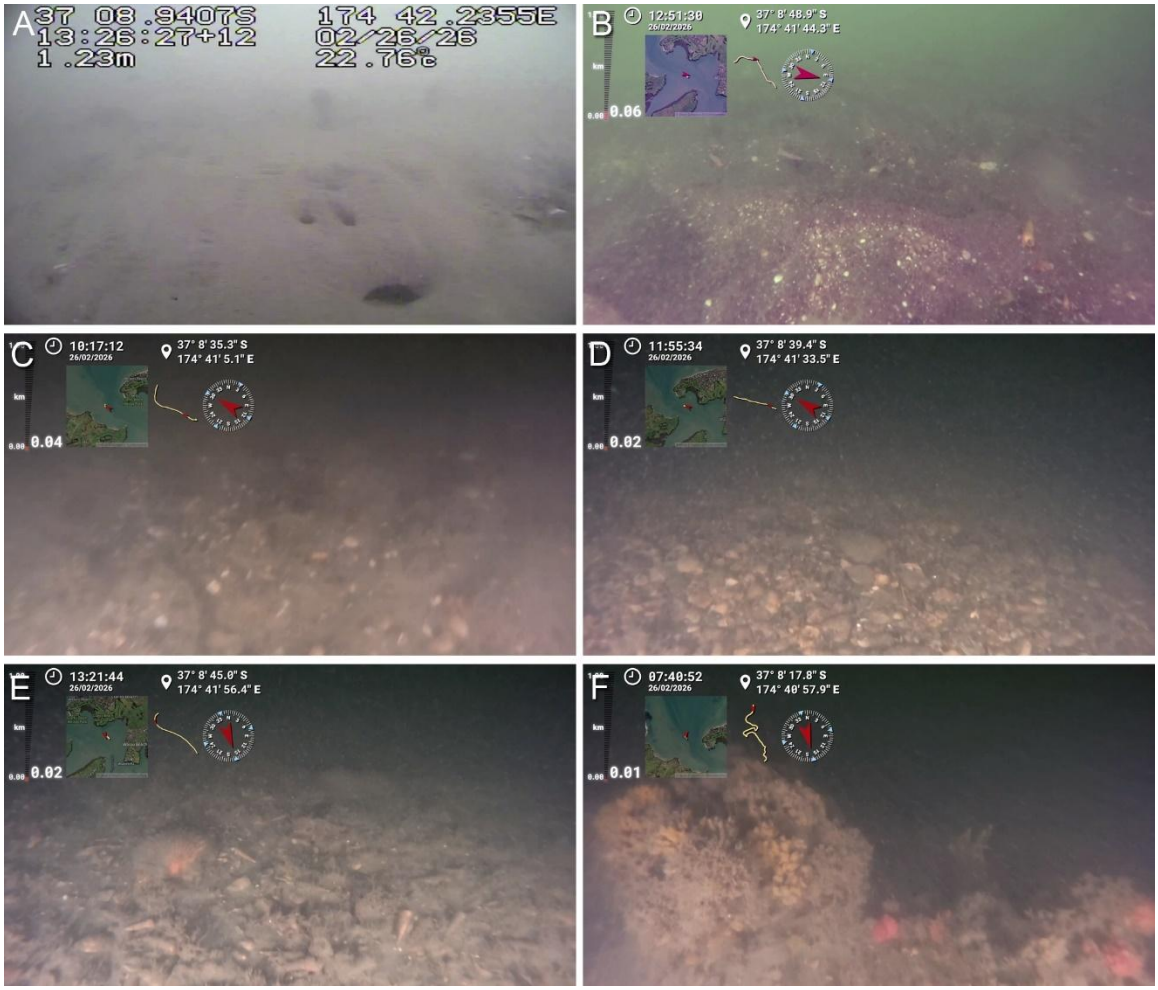


Figure 47. Distribution of substrate types within the survey area. Substrates have been grouped by type: A) soft substrates (bare mud, mud with burrows, sand, scattered shell); B) rubbly substrates (shell hash and gravelly rubble); and C) reef (contiguous reef, patchy reef). More than one substrate type may occur within each video transect.

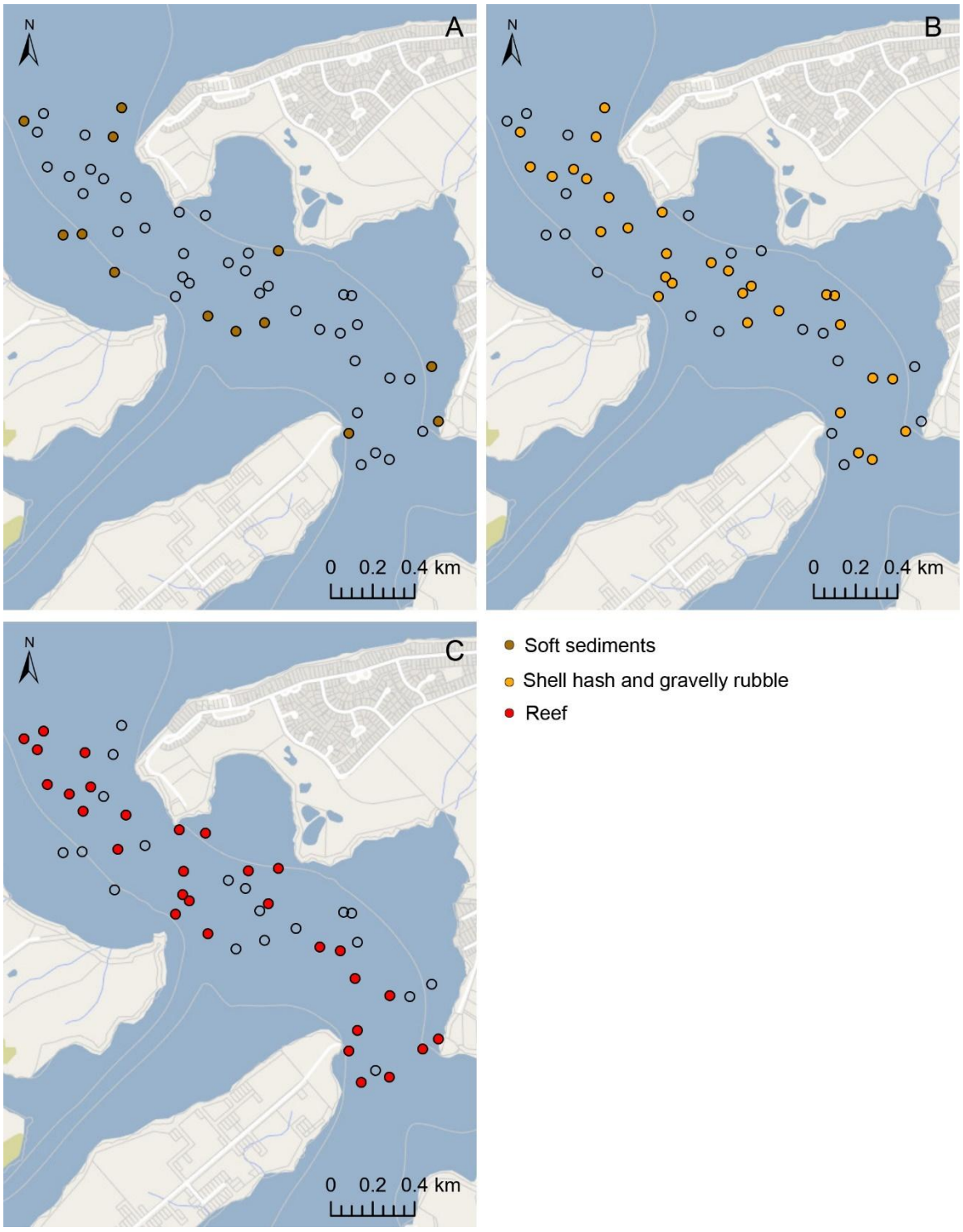


Figure 48. The percentage of transects in which each habitat type occurred. More than one substrate type may occur within each video transect.

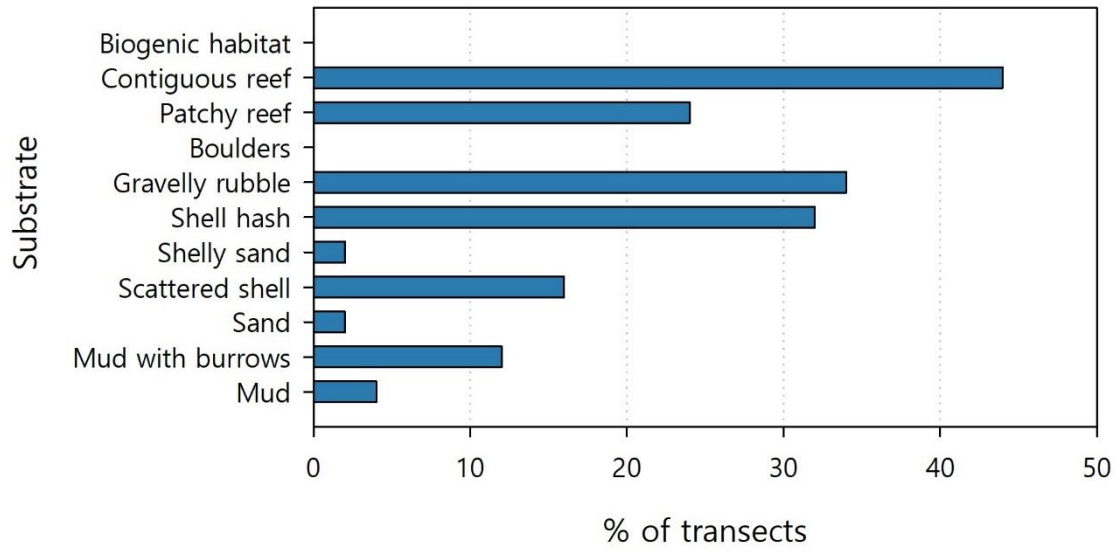


Figure 49. Examples of various sponges observed in video footage.

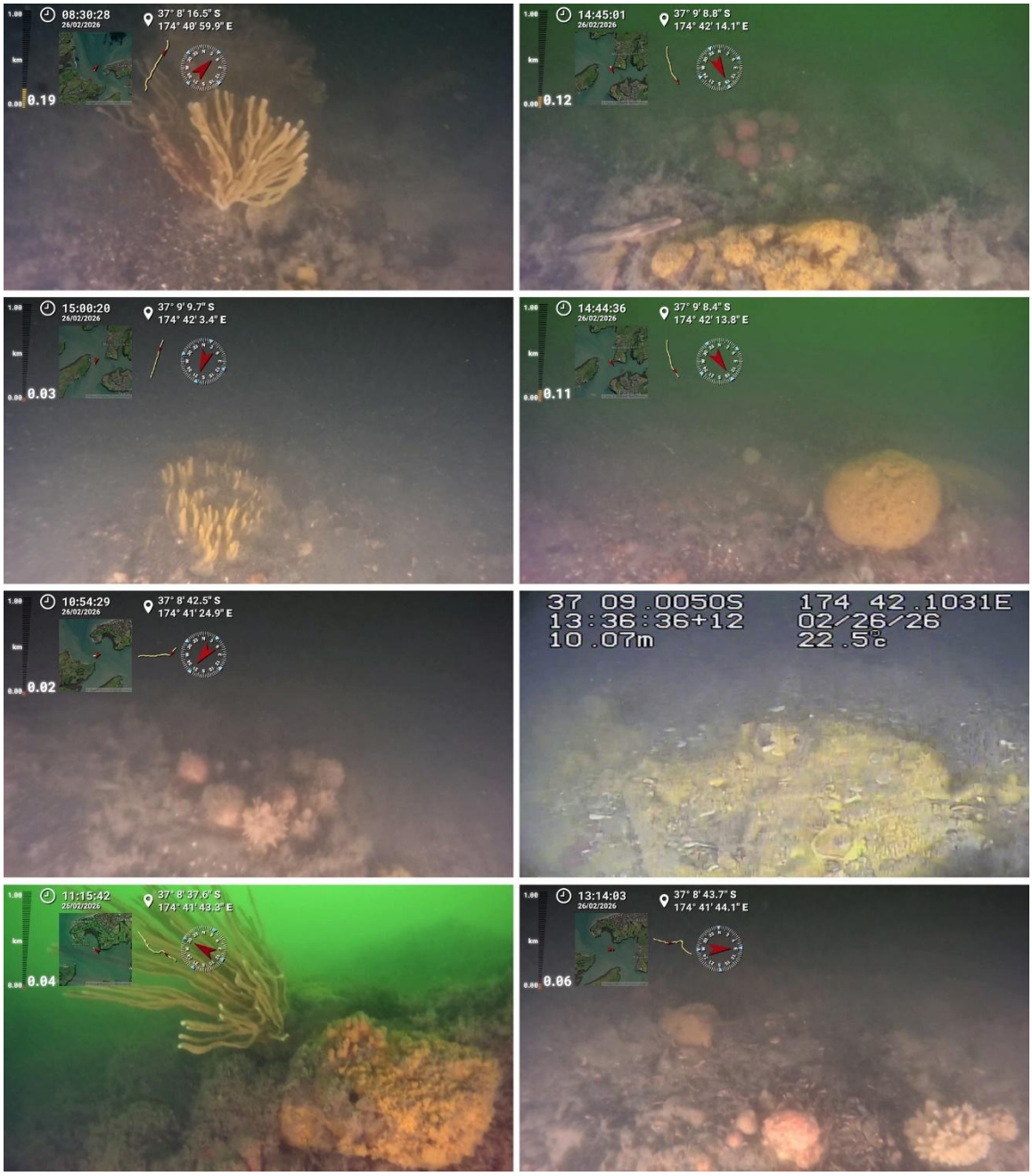


Figure 50. Examples of various bryozoans and ascidians (arrows) observed in video footage.

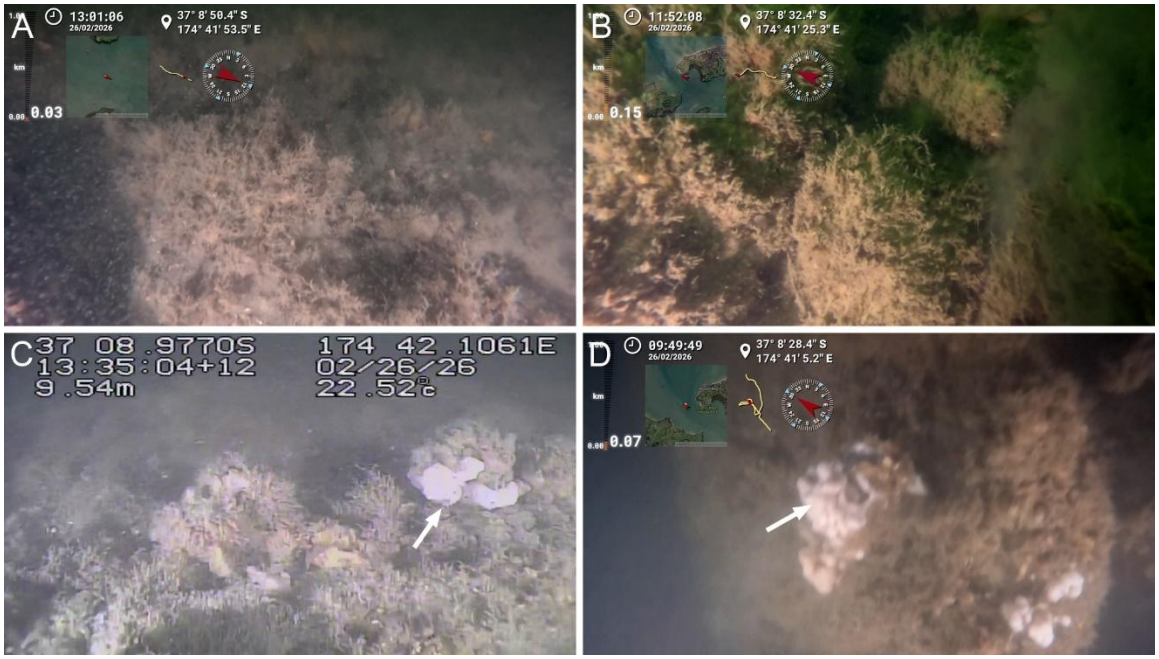


Figure 51. Examples of various macroalgae observed in video footage.

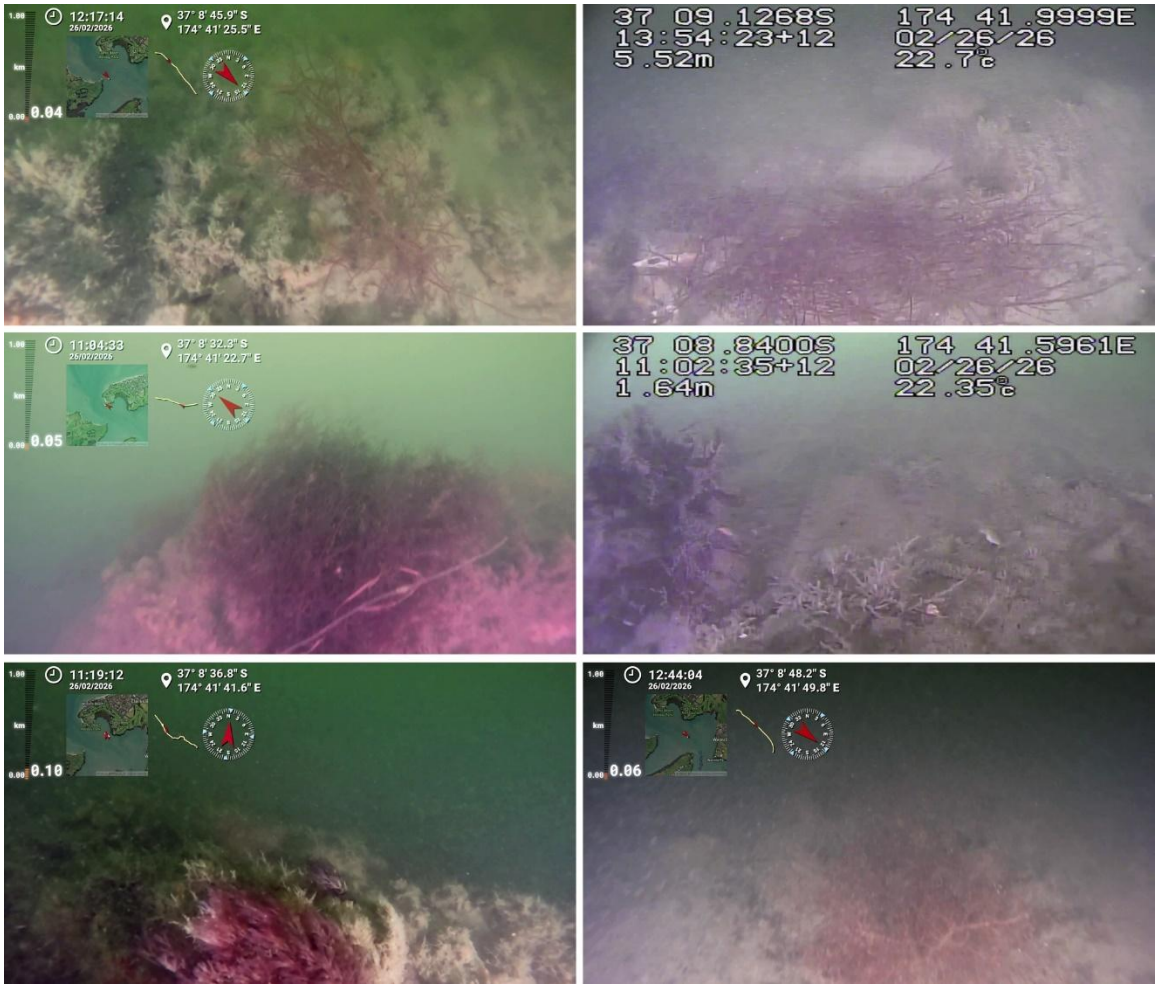


Figure 52. Examples of other biota observed in video footage: A & B) cushion stars; C) tubeworms; D) anemones; E & F) scallops; G) Asian paddle crab (a pest species); H) a shrimp.

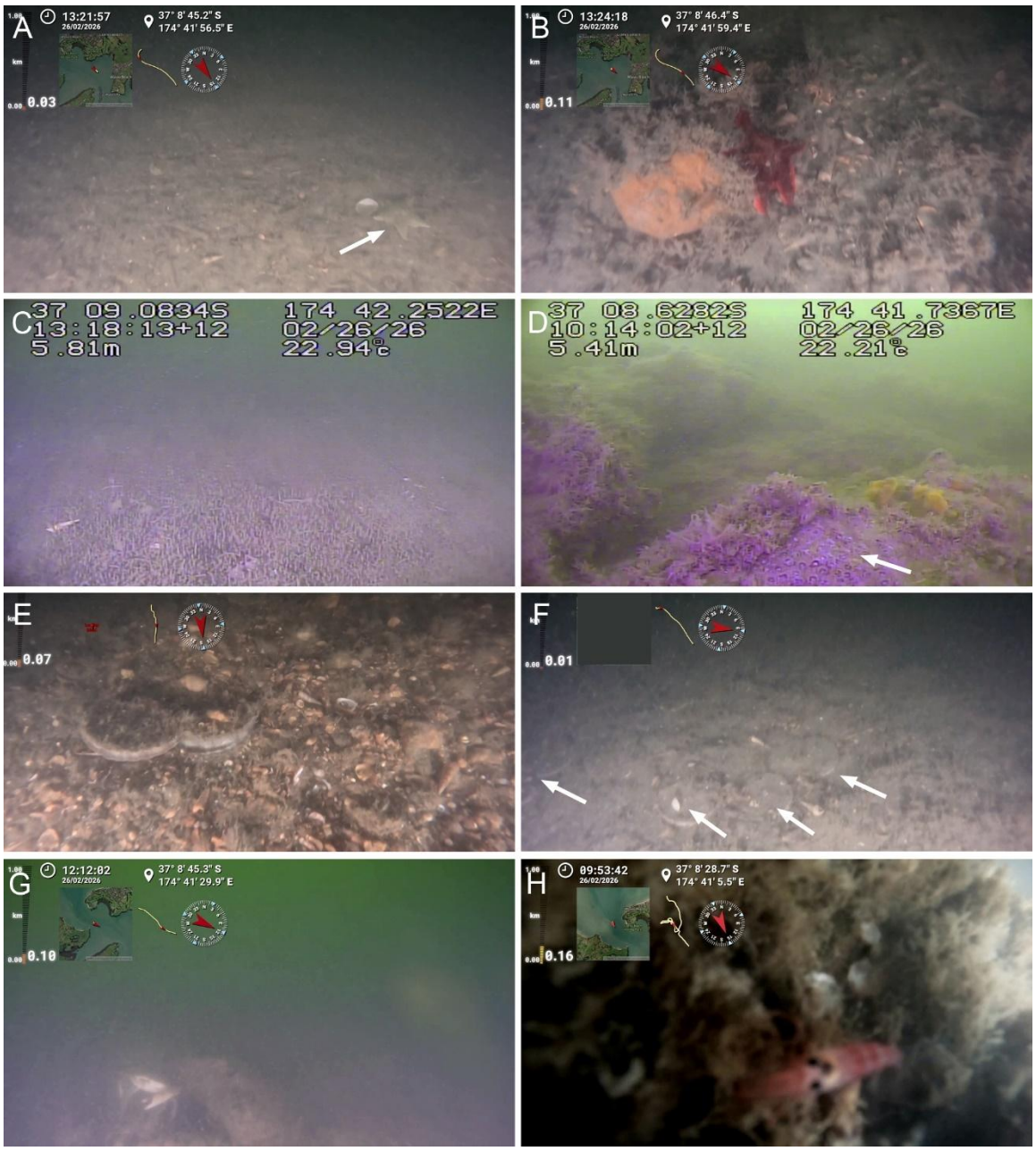


Figure 53. Examples of various fish observed in the video footage. A) snapper and an unidentified small fish (arrow); B) probable kingfish; C) probable kahawai; D) an eagle ray.

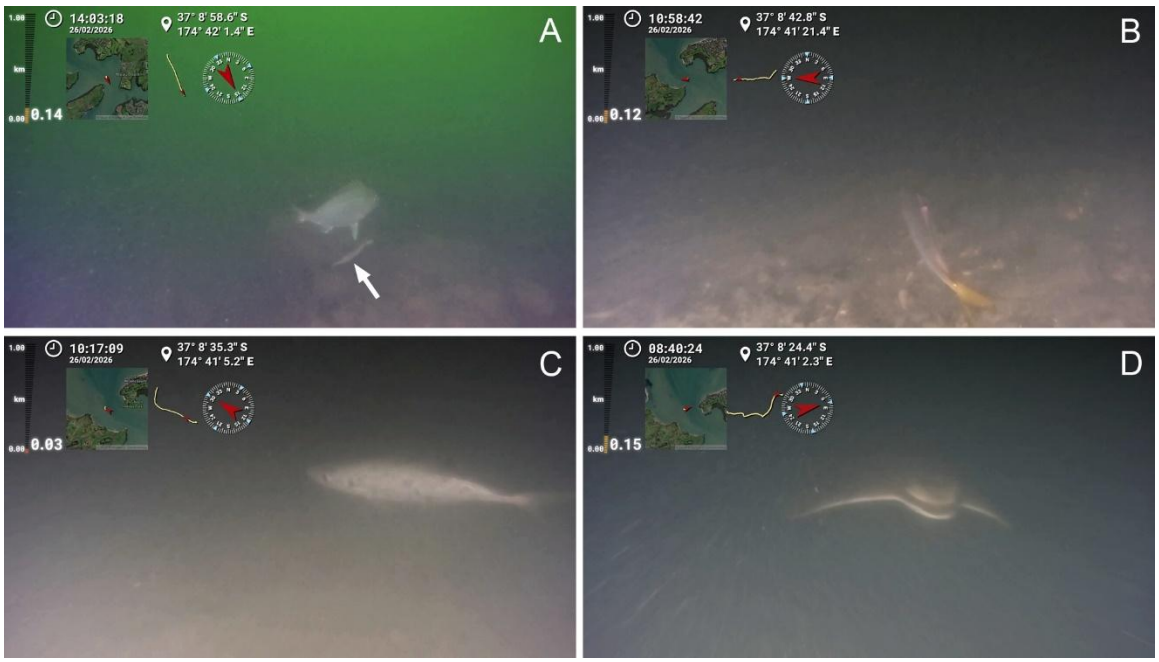


Figure 54. The percentage of transects in which each taxa/taxa group occurred in 2025 and 2026.

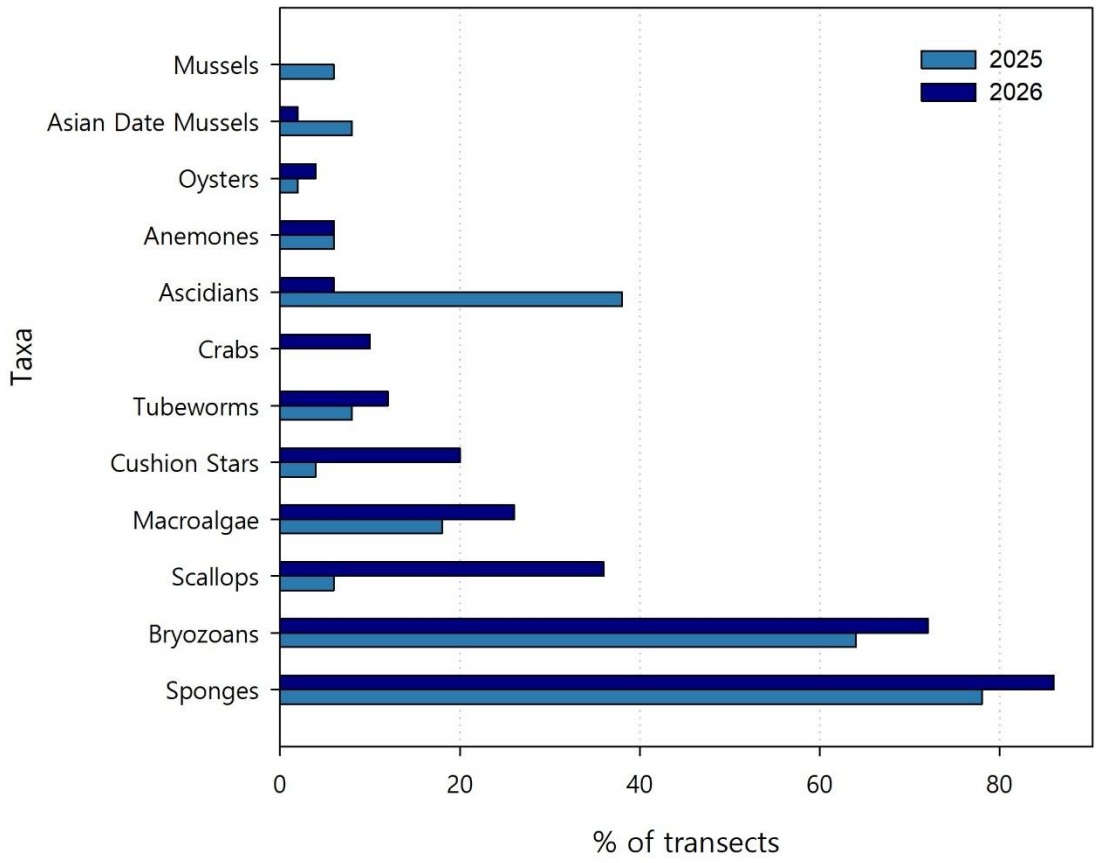


Figure 55. Distribution of the four most abundant taxa groups within the survey area. More than one taxa group may occur in the same video transect.

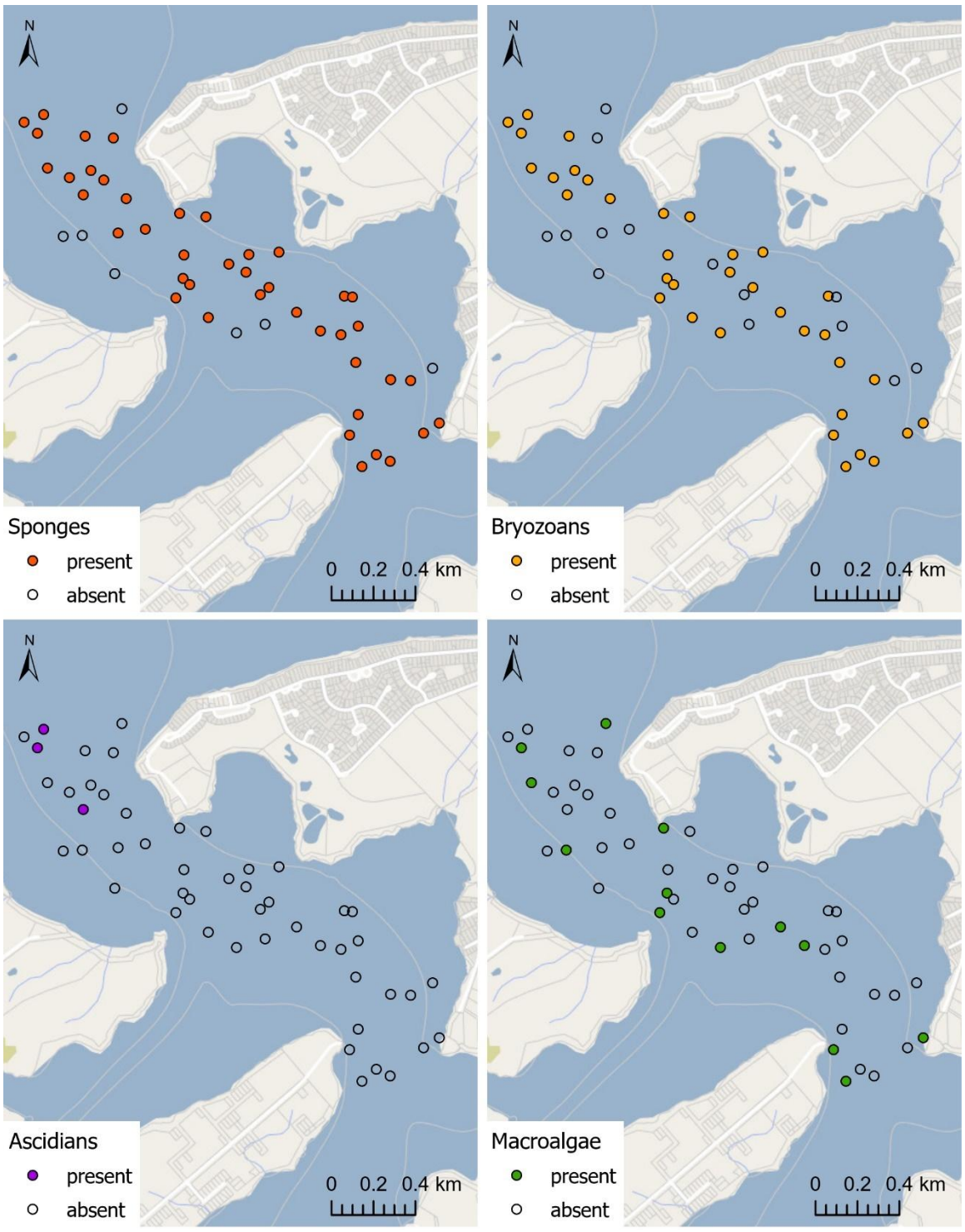
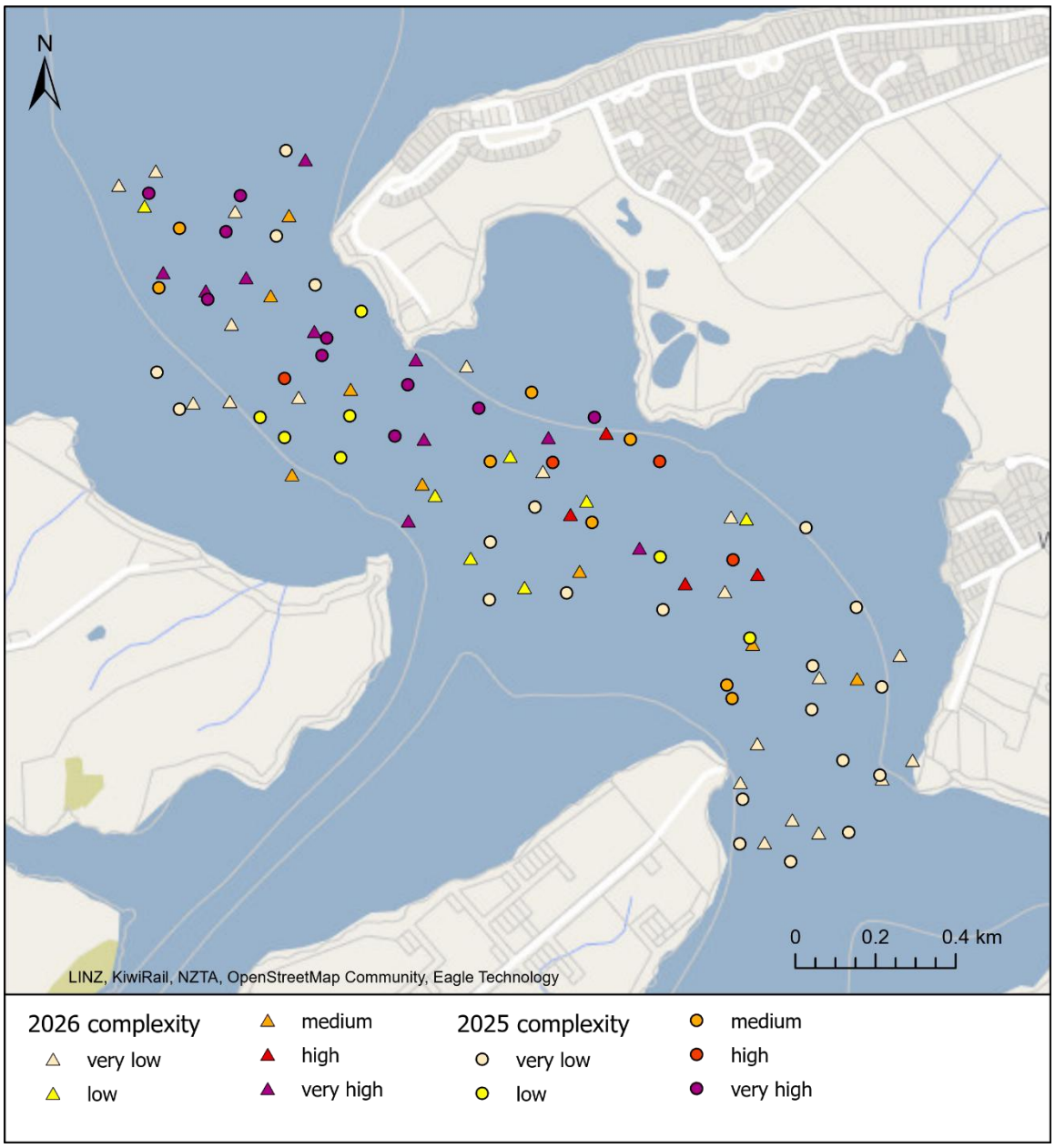


Figure 56. Ecological complexity rankings in the survey area from very low to very high for 2025 and 2026.



8 CONCLUSIONS

Baseline monitoring carried out in 2025–26 included:

- monthly sampling for general water quality and phytoplankton;
- 24-hour monitoring of dissolved oxygen at a site below the newly consented outfall site in December 2025, March 2026 and May 2026;
- sampling and characterisation of intertidal benthic macroinvertebrate communities at nine intertidal sites on the western and eastern sides of Waiuku Channel;

- sampling and analysis of sediment characteristics and quality at the nine intertidal sites where ecological samples were collected;
- obtaining underwater video footage along 50, 100 m transects for the analysis of biogenic and physical features.

Results show that water quality at the remote Whatapaka reference site was much poorer than in all other sites. Whatapaka is therefore considered to be unsuitable for assessing the effects of Clarks WWTP discharges.

Concentrations of all forms of nitrogen (NH_x-N, TON, TIN, and TN) were similar among the Clarks Beach sites (excluding Whatapaka) and temporal patterns in each form were highly correlated. NH_x-N concentrations were commonly below detection limits between June 2024 and April 2025. Increases between May and December 2025 and February to June 2026 resulted in higher NH_x-N concentrations in the 2025–26 monitoring year than the 2024–25 year. Total oxidised nitrogen concentrations were considerably higher than NH_x-N concentrations, and therefore, had the greatest influence on TIN concentrations.

All Clarks Beach sites had similar DRP and TP concentrations, and temporal patterns were highly correlated among the sites. There was also little difference in pooled chlorophyll *a* concentrations among most of the Clarks Beach monitoring sites. However, the 1 km North (WQ 6) site was unusual in that chlorophyll *a* concentrations never exceeded 0.003 mg/L. Concentrations at other Clarks Beach sites, including the 3 km North (WQ 7) site, were more variable and all displayed a strong spike in chlorophyll *a* concentrations in November 2025.

Temporal variation in TSS concentrations and turbidity were correlated, with little difference among the Clarks Beach sites. Slight increasing trends in median DO saturation, salinity, and pH levels were apparent along the spatial gradient from up-river to down-river sites, but site differences in DO concentrations and temperature were negligible.

In 2025–26, enterococci concentrations exceeded the Alert level guideline for contact recreation once at the Taihiki (WQ 10) site and twice at the Whatapaka (WQ 8) site, and exceeded the Action level guidelines once at the Whatapaka (WQ 8) site.

Overall, a total of 99 phytoplankton taxa from 12 phyla or other general high-order groups were identified in samples collected in 2025–26. The top 10 genera by cell concentration included two genera from the flagellates-unicells group, five diatom genera, and three dinoflagellate genera. For cell volume, the top 10 genera included two genera from the flagellates-unicells group, six diatom and two dinoflagellate genera. Seasonal cycles were apparent in total phytoplankton taxa, and cell concentrations and biovolumes with: highest biovolumes in spring–early summer (Nov–Dec); highest cell concentrations in mid to late summer (Feb–Mar); and, lowest taxa diversity in winter.

In 2025–26, potentially toxic filamentous cyanobacteria (*Anabaena* sp.) were detected at all phytoplankton sampling sites in December 2025. Other known toxic species obtained in 2025–26, included *Alexandrium minutum, Gymnodinium catenatum*, and *Prorocentrum lima.* It is possible that other potentially toxic taxa from the *Alexandrium, Karenia, Pseudo-nitzschia, Gymnodinium* and *Dinophysis* genera were also present, but these taxa were not identified to species levels.

Sediment quality

Sediments at the Ngahere site, on the eastern side of the main channel had the highest proportion of mud (48%). On that side of the channel, a clear demarcation in sediment characteristics occurred around the entrance to Waiuku River (between Tokaroa and Karaka Points), with sediment mud content decreasing in the northern sites in the main body of the harbour. A similar change occurred on the western side of the channel, with a marked difference occurring between the Rauau and Tokaroa North sites (Tokaroa North had the lowest proportion of mud of any site). However, mud content increased again between the Tokaroa North and Wairoa Point sites. All sites had moderate to high percentages of sand (51–99%), with the Tokaroa North and Clarks Beach sites having the highest percentage (95–96%).

Mud, TOC, TP and TN concentrations were highly correlated, and therefore all four parameters displayed similar spatial patterns to those described above for mud content.

Intertidal benthic macrofauna

A diverse assemblage of intertidal macrofauna was identified, with 18,735 individuals and 90 taxa collected from the nine monitoring sites. The abundance of individual taxa and results from four indicators of ecological diversity and abundance varied among sites. In summary:

- Twenty taxa comprised around 92% of all individuals collected, with the nut shell *Linucula hartvigiana* being the most abundant taxa, followed by cockles (*Austrovenus stutchburyi*), and the polychaete *Aonides trifida*.
- Clear spatial patterns were not apparent in any of the indicators of community diversity and abundance, apart from the Clarks West site appearing to have more within site variability than the other sites.
- Multivariate nMDS, cluster and SIMPROF analyses of the benthic community data showed that most sites could be differentiated from other sites based on their community composition. However, the following sites had communities that could be loosely grouped based on their positions on MDS plots:
    - sites on the outer, western side of the main channel (Tokaroa North and Wairoa Point);
    - the three Clarks sites from the outer, eastern side of the channel (Clarks West, Lower Clarks Beach, Clarks Beach);
    - Inner channel sites (Ohiku Creek, Rauau North, Waiau, and Ngahere) with the Ohiku Creek & Rauau North sites being most similar.
- Combined Health Scores were ranked as ‘fair’ for all sites, except Tokaroa North, which was ranked as ‘good’.

Subtidal habitats and biogenic features

Visibility in 2026 varied from exceptionally poor to reasonable, despite calm conditions and extended periods of dry weather prior to the survey dates. Hard substrates were the most frequently observed substrate, with contiguous reef observed in 44% of the transects, patchy reef observed in 24% of the transects, gravelly rubble observed in 34% of the transects, and

shell hash observed in 32% of the transects. Overall, hard substrates were found in 90% of transects, whereas primarily soft substrates were only found in 30% of transects. Soft substrates were generally found in the shallow areas at the edges of the channel, whereas hard substrates were more common in the deeper areas in the middle of the channel.

Sponges and bryozoans were the most common and widespread groups observed in video footage. Sponges were observed in 86% of the transects, followed by bryozoans (72%), scallops (36%) and macroalgae (26%). The percentage occurrences of sponges and bryozoans in 2026 were similar to those in 2025. Sponges were observed throughout the survey area, except for the southernmost section. The diversity and abundance of sponges on hard substrates were moderate. Bryozoans were also observed throughout the survey area in high abundance on hard substrates, but diversity appeared to be low. Ascidians were uncommon and limited to the outer part of the survey area, while scallops were restricted to certain areas. Macroalgae were found throughout the survey area but were uncommon. Ecological complexity was generally highest in the outer parts of the channel and lowest upstream. Complexity was typically highest on hard substrates (reef, rubble and shell hash).

Overall, monitoring results from June 2024–June 2026 provide a baseline for detecting future changes in water and sediment quality, and benthic ecology. Importantly, none of the univariate and multivariate water quality and phytoplankton plots from sites upstream and downstream of the WWTP discharge displayed patterns indicative of the discharge having a marked adverse effect. Patterns in the ecological results appear consistent with the environmental gradient from tidal river to central harbour intertidal flats, and variation in subtidal seabed substrates.

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11 APPENDICES

11.1 SITE COORDINATES

Table 11. Coordinates of the water quality monitoring sites.

Site	NZTM X	NZTM Y
WQ1	1751258	5887047
WQ2	1750831	5887704
WQ3	1750645	5887778
WQ4	1750555	5887821
WQ5	1750369	5887895
WQ6	1749736	5888304
WQ7	1748849	5890413
WQ8	1759646	5893505
WQ9	1751204	5885465
WQ10	1753220	5886897

Table 12. Corner coordinates for ecological and sediment quality monitoring sites.

Site Name	Site Number	Corner	NZTM X	NZTM Y
Waiau (WAI)	1	a	1751203	5887697
		b	1751261	5887752
		c	1751205	5887810
		d	1751148	5887754
Ngahere (NGA)	2	a	1750352	5888051
		b	1750344	5888120
		c	1750304	5888116
		d	1750312	5888046
Ohiku Creek (OC)	3	a	1750719	5887143
		b	1750711	5887125
		c	1750435	5887242
		d	1750443	5887261
Rauau North (RN)	4	a	1749896	5887579
		b	1749878	5887501
		c	1749800	5887518
		d	1749818	5887596
Clarks West (CW)	5	a	1749876	5888476
		b	1749925	5888467
		c	1749946	5888585
		d	1749897	5888594
Lower Clarks Beach (LCB)	6	a	1750271	5889167
		b	1750351	5889172
		c	1750346	5889252
		d	1750266	5889247
Tokaroa North (TN)	7	a	1749050	5888560
		b	1748980	5888522
		c	1748942	5888593
		d	1749013	5888631
Wairoa Point (WP)	8	a	1748766	5889255
		b	1748688	5889237
		c	1748670	5889314
		d	1748748	5889333
Clarks Beach (CB)	9	a	1751310	5890139
		b	1751305	5890219
		c	1751225	5890214
		d	1751230	5890134

11.2 GENERAL WATER QUALITY DATA

Date	Site	NH_3NH_4 (mg/L)	TON (mg/L)	TIN (mg/L)	TN (mg/L)	DRP (mg/L)	TP (mg/L)	Chl a (mg/L)	TSS (mg/L)	Turbidity (NTU)	DO (mg/L)	DO (%)	Salinity (ppt)	pH	Temp (°C)	F coliforms (cfu/100 mL)	Entero (MPN/100 mL)
8/07/2025	Whatapaka (WQ8)	0.064	0.54	0.6	0.83	0.026	0.036	0.001	11	6.3	8.66	97.4	28	8.2	12.9	66	41
4/08/2025	Upper Waiuku (WQ9)	0.047	0.31	0.36	0.51	0.022	0.022	0.00084	5.4	1.8	8.61	92.5	26	8	12	5	10
4/08/2025	Taihiki (WQ10)	0.037	0.33	0.37	0.52	0.022	0.021	<0.0006	10	1.8	9.42	93.4	28	8	12.5	3.3	<10
4/08/2025	1 km South (WQ1)	0.021	0.18	0.2	0.29	0.02	0.02	0.001	7.6	2.1	8.46	94.8	30	8	12.9	3.3	10
4/08/2025	250m South (WQ2)	0.031	0.26	0.29	0.42	0.021	0.02	<0.0006	6.6	2.3	8.58	92.1	27	8	11.7	6.7	<10
4/08/2025	50 m South (WQ3)	0.032	0.27	0.3	0.39	0.021	0.019	<0.0006	7.4	2.3	8.56	93.4	28	8	12.2	<1.7	<10
4/08/2025	50 m North (WQ4)	0.031	0.25	0.28	0.42	0.021	0.021	<0.0006	6.2	2.6	8.6	94.1	28	8.1	12.3	<1.7	<10
4/08/2025	250 m North (WQ5)	0.03	0.24	0.27	0.39	0.02	0.021	<0.0006	9.2	2.5	8.57	93.7	28	8	12.2	1.7	<10
4/08/2025	1 km North (WQ6)	0.026	0.2	0.23	0.34	0.02	0.021	<0.0006	9.6	3	8.46	95.3	30	8	13	6.7	<10
4/08/2025	3 km North (WQ7)	0.019	0.14	0.16	0.26	0.019	0.02	0.00094	7.4	2.1	8.44	95.5	31	8.1	13.1	<1.7	<10
6/08/2025	Whatapaka (WQ8)	0.04	0.23	0.27	0.41	0.021	0.024	<0.0006	6.6	4	8.8	97.7	29	8.2	11.8	1.6	<10
3/09/2025	Upper Waiuku (WQ9)	0.026	0.11	0.13	0.26	0.0143	0.015	<0.0006	7.4	1.7	8.59	95.8	29	8.2	12.6	1.7	<10
3/09/2025	Taihiki (WQ10)	0.019	0.11	0.13	0.24	0.017	0.017	0.0019	8.6	2.7	8.32	96	31	8.2	13.4	3.3	<10
3/09/2025	1 km South (WQ1)	0.0073	0.061	0.068	0.17	0.015	0.014	0.0014	6.6	2.2	8.31	97.3	33	8.2	13.6	1.7	<10
3/09/2025	250m South (WQ2)	0.012	0.075	0.087	0.19	0.0152	0.014	0.00079	5.6	2.4	8.36	97.3	32	8.2	13.6	1.7	<10
3/09/2025	50 m South (WQ3)	0.013	0.072	0.086	0.19	0.015	0.015	0.00076	8.2	2.2	8.32	96.2	32	8.2	13.4	<1.7	10
3/09/2025	50 m North (WQ4)	0.012	0.069	0.081	0.18	0.0142	0.013	<0.0006	9	2.5	8.37	96.8	32	8.2	13.4	6.7	10
3/09/2025	250 m North (WQ5)	0.012	0.071	0.083	0.19	0.015	0.013	<0.0006	7	2.3	8.35	97.2	32	8.2	13.5	<1.7	<10
3/09/2025	1 km North (WQ6)	0.029	0.065	0.094	0.19	0.0143	0.015	<0.0006	11	3.1	8.3	97.1	33	8.2	13.7	<1.7	<10
3/09/2025	3 km North (WQ7)	<0.005	0.041	0.041	0.14	0.0124	0.012	<0.0006	6.6	1.9	8.33	98.1	33	8.2	13.8	<1.7	10
5/09/2025	Whatapaka (WQ8)	0.049	0.13	0.18	0.41	0.016	0.03	0.0096	17	8.8	8.4	99.4	30	8.1	14.6	13	<10
3/10/2025	Upper Waiuku (WQ9)	0.037	0.19	0.23	0.36	0.014	0.019	0.0015	6.9	4.9	7.84	96.9	29	7.5	16.9	5	<10

Date	Site	NH_3NH_4 (mg/L)	TON (mg/L)	TIN (mg/L)	TN (mg/L)	DRP (mg/L)	TP (mg/L)	Chl a (mg/L)	TSS (mg/L)	Turbidity (NTU)	DO (mg/L)	DO (%)	Salinity (ppt)	pH	Temp (°C)	F coliforms (cfu/100 mL)	Entero (MPN/100 mL)
3/10/2025	Taihiki (WQ10)	0.03	0.18	0.21	0.31	0.014	0.022	0.0008	12	4.6	7.88	97.8	30	7.8	16.8	5	<10
3/10/2025	1 km South (WQ1)	0.018	0.1	0.12	0.23	0.012	0.018	0.0021	17	6.1	8.03	100.1	32	8	16.6	1.7	10
3/10/2025	250m South (WQ2)	0.03	0.12	0.15	0.27	0.011	0.013	0.0015	9.2	3.1	7.99	99.4	31	7.9	16.7	1.7	<10
3/10/2025	50 m South (WQ3)	0.026	0.13	0.16	0.27	0.012	0.014	0.0022	8.2	3	8.02	99.8	31	8.1	16.9	<1.7	<10
3/10/2025	50 m North (WQ4)	0.027	0.13	0.16	0.26	0.013	0.02	0.0013	10	3.3	8.02	99.8	31	8	16.8	1.7	<10
3/10/2025	250 m North (WQ5)	0.019	0.11	0.13	0.24	0.012	0.031	0.0021	11	5	8.01	99.9	31	8.1	16.7	3.3	<10
3/10/2025	1 km North (WQ6)	0.032	0.11	0.14	0.24	0.011	0.022	0.0028	15	6.2	8.05	100.3	32	8	16.6	1.7	<10
3/10/2025	3 km North (WQ7)	0.0097	0.075	0.084	0.17	0.009	0.013	0.0019	10	3.1	8.9	102.3	32	8	16.4	<1.7	<10
17/10/2025	Whatapaka (WQ8)	0.013	0.13	0.14	0.42	0.01	0.039	0.0031	91	20	7.48	92.2	30	8.2	16.8	62	10
3/11/2025	Whatapaka (WQ8)	0.054	0.072	0.13	0.42	0.02	0.051	0.0062	68	28	6.74	87.9	31	8	19.4	46	<10
13/11/2025	Upper Waiuku (WQ9)	0.024	0.02	0.044	0.18	0.015	0.026	0.013	36	11	6.73	91.7	33	8	20.4	<1.7	<10
13/11/2025	Taihiki (WQ10)	0.026	0.029	0.054	0.24	0.016	0.032	0.014	43	17	6.7	91.4	33	8	20.5	6.7	10
13/11/2025	1 km South (WQ1)	0.02	0.016	0.036	0.23	0.014	0.041	0.013	52	23	6.87	93.6	33	8	20.4	5	10
13/11/2025	250m South (WQ2)	0.018	0.017	0.035	0.21	0.013	0.028	0.013	40	18	6.82	93.1	33	8	20.5	3.3	<10
13/11/2025	50 m South (WQ3)	0.026	0.017	0.043	0.2	0.013	0.028	0.015	68	21	6.83	93.4	33	8	20.6	1.7	<10
13/11/2025	50 m North (WQ4)	0.021	0.017	0.038	0.23	0.016	0.03	0.015	50	19	6.88	93.9	33	8	20.6	<1.7	<10
13/11/2025	250 m North (WQ5)	0.018	0.015	0.032	0.21	0.014	0.032	0.017	48	21	6.85	93.5	33	8.1	20.5	1.7	<10
13/11/2025	1 km North (WQ6)	0.016	0.016	0.032	0.24	0.013	0.046	0.00085	68	25	6.85	93.5	33	8.1	20.5	<1.7	<10
13/11/2025	3 km North (WQ7)	0.015	0.011	0.026	0.23	0.013	0.048	0.017	77	28	6.93	94.2	33	8.1	20.3	<1.7	<10
2/12/2025	Whatapaka (WQ8)	0.031	0.0097	0.041	0.2	0.02	0.022	0.0083	45	22	6.07	83.4	31	8	22.1	380	63
15/12/2025	Upper Waiuku (WQ9)	0.0053	0.0029	0.0082	0.16	0.013	0.021	0.0097	3.8	1.6	7.18	99.9	33	8	22.6	<1.6	<10
15/12/2025	Taihiki (WQ10)	<0.005	0.0043	<0.005	0.17	0.016	0.021	0.0045	8.6	2.9	6.95	97	34	8	22.6	1.6	<10
15/12/2025	1 km South (WQ1)	<0.005	0.0032	<0.005	0.15	0.014	0.019	0.00091	8.4	1.8	7.15	100	34	8	22.6	<1.6	<10
15/12/2025	250m South (WQ2)	<0.005	0.0032	<0.005	0.16	0.015	0.024	0.0015	4.8	1.6	7.23	101.2	34	8.1	22.7	<1.6	<10
15/12/2025	50 m South (WQ3)	<0.005	0.0027	<0.005	0.16	0.014	0.02	0.0014	7.6	2.3	7.2	100.9	34	8.1	22.7	<1.6	<10

Date	Site	NH_3NH_4 (mg/L)	TON (mg/L)	TIN (mg/L)	TN (mg/L)	DRP (mg/L)	TP (mg/L)	Chl a (mg/L)	TSS (mg/L)	Turbidity (NTU)	DO (mg/L)	DO (%)	Salinity (ppt)	pH	Temp (°C)	F coliforms (cfu/100 mL)	Entero (MPN/100 mL)
15/12/2025	50 m North (WQ4)	<0.005	0.0042	<0.005	0.16	0.014	0.019	0.0017	8.6	1.4	7.22	101.1	34	8.1	22.7	1.6	<10
15/12/2025	250 m North (WQ5)	<0.005	0.0016	<0.005	0.16	0.014	0.018	0.0008	5	2.3	7.22	101	34	8.1	22.6	<1.6	10
15/12/2025	1 km North (WQ6)	0.013	0.0028	0.015	0.2	0.014	0.016	0.0016	13	2.2	7.25	101.6	34	8.1	22.7	<1.6	<10
15/12/2025	3 km North (WQ7)	<0.005	0.0059	0.0059	0.15	0.013	0.022	0.00074	6	1.4	7.27	101.8	34	8.1	22.7	<1.6	<10
14/01/2026	Upper Waiuku (WQ9)	0.0083	0.0061	0.014	0.18	0.016	0.026	0.0024	8.8	3.5	6.61	95.1	34	8	24	<1.7	<10
14/01/2026	Taihiki (WQ10)	0.01	0.0086	0.019	0.18	0.015	0.025	0.0021	12	3.6	6.5	93.7	33	8	24.1	<1.7	<10
14/01/2026	1 km South (WQ1)	<0.005	0.0066	0.0066	0.16	0.014	0.022	0.0021	13	3.9	6.65	96	34	8	24	<1.7	<10
14/01/2026	250m South (WQ2)	<0.005	0.0092	0.0092	0.16	0.014	0.019	0.002	7.4	2.7	6.79	97.7	34	8	23.9	<1.7	<10
14/01/2026	50 m South (WQ3)	<0.005	0.0073	0.0073	0.16	0.014	0.02	0.001	7.2	3.1	6.81	98.2	34	8	23.9	<1.7	10
14/01/2026	50 m North (WQ4)	<0.005	0.008	0.008	0.16	0.015	0.024	0.0056	5.8	3	6.81	98.2	34	8	24	<1.7	<10
14/01/2026	250 m North (WQ5)	<0.005	0.0073	0.0073	0.16	0.015	0.021	0.00087	6.8	2.9	6.78	97.5	34	8	23.9	<1.7	10
14/01/2026	1 km North (WQ6)	<0.005	0.007	0.007	0.15	0.014	0.023	0.003	9	3.7	6.81	97.6	34	8	23.7	<1.7	<10
14/01/2026	3 km North (WQ7)	<0.005	0.0049	<0.005	0.15	0.014	0.023	0.0031	8.8	3.1	6.73	96.2	34	8	23.5	<1.7	<10
14/01/2026	Whatapaka (WQ8)	0.025	0.008	0.033	0.37	0.03	0.067	0.0073	35	20	5.74	82.6	34	7.9	23.8	6.6	<10
11/02/2026	Upper Waiuku (WQ9)	0.026	0.024	0.05	0.22	0.021	0.027	0.0017	8.2	3	6.49	91.8	33	8	23.3	1.6	<10
11/02/2026	Taihiki (WQ10)	0.021	0.031	0.052	0.21	0.023	0.027	0.0013	6.6	2.2	6.49	91.9	33	8	23.4	<1.6	<10
11/02/2026	1 km South (WQ1)	0.01	0.022	0.033	0.19	0.018	0.024	0.0016	4.8	2.2	6.82	96.2	34	8	23.2	<1.6	<10
11/02/2026	250m South (WQ2)	0.0059	0.022	0.027	0.19	0.018	0.023	0.0021	4	1.8	6.89	97.8	34	8	23.4	<1.6	<10
11/02/2026	50 m South (WQ3)	0.0052	0.02	0.025	0.18	0.018	0.023	0.0015	5.2	2	6.97	98.8	34	8	23.4	1.6	<10
11/02/2026	50 m North (WQ4)	<0.005	0.021	0.021	0.17	0.018	0.02	0.0019	4	1.7	6.94	98.5	34	8	23.4	<1.6	<10
11/02/2026	250 m North (WQ5)	0.0055	0.021	0.027	0.025	0.016	0.026	0.0016	5.2	1.8	6.94	98.4	34	8	23.4	<1.6	<10
11/02/2026	1 km North (WQ6)	<0.005	0.021	0.021	0.19	0.017	0.025	0.0018	6.4	2.2	6.86	97.3	34	8	23.4	<1.6	10
11/02/2026	3 km North (WQ7)	<0.005	0.014	0.014	0.16	0.015	0.021	0.002	5.2	1.5	7.21	102.1	34	8.1	23.2	<1.6	<10
27/02/2026	Whatapaka (WQ8)	0.026	0.011	0.036	0.31	0.0213	0.073	0.0053	29	13	7.24	101.8	35	8.1	22.3	6.6	<10
13/03/2026	Upper Waiuku (WQ9)	0.033	0.021	0.054	0.2	0.021	0.035	0.0013	11	2.6	6.8	92.4	35	8	19.8	<1.7	<10

Date	Site	NH_3NH_4 (mg/L)	TON (mg/L)	TIN (mg/L)	TN (mg/L)	DRP (mg/L)	TP (mg/L)	Chl a (mg/L)	TSS (mg/L)	Turbidity (NTU)	DO (mg/L)	DO (%)	Salinity (ppt)	pH	Temp (°C)	F coliforms (cfu/100 mL)	Entero (MPN/100 mL)
13/03/2026	Taihiki (WQ10)	0.031	0.028	0.059	0.2	0.022	0.035	<0.0006	6.4	2.8	6.61	89.9	35	8	19.8	<1.7	<10
13/03/2026	1 km South (WQ1)	0.013	0.012	0.025	0.18	0.017	0.034	0.0013	12	3.4	6.91	94.2	35	8	19.8	<1.7	<10
13/03/2026	250m South (WQ2)	0.01	0.013	0.023	0.17	0.017	0.034	0.002	9.8	3.2	6.91	94	35	8	19.8	<1.7	<10
13/03/2026	50 m South (WQ3)	0.032	0.014	0.046	0.19	0.017	0.031	0.0019	8.6	3	6.95	94.6	35	8.1	19.8	<1.7	<10
13/03/2026	50 m North (WQ4)	0.014	0.014	0.028	0.18	0.017	0.033	0.002	7.2	2.9	6.97	94.9	35	8.1	19.8	<1.7	<10
13/03/2026	250 m North (WQ5)	0.0097	0.013	0.023	0.19	0.017	0.033	0.0029	6.2	3	6.98	95	35	8.1	19.8	<1.7	<10
13/03/2026	1 km North (WQ6)	0.007	0.0074	0.014	0.18	0.015	0.039	0.0023	13	4.1	6.99	95.1	36	8.1	19.7	1.7	<10
13/03/2026	3 km North (WQ7)	<0.005	0.0023	<0.005	0.17	0.014	0.032	0.0026	8.8	3.1	7.16	97.5	36	8.1	19.8	<1.7	<10
16/03/2026	Whatapaka (WQ8)	0.0059	0.0098	0.016	0.32	0.019	0.089	0.0075	37	19	6.68	88.9	35	8.1	19	1200	270
13/04/2026	Upper Waiuku (WQ9)	0.027	0.043	0.07	0.2	0.022	0.036	0.0023	12	3.6	7.09	93.4	32	8.1	19.2	54	75
13/04/2026	Taihiki (WQ10)	0.045	0.06	0.1	0.25	0.023	0.048	<0.0006	11	5	6.83	89.9	32	8	19.3	54	150
13/04/2026	1 km South (WQ1)	0.036	0.028	0.064	0.19	0.019	0.044	0.0016	18	8.1	7.03	93	33	8.1	19.2	63	20
13/04/2026	250m South (WQ2)	0.038	0.036	0.074	0.18	0.02	0.033	0.0015	10	3.3	7.09	93.8	33	8.1	19.2	27	75
13/04/2026	50 m South (WQ3)	0.024	0.033	0.057	0.19	0.019	0.037	0.0014	9.2	3.7	7.03	93.1	33	8.1	19.3	45	10
13/04/2026	50 m North (WQ4)	0.021	0.032	0.053	0.2	0.02	0.038	0.00092	11	3.6	7.01	92.8	33	8.1	19.3	18	41
13/04/2026	250 m North (WQ5)	0.023	0.031	0.054	0.2	0.019	0.036	0.0028	12	4.4	7.05	93.4	33	8.1	19.3	<9.0	63
13/04/2026	1 km North (WQ6)	0.016	0.025	0.041	0.2	0.018	0.051	0.0014	16	5.6	7.07	93.6	33	8.1	19.2	9	20
13/04/2026	3 km North (WQ7)	<0.005	0.011	0.011	0.14	0.019	0.031	0.0021	13	3.6	7.18	95.4	34	8.1	19.2	<9.0	20
15/04/2026	Whatapaka (WQ8)	0.028	0.053	0.081	0.42	0.017	0.076	0.016	320	160						440	440
17/04/2026	Whatapaka (WQ8)										7.45	92.7	32	8	16.6		
14/05/2026	Upper Waiuku (WQ9)	0.027	0.028	0.055	0.19	0.015	0.03	0.0016	11	2.9	7.79	92.6	29	8.1	16	1.6	<10
14/05/2026	Taihiki (WQ10)	0.028	0.044	0.073	0.18	0.016	0.033	<0.0006	12	4.1	7.7	91.1	29	8	15.9	4.9	<10
14/05/2026	1 km South (WQ1)	0.017	0.028	0.045	0.16	0.013	0.033	0.0016	13	4.4	7.77	92.5	29	8	16	8.2	<10
14/05/2026	250m South (WQ2)	0.017	0.027	0.044	0.17	0.014	0.029	<0.0006	15	4.5	7.15	89.5	29	8	16.1	1.6	<10
14/05/2026	50 m South (WQ3)	0.034	0.026	0.061	0.17	0.014	0.04	0.0014	12	5.2	7.79	93	29	8.1	16.2	3.3	<10

Date	Site	NH_3NH_4 (mg/L)	TON (mg/L)	TIN (mg/L)	TN (mg/L)	DRP (mg/L)	TP (mg/L)	Chl a (mg/L)	TSS (mg/L)	Turbidity (NTU)	DO (mg/L)	DO (%)	Salinity (ppt)	pH	Temp (°C)	F coliforms (cfu/100 mL)	Entero (MPN/100 mL)
14/05/2026	50 m North (WQ4)	0.03	0.028	0.058	0.18	0.014	0.041	0.0027	17	4.2	7.8	92.9	29	8	16.1	1.6	<10
14/05/2026	250 m North (WQ5)	0.017	0.028	0.046	0.18	0.014	0.038	0.002	11	4.2	7.79	92.8	29	8.1	16.1	1.6	<10
14/05/2026	1 km North (WQ6)	0.018	0.026	0.045	0.21	0.013	0.033	0.0027	17	6.4	7.63	91	29	8	16.1	13	<10
14/05/2026	3 km North (WQ7)	0.014	0.021	0.035	0.14	0.012	0.035	0.0022	23	6.4	7.82	93.7	30	8.1	16.2	<1.6	<10
14/05/2026	Whatapaka (WQ8)	0.023	0.016	0.039	0.19	0.019	0.047	0.0021	16	8.2	8.19	98.4	32	8.1	14.9	4.9	<10
10/06/2026	Upper Waiuku (WQ9)	0.0077	0.044	0.052	0.22	0.02	0.033	0.00079	8.2	2.3	8.07	92.7	31	8.1	13.8	<1.6	<10
10/06/2026	Taihiki (WQ10)	<0.005	0.048	0.048	0.23	0.02	0.033	<0.0006	9.6	3.8	7.95	92.5	32	8.1	14.2	8.2	<10
10/06/2026	1 km South (WQ1)	0.02	0.031	0.051	0.2	0.018	0.034	0.0016	13	4.6	7.92	93.3	32	8.1	14.6	<1.6	<10
10/06/2026	250m South (WQ2)	0.017	0.031	0.048	0.2	0.017	0.032	0.0014	11	4.3	7.93	93.4	32	8.1	14.6	<1.6	<10
10/06/2026	50 m South (WQ3)	0.02	0.029	0.049	0.2	0.017	0.034	0.0014	10	3	8.1	94.8	32	8.1	14.3	<1.6	<10
10/06/2026	50 m North (WQ4)	0.018	0.029	0.047	0.24	0.017	0.03	0.0016	8.2	3.1	7.97	93.7	32	8.1	14.5	<1.6	10
10/06/2026	250 m North (WQ5)	<0.005	0.031	0.031	0.21	0.018	0.033	0.0016	13	8	7.91	92.9	32	8.1	14.5	<1.6	<10
10/06/2026	1 km North (WQ6)	<0.005	0.033	0.033	0.22	0.018	0.044	0.0021	14	7.1	8.05	94.3	32	8.1	14.1	1.6	<10
10/06/2026	3 km North (WQ7)	0.012	0.018	0.03	1.3	0.016	0.032	0.002	15	4.6	8.03	94.9	33	8.1	14.7	<1.6	<10
15/06/2026	Whatapaka (WQ8)	0.029	0.063	0.093	0.38	0.028	0.12	0.0049	130	55	8.16	94.6	31	8	13.2	550	220
8/07/2025	Whatapaka (WQ8)	0.064	0.54	0.6	0.83	0.026	0.036	0.001	11	6.3	8.66	97.4	28	8.2	12.9	66	41
4/08/2025	Upper Waiuku (WQ9)	0.047	0.31	0.36	0.51	0.022	0.022	0.00084	5.4	1.8	8.61	92.5	26	8	12	5	10
4/08/2025	Taihiki (WQ10)	0.037	0.33	0.37	0.52	0.022	0.021	<0.0006	10	1.8	9.42	93.4	28	8	12.5	3.3	<10
4/08/2025	1 km South (WQ1)	0.021	0.18	0.2	0.29	0.02	0.02	0.001	7.6	2.1	8.46	94.8	30	8	12.9	3.3	10
4/08/2025	250m South (WQ2)	0.031	0.26	0.29	0.42	0.021	0.02	<0.0006	6.6	2.3	8.58	92.1	27	8	11.7	6.7	<10
4/08/2025	50 m South (WQ3)	0.032	0.27	0.3	0.39	0.021	0.019	<0.0006	7.4	2.3	8.56	93.4	28	8	12.2	<1.7	<10
4/08/2025	50 m North (WQ4)	0.031	0.25	0.28	0.42	0.021	0.021	<0.0006	6.2	2.6	8.6	94.1	28	8.1	12.3	<1.7	<10
4/08/2025	250 m North (WQ5)	0.03	0.24	0.27	0.39	0.02	0.021	<0.0006	9.2	2.5	8.57	93.7	28	8	12.2	1.7	<10
4/08/2025	1 km North (WQ6)	0.026	0.2	0.23	0.34	0.02	0.021	<0.0006	9.6	3	8.46	95.3	30	8	13	6.7	<10
4/08/2025	3 km North (WQ7)	0.019	0.14	0.16	0.26	0.019	0.02	0.00094	7.4	2.1	8.44	95.5	31	8.1	13.1	<1.7	<10

Date	Site	NH_3NH_4 (mg/L)	TON (mg/L)	TIN (mg/L)	TN (mg/L)	DRP (mg/L)	TP (mg/L)	Chl a (mg/L)	TSS (mg/L)	Turbidity (NTU)	DO (mg/L)	DO (%)	Salinity (ppt)	pH	Temp (°C)	F coliforms (cfu/100 mL)	Entero (MPN/100 mL)
6/08/2025	Whatapaka (WQ8)	0.04	0.23	0.27	0.41	0.021	0.024	<0.0006	6.6	4	8.8	97.7	29	8.2	11.8	1.6	<10
3/09/2025	Upper Waiuku (WQ9)	0.026	0.11	0.13	0.26	0.0143	0.015	<0.0006	7.4	1.7	8.59	95.8	29	8.2	12.6	1.7	<10
3/09/2025	Taihiki (WQ10)	0.019	0.11	0.13	0.24	0.017	0.017	0.0019	8.6	2.7	8.32	96	31	8.2	13.4	3.3	<10
3/09/2025	1 km South (WQ1)	0.0073	0.061	0.068	0.17	0.015	0.014	0.0014	6.6	2.2	8.31	97.3	33	8.2	13.6	1.7	<10
3/09/2025	250m South (WQ2)	0.012	0.075	0.087	0.19	0.0152	0.014	0.00079	5.6	2.4	8.36	97.3	32	8.2	13.6	1.7	<10
3/09/2025	50 m South (WQ3)	0.013	0.072	0.086	0.19	0.015	0.015	0.00076	8.2	2.2	8.32	96.2	32	8.2	13.4	<1.7	10
3/09/2025	50 m North (WQ4)	0.012	0.069	0.081	0.18	0.0142	0.013	<0.0006	9	2.5	8.37	96.8	32	8.2	13.4	6.7	10

Watercare Laboratory Services

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Certificate of Analysis
Laboratory Reference: 251124-120

Attention:	Environmental Care	*Final Report:*	**612289-0**
Client:	**WATERCARE SERVICES LTD**	*Report Issue Date:*	**05-Dec-2025**
Address:	**PO Box 92521, Wellesley Street, 1141**	*Received Date:*	**24-Nov-2025**
Client Reference:	**Clarks Beach WWTP Sediments**	*Laboratory Activity Dates:*	**24-Nov-2025 - 04-Dec-2025**
Purchase Order:	**3310-WV-02-693040**	*Quote Reference :*	**17724**

Sample Details					
Lab Sample ID:		**251124-120-1**	**251124-120-2**	**251124-120-3**	**251124-120-4**
Client Sample ID:					
Sample Date/Time		06/10/2025 15:30	06/10/2025 15:30	06/10/2025 15:30	06/10/2025 15:15
Description:		Clarks Beach CB-A	Clarks Beach CB-B	Clarks Beach CB-C	Clarks West CW-A
General Testing					
Total Solids	%	99.5	99.5	99.5	99.5
Metals					
Recoverable Metals by ICP-MS—Trace					
Arsenic (Recoverable Dry Wt.)	mg/kg	4.5	4.5	4.5	4.1
Cadmium (Recoverable Dry Wt.)	mg/kg	<0.09	<0.09	<0.089	<0.089
Chromium (Recoverable Dry Wt.)	mg/kg	7.3	7.7	7.4	4.8
Copper (Recoverable Dry Wt.)	mg/kg	1.3	1.5	1.4	1.0
Lead (Recoverable Dry Wt.)	mg/kg	2.5	2.7	2.5	2.2
Mercury (Recoverable Dry Wt.)	mg/kg	<0.045	<0.045	<0.045	<0.045
Nickel (Recoverable Dry Wt.)	mg/kg	3.2	3.3	3.1	2.1
Phosphorus (Recoverable Dry Wt.)	mg/kg	270	300	250	150
Zinc (Recoverable Dry Wt.)	mg/kg	21	28	21	23
Organics					
Total Carbon, Total Nitrogen and Total Sulfur (Dry Weight Basis) by Thermal Conductivity and/or Infrared Detection					
Total Nitrogen	% wt/wt	<0.093	<0.091	<0.095	<0.093
Total Organic Carbon (Dry Weight Basis) by Thermal Conductivity Detection					
Total Organic Carbon	% wt/wt	0.17	0.22	0.18	0.22

Sample Details					
Lab Sample ID:		**251124-120-5**	**251124-120-6**	**251124-120-7**	**251124-120-8**
Client Sample ID:					
Sample Date/Time		06/10/2025 15:15	06/10/2025 15:15	06/10/2025 15:15	06/10/2025 15:15
Description:		Clarks West CW-B	Clarks West CW-C	Lower Clarks Beach LCB-A	Lower Clarks Beach LCB-B
General Testing					
Total Solids	%	99.5	99.5	99.0	99.2
Metals					
Recoverable Metals by ICP-MS—Trace					
Arsenic (Recoverable Dry Wt.)	mg/kg	4.3	4.4	4.8	4.6
Cadmium (Recoverable Dry Wt.)	mg/kg	<0.089	<0.091	<0.088	<0.09
Chromium (Recoverable Dry Wt.)	mg/kg	4.9	5.0	6.7	5.7
Copper (Recoverable Dry Wt.)	mg/kg	1.0	1.1	1.5	1.3
Lead (Recoverable Dry Wt.)	mg/kg	2.2	2.4	3.0	2.6
Mercury (Recoverable Dry Wt.)	mg/kg	<0.044	<0.046	<0.044	<0.045
Nickel (Recoverable Dry Wt.)	mg/kg	1.9	2.2	3.0	2.6
Phosphorus (Recoverable Dry Wt.)	mg/kg	160	190	210	200
Zinc (Recoverable Dry Wt.)	mg/kg	14	15	20	19
Organics					
Total Carbon, Total Nitrogen and Total Sulfur (Dry Weight Basis) by Thermal Conductivity and/or Infrared Detection					
Total Nitrogen	% wt/wt	<0.097	<0.096	<0.098	<0.094

Sample Details (continued)		SOLIDS	SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		**251124-120-5**	**251124-120-6**	**251124-120-7**	**251124-120-8**
Client Sample ID:					
Sample Date/Time:		06/10/2025 15:15	06/10/2025 15:15	06/10/2025 15:15	06/10/2025 15:15
Description:		Clarks West CW-B	Clarks West CW-C	Lower Clarks Beach LCB-A	Lower Clarks Beach LCB-B
Organics					
Total Organic Carbon (Dry Weight Basis) by Thermal Conductivity Detection					
Total Organic Carbon	% wt/wt	0.20	0.21	0.28	0.26

Sample Details					
Lab Sample ID:		**251124-120-9**	**251124-120-10**	**251124-120-11**	**251124-120-12**
Client Sample ID:					
Sample Date/Time		06/10/2025 15:15	06/10/2025 16:15	06/10/2025 16:15	06/10/2025 16:15
Description:		Lower Clarks Beach LCB-C	Ngahere Nga-A	Ngahere Nga-B	Ngahere Nga-C
General Testing					
Total Solids	%	99.3	98.1	98.2	98.1
Metals					
Recoverable Metals by ICP-MS—Trace					
Arsenic (Recoverable Dry Wt.)	mg/kg	4.7	11	11	12
Cadmium (Recoverable Dry Wt.)	mg/kg	<0.089	<0.09	<0.09	<0.09
Chromium (Recoverable Dry Wt.)	mg/kg	6.3	13	14	14
Copper (Recoverable Dry Wt.)	mg/kg	1.4	4.1	4.2	4.3
Lead (Recoverable Dry Wt.)	mg/kg	2.9	7.3	7.3	7.4
Mercury (Recoverable Dry Wt.)	mg/kg	<0.045	<0.045	<0.045	<0.045
Nickel (Recoverable Dry Wt.)	mg/kg	2.8	6.2	6.3	6.4
Phosphorus (Recoverable Dry Wt.)	mg/kg	200	490	490	510
Zinc (Recoverable Dry Wt.)	mg/kg	19	45	45	47
Organics					
Total Carbon, Total Nitrogen and Total Sulfur (Dry Weight Basis) by Thermal Conductivity and/or Infrared Detection					
Total Nitrogen	% wt/wt	<0.093	0.14	0.14	0.13
Total Organic Carbon (Dry Weight Basis) by Thermal Conductivity Detection					
Total Organic Carbon	% wt/wt	0.25	1.1	1.0	1.0

Sample Details					
Lab Sample ID:		**251124-120-13**	**251124-120-14**	**251124-120-15**	**251124-120-16**
Client Sample ID:					
Sample Date/Time		10/10/2025 08:15	10/10/2025 08:15	10/10/2025 08:15	10/10/2025 08:15
Description:		Waiau Wai-A	Waiau Wai-B	Waiau Wai-C	Ohiku Creek OC-A
General Testing					
Total Solids	%	98.9	98.9	98.9	98.6
Metals					
Recoverable Metals by ICP-MS—Trace					
Arsenic (Recoverable Dry Wt.)	mg/kg	8.5	10	10	7.9
Cadmium (Recoverable Dry Wt.)	mg/kg	<0.091	<0.09	<0.089	<0.091
Chromium (Recoverable Dry Wt.)	mg/kg	7.9	9.2	9.8	8.8
Copper (Recoverable Dry Wt.)	mg/kg	2.3	3.0	3.0	2.9
Lead (Recoverable Dry Wt.)	mg/kg	5.2	6.1	6.4	4.9
Mercury (Recoverable Dry Wt.)	mg/kg	<0.046	<0.045	<0.045	<0.045
Nickel (Recoverable Dry Wt.)	mg/kg	3.5	4.1	4.3	4.2
Phosphorus (Recoverable Dry Wt.)	mg/kg	300	350	370	260
Zinc (Recoverable Dry Wt.)	mg/kg	28	33	34	27
Organics					
Total Carbon, Total Nitrogen and Total Sulfur (Dry Weight Basis) by Thermal Conductivity and/or Infrared Detection					
Total Nitrogen	% wt/wt	<0.093	<0.092	<0.093	<0.091
Total Organic Carbon (Dry Weight Basis) by Thermal Conductivity Detection					
Total Organic Carbon	% wt/wt	0.47	0.45	0.54	0.69

Sample Details					
Lab Sample ID:		**251124-120-17**	**251124-120-18**	**251124-120-19**	**251124-120-20**
Client Sample ID:					
Sample Date/Time		10/10/2025 08:15	10/10/2025 08:15	10/10/2025 07:45	10/10/2025 07:45
Description:		Ohiku Creek OC-B	Ohiku Creek OC-C	Rauau North RN-A	Rauau North RN-B
General Testing					
Total Solids	%	98.7	98.6	99.5	99.5
Metals					
Recoverable Metals by ICP-MS—Trace					
Arsenic (Recoverable Dry Wt.)	mg/kg	8.2	7.5	8.0	8.4
Cadmium (Recoverable Dry Wt.)	mg/kg	<0.09	<0.09	<0.09	<0.09
Chromium (Recoverable Dry Wt.)	mg/kg	9.1	8.2	8.2	8.0
Copper (Recoverable Dry Wt.)	mg/kg	3.1	2.9	2.6	2.4
Lead (Recoverable Dry Wt.)	mg/kg	5.1	4.7	5.3	5.3
Mercury (Recoverable Dry Wt.)	mg/kg	<0.045	<0.045	<0.045	<0.045
Nickel (Recoverable Dry Wt.)	mg/kg	4.4	4.1	3.8	3.5
Phosphorus (Recoverable Dry Wt.)	mg/kg	270	250	310	310
Zinc (Recoverable Dry Wt.)	mg/kg	28	25	29	28
Organics					
Total Carbon, Total Nitrogen and Total Sulfur (Dry Weight Basis) by Thermal Conductivity and/or Infrared Detection					
Total Nitrogen	% wt/wt	<0.09	<0.096	<0.092	<0.091
Total Organic Carbon (Dry Weight Basis) by Thermal Conductivity Detection					
Total Organic Carbon	% wt/wt	0.56	0.64	0.21	0.17

Sample Details					
Lab Sample ID:		**251124-120-21**	**251124-120-22**	**251124-120-23**	**251124-120-24**
Client Sample ID:					
Sample Date/Time		10/10/2025 07:45	10/10/2025 07:15	10/10/2025 07:15	10/10/2025 07:15
Description:		Rauau North RN-C	Tokaroa North TN-A	Tokaroa North TN-B	Tokaroa North TN-C
General Testing					
Total Solids	%	99.4	98.6	98.6	98.4
Metals					
Recoverable Metals by ICP-MS—Trace					
Arsenic (Recoverable Dry Wt.)	mg/kg	8.4	4.1	4.1	3.9
Cadmium (Recoverable Dry Wt.)	mg/kg	<0.089	<0.089	<0.089	<0.089
Chromium (Recoverable Dry Wt.)	mg/kg	8.5	3.3	3.7	3.7
Copper (Recoverable Dry Wt.)	mg/kg	2.6	0.67	0.74	0.78
Lead (Recoverable Dry Wt.)	mg/kg	5.6	2.3	2.4	2.3
Mercury (Recoverable Dry Wt.)	mg/kg	<0.044	<0.045	<0.045	<0.045
Nickel (Recoverable Dry Wt.)	mg/kg	3.9	1.1	1.3	1.4
Phosphorus (Recoverable Dry Wt.)	mg/kg	330	100	110	110
Zinc (Recoverable Dry Wt.)	mg/kg	30	9.6	11	11
Organics					
Total Carbon, Total Nitrogen and Total Sulfur (Dry Weight Basis) by Thermal Conductivity and/or Infrared Detection					
Total Nitrogen	% wt/wt	<0.087	<0.096	<0.094	<0.092
Total Organic Carbon (Dry Weight Basis) by Thermal Conductivity Detection					
Total Organic Carbon	% wt/wt	0.20	0.52	0.61	0.73

Sample Details				
Lab Sample ID:		**251124-120-25**	**251124-120-26**	**251124-120-27**
Client Sample ID:				
Sample Date/Time		10/10/2025 07:15	10/10/2025 07:15	10/10/2025 07:15
Description:		Wairoa Point WP-A	Wairoa Point WP-B	Wairoa Point WP-C
General Testing				
Total Solids	%	99.1	98.9	99.1
Metals				
Recoverable Metals by ICP-MS—Trace				
Arsenic (Recoverable Dry Wt.)	mg/kg	6.4	6.6	6.7
Cadmium (Recoverable Dry Wt.)	mg/kg	<0.09	<0.09	<0.091
Chromium (Recoverable Dry Wt.)	mg/kg	6.0	5.4	5.7
Copper (Recoverable Dry Wt.)	mg/kg	1.4	1.3	1.4
Lead (Recoverable Dry Wt.)	mg/kg	4.0	3.8	4.0
Mercury (Recoverable Dry Wt.)	mg/kg	<0.045	<0.045	<0.046

Sample Details (continued)		SOLIDS	SOLIDS	SOLIDS
Lab Sample ID:		**251124-120-25**	**251124-120-26**	**251124-120-27**
Client Sample ID:				
Sample Date/Time:		10/10/2025 07:15	10/10/2025 07:15	10/10/2025 07:15
Description:		Wairoa Point WP-A	Wairoa Point WP-B	Wairoa Point WP-C
Metals				
Recoverable Metals by ICP-MS—Trace				
Nickel (Recoverable Dry Wt.)	mg/kg	2.3	2.2	2.3
Phosphorus (Recoverable Dry Wt.)	mg/kg	190	190	200
Zinc (Recoverable Dry Wt.)	mg/kg	20	18	19
Organics				
Total Carbon, Total Nitrogen and Total Sulfur (Dry Weight Basis) by Thermal Conductivity and/or Infrared Detection				
Total Nitrogen	% wt/wt	<0.093	<0.09	<0.099
Total Organic Carbon (Dry Weight Basis) by Thermal Conductivity Detection				
Total Organic Carbon	% wt/wt	0.26	0.28	0.32

*Results marked with * are not accredited to International Accreditation New Zealand. A dash indicates no test performed.*

Where samples have been supplied by the client, they are tested as received.
The results of analysis contained in this report relate only to the sample(s) tested. Where sample collection was performed by the laboratory, the results of analysis contained in this report relate only to the sample(s) collected.

Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

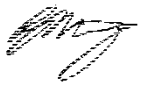
Analyte	Method Reference	MDL	Samples	Location
General Testing				
Total Solids by Gravimetry	APHA (online edition) 2540 G	0.1 %	All	Auckland
Metals				
Recoverable Metals by ICP-MS—Trace				
Arsenic (Recoverable Dry Wt.)	APHA (online edition) 3125 B by ICPMS	0.02 mg/kg	All	Auckland
Cadmium (Recoverable Dry Wt.)	APHA (online edition) 3125 B by ICPMS	0.01 mg/kg	All	Auckland
Chromium (Recoverable Dry Wt.)	APHA (online edition) 3125 B by ICPMS	0.05 mg/kg	All	Auckland
Copper (Recoverable Dry Wt.)	APHA (online edition) 3125 B by ICPMS	0.05 mg/kg	All	Auckland
Lead (Recoverable Dry Wt.)	APHA (online edition) 3125 B by ICPMS	0.03 mg/kg	All	Auckland
Mercury (Recoverable Dry Wt.)	APHA (online edition) 3125 B by ICPMS	0.005 mg/kg	All	Auckland
Nickel (Recoverable Dry Wt.)	APHA (online edition) 3125 B by ICPMS	0.05 mg/kg	All	Auckland
Phosphorus (Recoverable Dry Wt.)	APHA (online edition) 3125 B by ICPMS	2 mg/kg	All	Auckland
Zinc (Recoverable Dry Wt.)	APHA (online edition) 3125 B by ICPMS	0.75 mg/kg	All	Auckland
Organics				
Total Carbon, Total Nitrogen and Total Sulfur (Dry Weight Basis) by Thermal Conductivity and/or Infrared Detection				
Total Nitrogen	Dumas Catalytic Combustion (1150°C), Thermal Conductivity and/or Infrared Detector	0.05 % wt/wt	All	Auckland
Total Organic Carbon (Dry Weight Basis) by Thermal Conductivity Detection				
Total Organic Carbon	Dumas Catalytic Combustion (1150°C), Thermal Conductivity Detector	0.05 % wt/wt	All	Auckland
Preparations				
Digest for Recoverable Metals in Solids	US EPA 200.8 (1:1 Nitric:Hydrochloric Acid)		All	Auckland
Drying and Milling	US EPA 200.8		All	Auckland
Solids Sample Drying	In-house (dried 35°C: <2mm fraction) May contain a residual moisture content of 2-5%.		All	Auckland
Solids Sample Preparation for Total Organic Carbon	In-house (acidified: dried 60°C) May contain a residual moisture content of 2-5%.		All	Auckland

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Compliance and Projects Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Robyn Abernethy
Compliance and Projects Manager

11.4 BENTHIC MACROFAUNA MEAN COUNTS

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Ohiku Creek	West	Annelida	Clitellata		Oligochaeta	0.3333
Ohiku Creek	West	Annelida	Polychaeta	Capitellidae	*Heteromastus filiformis*	11.3333
Ohiku Creek	West	Annelida	Polychaeta	Cirratulidae	*Cirratulia* sp.	0.0833
Ohiku Creek	West	Annelida	Polychaeta	Glyceridae	*Glycera ovigera*	0.3333
Ohiku Creek	West	Annelida	Polychaeta	Hesionidae	*Oxydromus angustifrons*	0.0833
Ohiku Creek	West	Annelida	Polychaeta	Magelonidae	*Magelona dakini*	0.4167
Ohiku Creek	West	Annelida	Polychaeta	Maldanidae	*Macroclymenella stewartensis*	0.75
Ohiku Creek	West	Annelida	Polychaeta	Nereididae	*Nicon aestuariensis*	0.1667
Ohiku Creek	West	Annelida	Polychaeta	Nereididae	*Perinereis vallata*	0.5
Ohiku Creek	West	Annelida	Polychaeta	Opheliidae	*Armandia maculata*	0.3333
Ohiku Creek	West	Annelida	Polychaeta	Orbiniidae	*Scoloplos cylindrifer*	0.0833
Ohiku Creek	West	Annelida	Polychaeta	Oweniidae	*Owenia petersenae*	0.0833
Ohiku Creek	West	Annelida	Polychaeta	Paraonidae	*Aricidea* sp	0.0833
Ohiku Creek	West	Annelida	Polychaeta	Paraonidae	*Paradoneis lyra*	1.0833
Ohiku Creek	West	Annelida	Polychaeta	Pectinariidae	*Lagis australis*	0.5
Ohiku Creek	West	Annelida	Polychaeta	Polynoidae	*Lepidastheniella comma*	0.0833
Ohiku Creek	West	Annelida	Polychaeta	Spionidae	*Aonides trifida*	6.6667
Ohiku Creek	West	Annelida	Polychaeta	Spionidae	*Boccardia syrtis*	0.0833
Ohiku Creek	West	Annelida	Polychaeta	Spionidae	*Prionospio aucklandica*	7.4167
Ohiku Creek	West	Annelida	Polychaeta	Spionidae	*Pseudopolydora paucibranchiata*	0.1667
Ohiku Creek	West	Annelida	Polychaeta	Spionidae	*Scolecolepides benhami*	0.3333
Ohiku Creek	West	Annelida	Polychaeta	Syllidae	*Sphaerosyllis semiverrucosa*	0.4167
Ohiku Creek	West	Annelida	Polychaeta	Terebellidae	Terebellidae	0.0833

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Ohiku Creek	West	Arthropoda	Malacostraca	Diastylidae	*Colurostylis lemurum*	0.5833
Ohiku Creek	West	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus varius*	0.0833
Ohiku Creek	West	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus whitei*	1
Ohiku Creek	West	Arthropoda	Malacostraca	Macrophthalmidae	*Hemiplax hirtipes*	1
Ohiku Creek	West	Arthropoda	Malacostraca	Paracalliopidae	*Paracalliope novizealandiae*	0.75
Ohiku Creek	West	Arthropoda	Malacostraca	Phoxocephalidae	*Torridoharpinia hurleyi*	1.0833
Ohiku Creek	West	Arthropoda	Malacostraca	Sphaeromatidae	*Exosphaeroma planulum*	0.5833
Ohiku Creek	West	Arthropoda	Malacostraca	Sphaeromatidae	*Isocladus* sp.	0.0833
Ohiku Creek	West	Arthropoda	Malacostraca	Varunidae	*Austrohelice crassa*	0.1667
Ohiku Creek	West	Arthropoda	Maxillopoda	Balanomorpha	*Austrominius modestus*	0.0833
Ohiku Creek	West	Cnidaria	Anthozoa	Actiniidae	*Anthopleura aureoradiata*	3.25
Ohiku Creek	West	Mollusca	Bivalvia	Lasaeidae	*Arthritica bifurca*	4.6667
Ohiku Creek	West	Mollusca	Bivalvia	Mesodesmatidae	*Paphies australis*	0.0833
Ohiku Creek	West	Mollusca	Bivalvia	Mytilidae	*Arcuatula senhousia*	0.1667
Ohiku Creek	West	Mollusca	Bivalvia	Nuculidae	*Linucula hartvigiana*	43.75
Ohiku Creek	West	Mollusca	Bivalvia	Tellinidae	*Macomona liliana*	4.8333
Ohiku Creek	West	Mollusca	Bivalvia	Veneridae	*Austrovenus stutchburyi*	26.0833
Ohiku Creek	West	Mollusca	Gastropoda	Batillariidae	*Zeacumantus lutulentus*	0.25
Ohiku Creek	West	Mollusca	Gastropoda	Lottidae	*Notoacmea scapha*	9.1667
Ohiku Creek	West	Mollusca	Gastropoda	Nassariidae	*Tritia burchardi*	0.0833
Ohiku Creek	West	Mollusca	Gastropoda	Pyramidellidae	*Turbonilla* sp.	0.1667
Ohiku Creek	West	Mollusca	Gastropoda	Trochidae	*Diloma subrostrata*	0.3333
Ohiku Creek	West	Mollusca	Polyplacophora	Chitonidae	*Chiton glaucus*	0.1667
Ohiku Creek	West	Nemertea			Nemertean	0.4167
Ohiku Creek	West	Sipuncula			Sipuncula	0.0833
Rauau North	West	Annelida	Clitellata		Oligochaeta	0.1667

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Rauau North	West	Annelida	Polychaeta	Capitellidae	*Heteromastus filiformis*	6.9167
Rauau North	West	Annelida	Polychaeta	Cirratulidae	*Cirratulia* sp.	2.1667
Rauau North	West	Annelida	Polychaeta	Glyceridae	*Glycera ovigera*	0.1667
Rauau North	West	Annelida	Polychaeta	Maldanidae	*Macroclymenella stewartensis*	0.3333
Rauau North	West	Annelida	Polychaeta	Nephtyidae	*Ceratonereis* sp.	0.6667
Rauau North	West	Annelida	Polychaeta	Nereididae	*Nicon aestuariensis*	0.4167
Rauau North	West	Annelida	Polychaeta	Nereididae	*Perinereis vallata*	0.0833
Rauau North	West	Annelida	Polychaeta	Nereididae	*Platynereis australis*	0.0833
Rauau North	West	Annelida	Polychaeta	Opheliidae	*Armandia maculata*	0.0833
Rauau North	West	Annelida	Polychaeta	Orbiniidae	*Scoloplos cylindrifer*	0.0833
Rauau North	West	Annelida	Polychaeta	Paraonidae	*Aricidea* sp.	0.25
Rauau North	West	Annelida	Polychaeta	Paraonidae	*Paradoneis lyra*	0.5833
Rauau North	West	Annelida	Polychaeta	Pectinariidae	*Lagis australis*	0.0833
Rauau North	West	Annelida	Polychaeta	Phyllodocidae	*Eteone platycephala*	0.0833
Rauau North	West	Annelida	Polychaeta	Spionidae	*Aonides trifida*	21.25
Rauau North	West	Annelida	Polychaeta	Spionidae	*Boccardia syrtis*	0.0833
Rauau North	West	Annelida	Polychaeta	Spionidae	*Prionospio aucklandica*	20.9167
Rauau North	West	Annelida	Polychaeta	Spionidae	*Prionospio yuriel*	0.0833
Rauau North	West	Annelida	Polychaeta	Spionidae	*Pseudopolydora paucibranchiata*	0.75
Rauau North	West	Annelida	Polychaeta	Spionidae	*Scolecolepides benhami*	0.5
Rauau North	West	Annelida	Polychaeta	Syllidae	Exogoninae (not Sphaerosyllis)	0.9167
Rauau North	West	Annelida	Polychaeta	Syllidae	*Sphaerosyllis semiverrucosa*	0.8333
Rauau North	West	Arthropoda	Malacostraca	Diastylidae	*Colurostylis lemurum*	0.25
Rauau North	West	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus whitei*	1
Rauau North	West	Arthropoda	Malacostraca	Macrophthalmidae	*Hemiplax hirtipes*	0.9167
Rauau North	West	Arthropoda	Malacostraca	Paracalliopidae	*Paracalliope novizealandiae*	0.9167

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Rauau North	West	Arthropoda	Malacostraca	Phoxocephalidae	*Torridoharpinia hurleyi*	1.8333
Rauau North	West	Arthropoda	Malacostraca	Sphaeromatidae	*Exosphaeroma planulum*	1.1667
Rauau North	West	Arthropoda	Malacostraca	Varunidae	*Austrohelice crassa*	0.25
Rauau North	West	Arthropoda	Maxillopoda	Balanomorpha	*Austrominius modestus*	0.25
Rauau North	West	Cnidaria	Anthozoa	Actiniidae	*Anthopleura aureoradiata*	6.0833
Rauau North	West	Mollusca	Bivalvia	Lasaeidae	*Arthritica bifurca*	5
Rauau North	West	Mollusca	Bivalvia	Mesodesmatidae	*Paphies australis*	0.3333
Rauau North	West	Mollusca	Bivalvia	Mytilidae	*Arcuatula senhousia*	0.0833
Rauau North	West	Mollusca	Bivalvia	Nuculidae	*Linucula hartvigiana*	52.75
Rauau North	West	Mollusca	Bivalvia	Tellinidae	*Macomona liliana*	3.0833
Rauau North	West	Mollusca	Bivalvia	Veneridae	*Austrovenus stutchburyi*	29.5
Rauau North	West	Mollusca	Gastropoda	Batillariidae	*Zeacumantus lutulentus*	2.1667
Rauau North	West	Mollusca	Gastropoda	Cominellidae	*Cominella glandiformis*	1
Rauau North	West	Mollusca	Gastropoda	Lottidae	*Notoacmea scapha*	19.5
Rauau North	West	Mollusca	Gastropoda	Muricidae	*Xymene* sp.	0.0833
Rauau North	West	Mollusca	Gastropoda	Nassariidae	*Tritia burchardi*	0.25
Rauau North	West	Mollusca	Gastropoda	Pyramidellidae	*Turbonilla* sp.	0.0833
Rauau North	West	Mollusca	Gastropoda	Trochidae	*Diloma subrostrata*	0.9167
Rauau North	West	Mollusca	Gastropoda		Nudibranchia	0.25
Rauau North	West	Nemertea			Nemertean	0.75
Tokaroa North	West	Annelida	Clitellata		Oligochaeta	3.1667
Tokaroa North	West	Annelida	Polychaeta	Capitellidae	*Capitella* spp.	0.1667
Tokaroa North	West	Annelida	Polychaeta	Capitellidae	*Heteromastus filiformis*	16.5833
Tokaroa North	West	Annelida	Polychaeta	Cossuridae	*Cossura consimilis*	0.0833
Tokaroa North	West	Annelida	Polychaeta	Dorvilleidae	Dorvilleidae	0.0833
Tokaroa North	West	Annelida	Polychaeta	Glyceridae	*Glycera ovigera*	0.6667

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Tokaroa North	West	Annelida	Polychaeta	Hesionidae	Hesionidae	0.0833
Tokaroa North	West	Annelida	Polychaeta	Magelonidae	*Magelona dakini*	4.0833
Tokaroa North	West	Annelida	Polychaeta	Maldanidae	*Macroclymenella stewartensis*	0.6667
Tokaroa North	West	Annelida	Polychaeta	Nephtyidae	*Ceratonereis* sp.	0.1667
Tokaroa North	West	Annelida	Polychaeta	Nereididae	*Perinereis vallata*	0.5
Tokaroa North	West	Annelida	Polychaeta	Opheliidae	*Armandia maculata*	0.0833
Tokaroa North	West	Annelida	Polychaeta	Orbiniidae	*Scoloplos cylindrifer*	0.8333
Tokaroa North	West	Annelida	Polychaeta	Oweniidae	*Owenia petersenae*	1.4167
Tokaroa North	West	Annelida	Polychaeta	Paraonidae	*Aricidea* sp.	0.3333
Tokaroa North	West	Annelida	Polychaeta	Paraonidae	*Paradoneis lyra*	3.8333
Tokaroa North	West	Annelida	Polychaeta	Pectinariidae	*Lagis australis*	0.0833
Tokaroa North	West	Annelida	Polychaeta	Spionidae	*Aonides trifida*	7.9167
Tokaroa North	West	Annelida	Polychaeta	Spionidae	*Boccardia acus*	0.0833
Tokaroa North	West	Annelida	Polychaeta	Spionidae	*Prionospio aucklandica*	2.0833
Tokaroa North	West	Annelida	Polychaeta	Spionidae	*Prionospio ehlersi*	0.0833
Tokaroa North	West	Annelida	Polychaeta	Spionidae	*Pseudopolydora paucibranchiata*	0.0833
Tokaroa North	West	Annelida	Polychaeta	Spionidae	*Scolecolepides benhami*	0.25
Tokaroa North	West	Annelida	Polychaeta	Syllidae	Exogoninae (not Sphaerosyllis)	0.0833
Tokaroa North	West	Annelida	Polychaeta	Syllidae	*Sphaerosyllis semiverrucosa*	2.75
Tokaroa North	West	Arthropoda	Malacostraca	Diastylidae	*Colurostylis lemurum*	9.4167
Tokaroa North	West	Arthropoda	Malacostraca	Exoedicerotidae	*Methalimedon* sp.	0.4167
Tokaroa North	West	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus whitei*	0.4167
Tokaroa North	West	Arthropoda	Malacostraca	Melitidae	*Melita awa*	0.0833
Tokaroa North	West	Arthropoda	Malacostraca	Paracalliopidae	*Paracalliope novizealandiae*	0.8333
Tokaroa North	West	Arthropoda	Malacostraca	Phoxocephalidae	*Torridoharpinia hurleyi*	0.75
Tokaroa North	West	Arthropoda	Malacostraca	Sphaeromatidae	*Exosphaeroma planulum*	0.0833

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Tokaroa North	West	Cnidaria	Anthozoa	Actiniidae	*Anthopleura aureoradiata*	2.5
Tokaroa North	West	Mollusca	Bivalvia	Lasaeidae	*Arthritica bifurca*	5.9167
Tokaroa North	West	Mollusca	Bivalvia	Mactridae	*Cyclomactra ovata*	0.0833
Tokaroa North	West	Mollusca	Bivalvia	Mytilidae	*Arcuatula senhousia*	72.75
Tokaroa North	West	Mollusca	Bivalvia	Nuculidae	*Linucula hartvigiana*	20.0833
Tokaroa North	West	Mollusca	Bivalvia	Semelidae	*Theora lubrica*	0.0833
Tokaroa North	West	Mollusca	Bivalvia	Tellinidae	*Macomona liliana*	4.9167
Tokaroa North	West	Mollusca	Bivalvia	Veneridae	*Austrovenus stutchburyi*	34.6667
Tokaroa North	West	Mollusca	Gastropoda	Cominellidae	*Cominella glandiformis*	0.3333
Tokaroa North	West	Mollusca	Gastropoda	Lottidae	*Notoacmea scapha*	0.25
Tokaroa North	West	Mollusca	Gastropoda	Nassariidae	*Tritia burchardi*	0.5833
Tokaroa North	West	Nemertea			Nemertean	1.6667
Tokaroa North	West	Phoronida			Phoronida	0.25
Wairoa Point	West	Annelida	Clitellata		Oligochaeta	1.0833
Wairoa Point	West	Annelida	Polychaeta	Capitellidae	*Heteromastus filiformis*	10.3333
Wairoa Point	West	Annelida	Polychaeta	Cossuridae	*Cossura consimilis*	1.6667
Wairoa Point	West	Annelida	Polychaeta	Dorvilleidae	Dorvilleidae	0.0833
Wairoa Point	West	Annelida	Polychaeta	Glyceridae	*Glycera ovigera*	0.1667
Wairoa Point	West	Annelida	Polychaeta	Magelonidae	*Magelona dakini*	4.5833
Wairoa Point	West	Annelida	Polychaeta	Maldanidae	*Macroclymenella stewartensis*	0.4167
Wairoa Point	West	Annelida	Polychaeta	Nephtyidae	*Ceratonereis* sp.	0.1667
Wairoa Point	West	Annelida	Polychaeta	Nereididae	*Nicon aestuariensis*	0.4167
Wairoa Point	West	Annelida	Polychaeta	Nereididae	*Perinereis vallata*	0.1667
Wairoa Point	West	Annelida	Polychaeta	Opheliidae	*Armandia maculata*	0.0833
Wairoa Point	West	Annelida	Polychaeta	Orbiniidae	*Scoloplos cylindrifer*	0.3333
Wairoa Point	West	Annelida	Polychaeta	Oweniidae	*Owenia petersenae*	0.5

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Wairoa Point	West	Annelida	Polychaeta	Paraonidae	*Aricidea* sp.	0.5
Wairoa Point	West	Annelida	Polychaeta	Paraonidae	*Paradoneis lyra*	2.75
Wairoa Point	West	Annelida	Polychaeta	Pectinariidae	*Lagis australis*	0.3333
Wairoa Point	West	Annelida	Polychaeta	Spionidae	*Aonides trifida*	2
Wairoa Point	West	Annelida	Polychaeta	Spionidae	*Prionospio aucklandica*	1.3333
Wairoa Point	West	Annelida	Polychaeta	Spionidae	*Pseudopolydora paucibranchiata*	0.0833
Wairoa Point	West	Annelida	Polychaeta	Syllidae	Exogoninae (not Sphaerosyllis)	0.0833
Wairoa Point	West	Arthropoda	Malacostraca	Diastylidae	*Colurostylis lemurum*	9.4167
Wairoa Point	West	Arthropoda	Malacostraca	Exoedicerotidae	*Methalimedon* sp.	0.5833
Wairoa Point	West	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus whitei*	0.5833
Wairoa Point	West	Arthropoda	Malacostraca	Macrophthalmidae	*Hemiplax hirtipes*	0.5
Wairoa Point	West	Arthropoda	Malacostraca	Paracalliopidae	*Paracalliope novizealandiae*	2.3333
Wairoa Point	West	Arthropoda	Malacostraca	Phoxocephalidae	Phoxocephalidae other	0.25
Wairoa Point	West	Arthropoda	Malacostraca	Phoxocephalidae	*Torridoharpinia hurleyi*	2.4167
Wairoa Point	West	Cnidaria	Anthozoa	Actiniidae	*Anthopleura aureoradiata*	0.8333
Wairoa Point	West	Mollusca	Bivalvia	Lasaeidae	*Arthritica bifurca*	2
Wairoa Point	West	Mollusca	Bivalvia	Mactridae	*Cyclomactra ovata*	0.1667
Wairoa Point	West	Mollusca	Bivalvia	Mytilidae	*Arcuatula senhousia*	25.0833
Wairoa Point	West	Mollusca	Bivalvia	Nuculidae	*Linucula hartvigiana*	16.9167
Wairoa Point	West	Mollusca	Bivalvia	Semelidae	*Theora lubrica*	0.1667
Wairoa Point	West	Mollusca	Bivalvia	Tellinidae	*Macomona liliana*	6.1667
Wairoa Point	West	Mollusca	Bivalvia	Veneridae	*Austrovenus stutchburyi*	16.75
Wairoa Point	West	Mollusca	Gastropoda	Batillariidae	*Zeacumantus lutulentus*	0.1667
Wairoa Point	West	Mollusca	Gastropoda	Cominellidae	*Cominella glandiformis*	0.25
Wairoa Point	West	Mollusca	Gastropoda	Nassariidae	*Tritia burchardi*	0.5
Wairoa Point	West	Nemertea			Nemertean	0.0833

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Wairoa Point	West	Phoronida			Phoronida	0.0833
Waiau	East	Annelida	Clitellata		Oligochaeta	5.75
Waiau	East	Annelida	Polychaeta	Capitellidae	*Heteromastus filiformis*	14.5833
Waiau	East	Annelida	Polychaeta	Cirratulidae	*Cirratulia* sp.	0.25
Waiau	East	Annelida	Polychaeta	Cossuridae	*Cossura consimilis*	2.75
Waiau	East	Annelida	Polychaeta	Magelonidae	*Magelona dakini*	0.4167
Waiau	East	Annelida	Polychaeta	Maldanidae	*Macroclymenella stewartensis*	1.6667
Waiau	East	Annelida	Polychaeta	Nereididae	*Nicon aestuariensis*	0.3333
Waiau	East	Annelida	Polychaeta	Nereididae	*Perinereis vallata*	0.3333
Waiau	East	Annelida	Polychaeta	Nereididae	*Platynereis australis*	0.0833
Waiau	East	Annelida	Polychaeta	Paraonidae	*Aricidea* sp.	0.1667
Waiau	East	Annelida	Polychaeta	Paraonidae	*Paradoneis lyra*	7.6667
Waiau	East	Annelida	Polychaeta	Pectinariidae	*Lagis australis*	0.1667
Waiau	East	Annelida	Polychaeta	Spionidae	*Aonides trifida*	9.75
Waiau	East	Annelida	Polychaeta	Spionidae	*Boccardia syrtis*	0.1667
Waiau	East	Annelida	Polychaeta	Spionidae	*Prionospio aucklandica*	19.3333
Waiau	East	Annelida	Polychaeta	Spionidae	*Pseudopolydora paucibranchiata*	0.3333
Waiau	East	Annelida	Polychaeta	Spionidae	*Scolecolepides benhami*	0.0833
Waiau	East	Annelida	Polychaeta	Syllidae	Exogoninae (not Sphaerosyllis)	0.3333
Waiau	East	Annelida	Polychaeta	Syllidae	*Sphaerosyllis semiverrucosa*	1.6667
Waiau	East	Arthropoda	Malacostraca	Diastylidae	*Colurostylis lemurum*	0.75
Waiau	East	Arthropoda	Malacostraca	Exoedicerotidae	*Methalimedon* sp.	0.1667
Waiau	East	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus varius*	0.4167
Waiau	East	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus whitei*	1.6667
Waiau	East	Arthropoda	Malacostraca	Macrophthalmidae	*Hemiplax hirtipes*	0.9167
Waiau	East	Arthropoda	Malacostraca	Paracalliopidae	*Paracalliope novizealandiae*	4

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Waiau	East	Arthropoda	Malacostraca	Phoxocephalidae	*Torridoharpinia hurleyi*	3.25
Waiau	East	Arthropoda	Malacostraca	Sphaeromatidae	*Exosphaeroma planulum*	0.5833
Waiau	East	Arthropoda	Malacostraca		Mysida	0.1667
Waiau	East	Arthropoda	Maxillopoda	Balanomorpha	*Austrominius modestus*	0.0833
Waiau	East	Cnidaria	Anthozoa	Actiniidae	*Anthopleura aureoradiata*	0.4167
Waiau	East	Mollusca	Bivalvia	Lasaeidae	*Arthritica bifurca*	5.25
Waiau	East	Mollusca	Bivalvia	Mytilidae	*Arcuatula senhousia*	0.0833
Waiau	East	Mollusca	Bivalvia	Nuculidae	*Linucula hartvigiana*	40.3333
Waiau	East	Mollusca	Bivalvia	Semelidae	*Theora lubrica*	0.5833
Waiau	East	Mollusca	Bivalvia	Tellinidae	*Macomona liliana*	3.6667
Waiau	East	Mollusca	Bivalvia	Veneridae	*Austrovenus stutchburyi*	40.9167
Waiau	East	Mollusca	Gastropoda	Batillariidae	*Zeacumantus lutulentus*	1.25
Waiau	East	Mollusca	Gastropoda	Cominellidae	*Cominella glandiformis*	0.0833
Waiau	East	Mollusca	Gastropoda	Lottidae	*Notoacmea scapha*	4.4167
Waiau	East	Mollusca	Gastropoda	Nassariidae	*Tritia burchardi*	0.4167
Waiau	East	Mollusca	Gastropoda	Pyramidellidae	*Turbonilla* sp.	0.1667
Waiau	East	Mollusca	Gastropoda	Trochidae	*Diloma subrostrata*	0.3333
Waiau	East	Nemertea			Nemertean	1.25
Waiau	East	Platyhelminthes	Rhabditophora	Stylochidae	Stylochidae	0.1667
Ngahere	East	Annelida	Clitellata		Oligochaeta	7.3333
Ngahere	East	Annelida	Polychaeta	Capitellidae	*Heteromastus filiformis*	7.1667
Ngahere	East	Annelida	Polychaeta	Cirratulidae	*Cirratulia* sp.	0.25
Ngahere	East	Annelida	Polychaeta	Cossuridae	*Cossura consimilis*	13.5833
Ngahere	East	Annelida	Polychaeta	Glyceridae	*Glycera ovigera*	0.1667
Ngahere	East	Annelida	Polychaeta	Goniadidae	*Glycinde trifida*	0.1667
Ngahere	East	Annelida	Polychaeta	Magelonidae	*Magelona dakini*	0.6667

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Ngahere	East	Annelida	Polychaeta	Nereididae	*Nicon aestuariensis*	1.1667
Ngahere	East	Annelida	Polychaeta	Opheliidae	*Armandia maculata*	0.0833
Ngahere	East	Annelida	Polychaeta	Paraonidae	*Aricidea* sp.	0.0833
Ngahere	East	Annelida	Polychaeta	Paraonidae	*Paradoneis lyra*	6.8333
Ngahere	East	Annelida	Polychaeta	Pectinariidae	*Lagis australis*	0.4167
Ngahere	East	Annelida	Polychaeta	Spionidae	*Aonides trifida*	0.0833
Ngahere	East	Annelida	Polychaeta	Spionidae	*Prionospio aucklandica*	12.1667
Ngahere	East	Annelida	Polychaeta	Spionidae	*Pseudopolydora paucibranchiata*	0.3333
Ngahere	East	Annelida	Polychaeta	Spionidae	*Scolecolepides benhami*	0.0833
Ngahere	East	Annelida	Polychaeta	Syllidae	*Sphaerosyllis semiverrucosa*	0.1667
Ngahere	East	Arthropoda	Malacostraca	Alpheidae	Alpheidae	0.0833
Ngahere	East	Arthropoda	Malacostraca	Diastylidae	*Colurostylis lemurum*	1.25
Ngahere	East	Arthropoda	Malacostraca	Exoedicerotidae	*Methalimedon* sp.	0.0833
Ngahere	East	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus whitei*	0.1667
Ngahere	East	Arthropoda	Malacostraca	Macrophthalmidae	*Hemiplax hirtipes*	1.3333
Ngahere	East	Arthropoda	Malacostraca	Paracalliopidae	*Paracalliope novizealandiae*	1.1667
Ngahere	East	Arthropoda	Malacostraca	Phoxocephalidae	*Torridoharpinia hurleyi*	2.8333
Ngahere	East	Arthropoda	Malacostraca	Sphaeromatidae	*Exosphaeroma planulum*	0.0833
Ngahere	East	Arthropoda	Malacostraca		Mysida	0.25
Ngahere	East	Arthropoda	Maxillopoda	Balanomorpha	*Austrominius modestus*	0.0833
Ngahere	East	Mollusca	Bivalvia	Lasaeidae	*Arthritica bifurca*	2.75
Ngahere	East	Mollusca	Bivalvia	Mactridae	*Cyclomactra ovata*	0.25
Ngahere	East	Mollusca	Bivalvia	Mytilidae	*Arcuatula senhousia*	0.1667
Ngahere	East	Mollusca	Bivalvia	Nuculidae	*Linucula hartvigiana*	2.9167
Ngahere	East	Mollusca	Bivalvia	Semelidae	*Theora lubrica*	2.9167
Ngahere	East	Mollusca	Bivalvia	Tellinidae	*Macomona liliana*	2.75

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Ngahere	East	Mollusca	Bivalvia	Veneridae	*Austrovenus stutchburyi*	45.6667
Ngahere	East	Mollusca	Gastropoda	Batillariidae	*Zeacumantus lutulentus*	0.0833
Ngahere	East	Mollusca	Gastropoda	Cominellidae	*Cominella adspersa*	0.0833
Ngahere	East	Mollusca	Gastropoda	Cominellidae	*Cominella glandiformis*	0.0833
Ngahere	East	Mollusca	Gastropoda	Lottidae	*Notoacmea scapha*	0.5
Ngahere	East	Mollusca	Gastropoda	Nassariidae	*Tritia burchardi*	1.3333
Ngahere	East	Mollusca	Gastropoda	Philinidae	*Philine* sp.	0.0833
Ngahere	East	Mollusca	Gastropoda	Trochidae	*Diloma subrostrata*	0.1667
Ngahere	East	Nemertea			Nemertean	0.6667
Ngahere	East	Platyhelminthes	Rhabditophora	Stylochidae	Stylochidae	0.0833
Clarks West	East	Annelida	Clitellata		Oligochaeta	1.6667
Clarks West	East	Annelida	Polychaeta	Capitellidae	*Capitella* spp.	0.3333
Clarks West	East	Annelida	Polychaeta	Capitellidae	*Heteromastus filiformis*	11.25
Clarks West	East	Annelida	Polychaeta	Cirratulidae	*Cirratulia* sp.	0.5833
Clarks West	East	Annelida	Polychaeta	Cossuridae	*Cossura consimilis*	0.25
Clarks West	East	Annelida	Polychaeta	Dorvilleidae	Dorvilleidae	0.1667
Clarks West	East	Annelida	Polychaeta	Glyceridae	*Glycera ovigera*	0.0833
Clarks West	East	Annelida	Polychaeta	Goniadidae	*Glycinde trifida*	0.0833
Clarks West	East	Annelida	Polychaeta	Hesionidae	*Oxydromus angustifrons*	0.0833
Clarks West	East	Annelida	Polychaeta	Magelonidae	*Magelona dakini*	3
Clarks West	East	Annelida	Polychaeta	Maldanidae	*Macroclymenella stewartensis*	3.1667
Clarks West	East	Annelida	Polychaeta	Nephtyidae	*Ceratonereis* sp.	0.0833
Clarks West	East	Annelida	Polychaeta	Nereididae	*Nicon aestuariensis*	0.1667
Clarks West	East	Annelida	Polychaeta	Onuphidae	*Onuphis aucklandensis*	0.0833
Clarks West	East	Annelida	Polychaeta	Opheliidae	*Armandia maculata*	0.3333
Clarks West	East	Annelida	Polychaeta	Oweniidae	*Owenia petersenae*	2.8333

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Clarks West	East	Annelida	Polychaeta	Paraonidae	*Aricidea* sp.	0.1667
Clarks West	East	Annelida	Polychaeta	Paraonidae	*Paradoneis lyra*	1.0833
Clarks West	East	Annelida	Polychaeta	Pectinariidae	*Lagis australis*	0.0833
Clarks West	East	Annelida	Polychaeta	Sabellidae	*Sabellidae*	0.0833
Clarks West	East	Annelida	Polychaeta	Spionidae	*Aonides trifida*	93.1667
Clarks West	East	Annelida	Polychaeta	Spionidae	*Boccardia acus*	0.0833
Clarks West	East	Annelida	Polychaeta	Spionidae	*Boccardia syrtis*	1.0833
Clarks West	East	Annelida	Polychaeta	Spionidae	*Prionospio aucklandica*	4.3333
Clarks West	East	Annelida	Polychaeta	Spionidae	*Pseudopolydora corniculata*	2
Clarks West	East	Annelida	Polychaeta	Spionidae	*Pseudopolydora paucibranchiata*	1.5
Clarks West	East	Annelida	Polychaeta	Spionidae	*Scolecolepides benhami*	0.1667
Clarks West	East	Annelida	Polychaeta	Syllidae	Exogoninae (not Sphaerosyllis)	0.1667
Clarks West	East	Annelida	Polychaeta	Syllidae	*Sphaerosyllis semiverrucosa*	0.5
Clarks West	East	Arthropoda	Malacostraca	Diastylidae	*Colurostylis lemurum*	11.9167
Clarks West	East	Arthropoda	Malacostraca	Exoedicerotidae	*Methalimedon* sp.	0.8333
Clarks West	East	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus varius*	0.5833
Clarks West	East	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus whitei*	0.9167
Clarks West	East	Arthropoda	Malacostraca	Ischyroceridae	Ischyroceridae	0.0833
Clarks West	East	Arthropoda	Malacostraca	Macrophthalmidae	*Hemiplax hirtipes*	0.5833
Clarks West	East	Arthropoda	Malacostraca	Paracalliopidae	*Paracalliope novizealandiae*	4.9167
Clarks West	East	Arthropoda	Malacostraca	Phoxocephalidae	Phoxocephalidae other	1.25
Clarks West	East	Arthropoda	Malacostraca	Phoxocephalidae	*Torridoharpinia hurleyi*	7.25
Clarks West	East	Arthropoda	Malacostraca		Mysida	0.25
Clarks West	East	Cnidaria	Anthozoa	Actiniidae	*Anthopleura aureoradiata*	1.25
Clarks West	East	Hemichordata	Enteropneusta	Ptychoderidae	*Balanoglossus australiensis*	0.0833
Clarks West	East	Mollusca	Bivalvia	Lasaeidae	*Arthritica bifurca*	4.9167

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Clarks West	East	Mollusca	Bivalvia	Mactridae	*Cyclomactra ovata*	0.1667
Clarks West	East	Mollusca	Bivalvia	Mytilidae	*Arcuatula senhousia*	0.0833
Clarks West	East	Mollusca	Bivalvia	Nuculidae	*Linucula hartvigiana*	16.0833
Clarks West	East	Mollusca	Bivalvia	Solemyidae	*Solemya parkinsonii*	0.1667
Clarks West	East	Mollusca	Bivalvia	Tellinidae	*Macomona liliana*	8.1667
Clarks West	East	Mollusca	Bivalvia	Veneridae	*Austrovenus stutchburyi*	18.5
Clarks West	East	Mollusca	Gastropoda	Batillariidae	*Zeacumantus lutulentus*	0.0833
Clarks West	East	Mollusca	Gastropoda	Cominellidae	*Cominella glandiformis*	0.5
Clarks West	East	Mollusca	Gastropoda	Lottidae	*Notoacmea scapha*	0.5833
Clarks West	East	Mollusca	Gastropoda	Nassariidae	*Tritia burchardi*	0.25
Clarks West	East	Mollusca	Gastropoda	Philinidae	*Philine* sp.	0.0833
Clarks West	East	Nemertea			Nemertean	2.0833
Clarks West	East	Platyhelminthes	Rhabditophora	Stylochidae	Stylochidae	0.0833
Lower Clarks Beach	East	Annelida	Clitellata		Oligochaeta	1.3333
Lower Clarks Beach	East	Annelida	Polychaeta	Capitellidae	*Capitella* spp.	0.5833
Lower Clarks Beach	East	Annelida	Polychaeta	Capitellidae	*Heteromastus filiformis*	11.75
Lower Clarks Beach	East	Annelida	Polychaeta	Cirratulidae	*Cirratulia* sp.	0.8333
Lower Clarks Beach	East	Annelida	Polychaeta	Dorvilleidae	Dorvilleidae	0.6667
Lower Clarks Beach	East	Annelida	Polychaeta	Glyceridae	*Glycera ovigera*	0.25
Lower Clarks Beach	East	Annelida	Polychaeta	Hesionidae	Hesionidae	0.0833
Lower Clarks Beach	East	Annelida	Polychaeta	Hesionidae	*Oxydromus angustifrons*	0.1667
Lower Clarks Beach	East	Annelida	Polychaeta	Magelonidae	*Magelona dakini*	0.75
Lower Clarks Beach	East	Annelida	Polychaeta	Maldanidae	*Macroclymenella stewartensis*	12.8333
Lower Clarks Beach	East	Annelida	Polychaeta	Nereididae	*Nicon aestuariensis*	0.5833
Lower Clarks Beach	East	Annelida	Polychaeta	Nereididae	*Platynereis australis*	1.25
Lower Clarks Beach	East	Annelida	Polychaeta	Orbiniidae	*Scoloplos cylindrifer*	0.0833

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Lower Clarks Beach	East	Annelida	Polychaeta	Paraonidae	*Aricidea* sp.	0.75
Lower Clarks Beach	East	Annelida	Polychaeta	Paraonidae	*Paradoneis lyra*	7
Lower Clarks Beach	East	Annelida	Polychaeta	Pectinariidae	*Lagis australis*	0.1667
Lower Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Aonides trifida*	0.5
Lower Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Boccardia syrtis*	7.75
Lower Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Prionospio aucklandica*	11.4167
Lower Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Pseudopolydora corniculata*	1.6667
Lower Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Pseudopolydora paucibranchiata*	4.4167
Lower Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Scolecolepides benhami*	0.0833
Lower Clarks Beach	East	Annelida	Polychaeta	Syllidae	Exogoninae (not Sphaerosyllis)	0.4167
Lower Clarks Beach	East	Annelida	Polychaeta	Syllidae	*Sphaerosyllis semiverrucosa*	0.0833
Lower Clarks Beach	East	Arthropoda	Malacostraca	Bodotriidae	*Cyclaspis thomsoni*	0.9167
Lower Clarks Beach	East	Arthropoda	Malacostraca	Dexaminidae	Dexaminidae	0.0833
Lower Clarks Beach	East	Arthropoda	Malacostraca	Diastylidae	*Colurostylis lemurum*	0.6667
Lower Clarks Beach	East	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus varius*	3.5833
Lower Clarks Beach	East	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus whitei*	0.1667
Lower Clarks Beach	East	Arthropoda	Malacostraca	Ischyroceridae	Ischyroceridae	0.1667
Lower Clarks Beach	East	Arthropoda	Malacostraca	Macrophthalmidae	*Hemiplax hirtipes*	0.75
Lower Clarks Beach	East	Arthropoda	Malacostraca	Paracalliopidae	*Paracalliope novizealandiae*	4.4167
Lower Clarks Beach	East	Arthropoda	Malacostraca	Phoxocephalidae	Phoxocephalidae other	0.75
Lower Clarks Beach	East	Arthropoda	Malacostraca	Phoxocephalidae	*Torridoharpinia hurleyi*	12.4167
Lower Clarks Beach	East	Arthropoda	Malacostraca	Sphaeromatidae	*Exosphaeroma planulum*	1
Lower Clarks Beach	East	Arthropoda	Malacostraca	Sphaeromatidae	*Isocladus* sp.	0.0833
Lower Clarks Beach	East	Arthropoda	Malacostraca	Varunidae	*Austrohelice crassa*	0.0833
Lower Clarks Beach	East	Arthropoda	Malacostraca		Mysida	0.8333
Lower Clarks Beach	East	Echinodermata	Ophiuroidea	Amphiuridae	*Amphiura* sp.	0.25

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Lower Clarks Beach	East	Mollusca	Bivalvia	Lasaeidae	*Arthritica bifurca*	10.8333
Lower Clarks Beach	East	Mollusca	Bivalvia	Mactridae	*Cyclomactra ovata*	0.1667
Lower Clarks Beach	East	Mollusca	Bivalvia	Mytilidae	*Arcuatula senhousia*	0.25
Lower Clarks Beach	East	Mollusca	Bivalvia	Nuculidae	*Linucula hartvigiana*	101.1667
Lower Clarks Beach	East	Mollusca	Bivalvia	Semelidae	*Theora lubrica*	0.0833
Lower Clarks Beach	East	Mollusca	Bivalvia	Solemyidae	*Solemya parkinsonii*	0.0833
Lower Clarks Beach	East	Mollusca	Bivalvia	Tellinidae	*Macomona liliana*	4.9167
Lower Clarks Beach	East	Mollusca	Bivalvia	Veneridae	*Austrovenus stutchburyi*	30.75
Lower Clarks Beach	East	Mollusca	Gastropoda	Cominellidae	*Cominella glandiformis*	0.5
Lower Clarks Beach	East	Mollusca	Gastropoda	Lottidae	*Notoacmea scapha*	28.6667
Lower Clarks Beach	East	Mollusca	Gastropoda	Nassariidae	*Tritia burchardi*	0.5
Lower Clarks Beach	East	Mollusca	Gastropoda	Pyramidellidae	*Turbonilla* sp.	0.4167
Lower Clarks Beach	East	Mollusca	Gastropoda	Skeneidae	*Zalipais lissa*	0.4167
Lower Clarks Beach	East	Mollusca	Gastropoda	Trochidae	*Diloma subrostrata*	0.75
Lower Clarks Beach	East	Mollusca	Gastropoda	Trochidae	*Micrelenchus huttonii*	0.5
Lower Clarks Beach	East	Mollusca	Polyplacophora	Chitonidae	*Chiton glaucus*	0.4167
Lower Clarks Beach	East	Nemertea			Nemertean	1
Clarks Beach	East	Annelida	Clitellata		Oligochaeta	2.75
Clarks Beach	East	Annelida	Polychaeta	Capitellidae	*Capitella* spp.	0.0833
Clarks Beach	East	Annelida	Polychaeta	Capitellidae	*Heteromastus filiformis*	15.1667
Clarks Beach	East	Annelida	Polychaeta	Cirratulidae	Cirratulidae	0.25
Clarks Beach	East	Annelida	Polychaeta	Dorvilleidae	Dorvilleidae	0.5
Clarks Beach	East	Annelida	Polychaeta	Goniadidae	*Glycinde trifida*	0.3333
Clarks Beach	East	Annelida	Polychaeta	Hesionidae	*Oxydromus angustifrons*	0.0833
Clarks Beach	East	Annelida	Polychaeta	Magelonidae	*Magelona dakini*	1.9167
Clarks Beach	East	Annelida	Polychaeta	Maldanidae	*Macroclymenella stewartensis*	15.1667

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Clarks Beach	East	Annelida	Polychaeta	Nereididae	*Nicon aestuariensis*	0.1667
Clarks Beach	East	Annelida	Polychaeta	Nereididae	*Platynereis australis*	0.6667
Clarks Beach	East	Annelida	Polychaeta	Orbiniidae	*Orbinia papillosa*	0.3333
Clarks Beach	East	Annelida	Polychaeta	Oweniidae	*Owenia petersenae*	1.3333
Clarks Beach	East	Annelida	Polychaeta	Paraonidae	*Aricidea* sp.	1.5
Clarks Beach	East	Annelida	Polychaeta	Paraonidae	*Levinsenia gracilis*	0.0833
Clarks Beach	East	Annelida	Polychaeta	Paraonidae	*Paradoneis lyra*	11.9167
Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Boccardia syrtis*	3.5
Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Prionospio aucklandica*	1.1667
Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Pseudopolydora corniculata*	2.25
Clarks Beach	East	Annelida	Polychaeta	Spionidae	*Pseudopolydora paucibranchiata*	3
Clarks Beach	East	Annelida	Polychaeta	Spionidae	Scolecolepides benhami	0.1667
Clarks Beach	East	Annelida	Polychaeta	Syllidae	Exogoninae (not Sphaerosyllis)	0.0833
Clarks Beach	East	Annelida	Polychaeta	Syllidae	Syllinae	1.25
Clarks Beach	East	Annelida	Polychaeta	Terebellidae	Terebellidae	0.25
Clarks Beach	East	Arthropoda	Malacostraca	Bodotriidae	*Cyclapsis thomsoni*	0.6667
Clarks Beach	East	Arthropoda	Malacostraca	Dexaminidae	Dexaminidae	0.5
Clarks Beach	East	Arthropoda	Malacostraca	Diastylidae	*Colurostylis lemurum*	0.1667
Clarks Beach	East	Arthropoda	Malacostraca	Exoedicerotidae	*Methalimedon* sp.	0.1667
Clarks Beach	East	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus varius*	2.4167
Clarks Beach	East	Arthropoda	Malacostraca	Hymenosomatidae	*Halicarcinus whitei*	1.4167
Clarks Beach	East	Arthropoda	Malacostraca	Ischyroceridae	Ischyroceridae	1.25
Clarks Beach	East	Arthropoda	Malacostraca	Macrophthalmidae	*Hemiplax hirtipes*	0.3333
Clarks Beach	East	Arthropoda	Malacostraca	Paracalliopidae	*Paracalliope novizealandiae*	1.6667
Clarks Beach	East	Arthropoda	Malacostraca	Photidae	*Gammaropsis* sp.	0.3333
Clarks Beach	East	Arthropoda	Malacostraca	Phoxocephalidae	Phoxocephalidae other	2.5833

Site	Side of Channel	Phylum	Class	Family	Taxa	Mean Count
Clarks Beach	East	Arthropoda	Malacostraca	Phoxocephalidae	*Torridoharpinia hurleyi*	10.25
Clarks Beach	East	Arthropoda	Malacostraca	Sphaeromatidae	*Exosphaeroma planulum*	0.1667
Clarks Beach	East	Arthropoda	Malacostraca	Sphaeromatidae	*Isocladus* sp.	0.0833