Wairoa Dam
2024-2025 Annual Report

Final - November 2025

Watercare

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REVISION HISTORY

Rev	Revision Date	Name	Position	Signature
1	DD/MM/YYYY	Michiel Jonker	Environmental Care Manager	
2	31/10/2025	Brendon Dockary	Operations Controller	
3	31/10/2025	James Talbot	[Headworks Manager]	

APPROVED

Date	Name	Position	Signature
DD/MM/YYYY	Michiel Jonker	Environmental Care Manager	

CONSENT CHANGE AND MONITORING HISTORY

Change type	Description	Effective date	Reference / condition	Reporting / monitoring implications
Reduced compensation flow	Watercare exercised emergency powers to reduce compensation flow discharges as a result of drought conditions.	9/04/2020	4(i)-(iv) of baseline consents.	Requirements of 4(i)-(iv) not applicable.
Reduced compensation flow	Short-term resource consents authorising a reduction in compensation flow from the Dam.	24/07/2020	4(i)-(iv) of baseline consents replaced by consent DIS60357053.	Requirements for compensation flow, monitoring and reporting authorised by DIS60357054. No annual reporting required, but increased monitoring and notification of issues throughout critical spring-summer period.
Reduced compensation flow	DIS60382588 continued reduced compensation flow requirements following the expiry of consent DIS60357053.	22/07/2022	4(i)-(iv) of baseline consents replaced by consent DIS60382588	As above.
Change in monitoring location	Wairoa River Site F has been inaccessible following the Tasman Tempest Storm in March 2017. Safe access has been reestablished.	3/12/2024	4 of baseline consents	Sampling restarted from January 2025. Data gaps will impact trend analysis.
Increased compensation flow	DIS60382588 required reduced compensation flows to cease on 30 April 2025, returning to a compensation flow regime determined by total system storage.	1/05/2025	4(i)-(iv) of the baseline consents.	Management and reporting of compensation flow compliance is in accordance with total system storage and the baseline consents from 1 May 2025.
Annual report due date	Watercare requested all dam annual reports to be extended from 30	19/05/2025	7	All reports to be submitted by 31 October of each year.

Change type	Description	Effective date	Reference / condition	Reporting / monitoring implications
	September to 31 October.			
Change in monitoring location	Wairoa River Site A has been inaccessible and unsuitable for monitoring following Cyclone Gabrielle in 2023. An alternative location for Site A was established in 2024-2025.	28/05/2025	4 of baseline consents	New location has been sampled since winter 2025. Comparisons with historical data take into consideration the change. Data gaps will affect trend analysis.

EXECUTIVE SUMMARY

The 2024-2025 Annual Report for the Wairoa Dam provides an overview of compliance and monitoring activities conducted over the reporting period from 1 July 2024 to 30 June 2025. The report covers various aspects, including water abstraction, reservoir levels, spillway discharges, compensation flows, environmental monitoring, and pipeline operations, as required under the respective resource consents.

Key findings and highlights from the monitoring activities include:

- Water usage: The total volume of water abstracted during the reporting period was 8,401,511 m^3, measured accurately with Magflow meters
- Reservoir levels: The reservoir was continuously monitored, showing average daily reservoir levels between 30.4 and 33.5 meters
- Compensation flows: Daily average flow in the Wairoa River at Tourist Road was below 340 L/s on 16 days, on which occasions, the maximum required flows were released from the Cosseys and Wairoa Dams.
- Environmental stream monitoring: Monitoring downstream of the dams highlighted stable water quality, nutrient levels and macroinvertebrate communities. No triggers in the adaptive management plan were reached.
- Fisheries management: Two migrating eels were caught for downstream migration
- Free discharge valve operations: Routine free discharge valve operations were performed at the dam, with turbidity levels monitored before and after discharges to ensure compliance with environmental standards.
- Network efficiency and conservation: Watercare continues its water efficiency efforts, identifying and repairing leaks across the region, reducing non-revenue water, and promoting residential and commercial water conservation initiatives

In conclusion, Wairoa Dam has remained fully compliant throughout the 2024-2025 monitoring period, and no equipment failures or maintenance activities resulted in adverse environmental effects.

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1 INTRODUCTION

This report contains the monitoring results required annually by the following resource consents for the Wairoa Dam: 39469 (WAT80316875), 39470 (WAT80316917) and 39471 (DIS80296822). In addition, this report covers the short-term compensation flow reduction consent DIS60382588.

This report covers data for the period 1 July 2024 to 30 June 2025 for the conditions listed in Table 1-1. The conditions across each of the three primary consents are identical.

Table 1-1: Resource consent conditions requiring annual reports.

Reporting information	Consent conditions
Water use	Condition 1 Condition 7 (iii)
Reservoir level	Condition 2 (ii) Condition 7 (iii)
Environmental monitoring	Condition 5 Condition 7 (iii)
Free discharge valve monitoring	Condition 6 Condition 7 (iii)
Network efficiency and conservation	Condition 9 Condition 7 (iii)
Pipeline scour valve operations	Condition 2 (iii – iv) Condition 3

2 WATER USAGE

The daily quantity of water being taken from the Wairoa Dam is measured by a Magflow meter located on the outgoing pipeline. The meter measures to an accuracy of at least ± 5%, is appropriately verified, and maintained in working condition at all times.

Daily abstraction for the reporting period is shown in Figure 2-1. The full dataset is in Appendix A. Over the 12 months, 8,401,511 m^3 was abstracted, with an average of 23,018 m^3 per day.

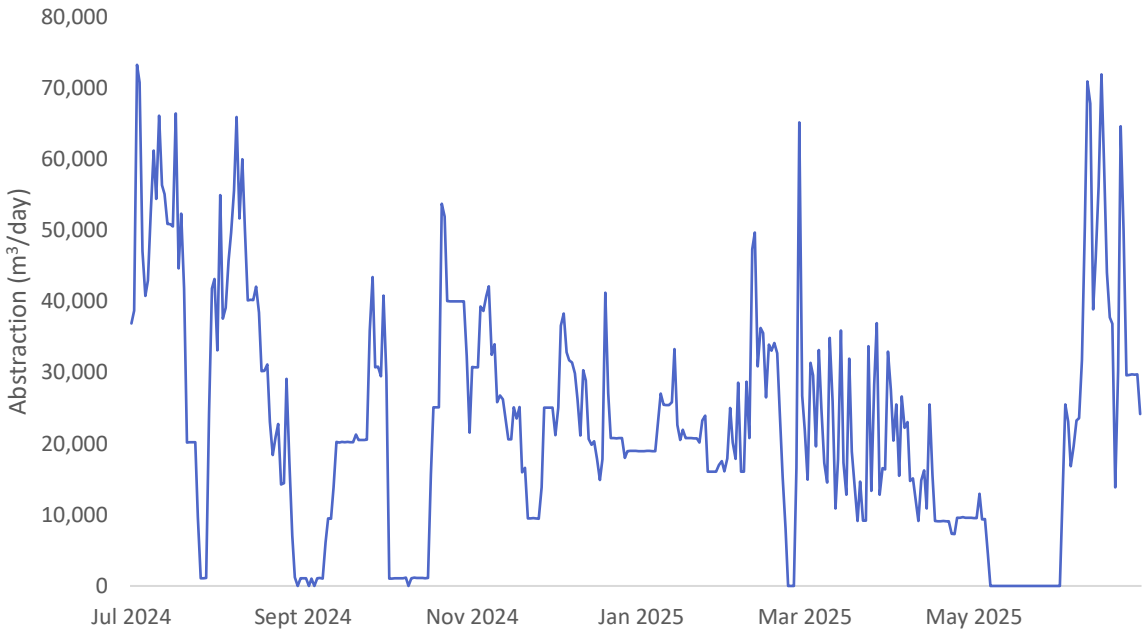

Figure 2-1: Total daily abstraction from Wairoa Dam for the reporting period 2024-2025.

3 RESERVOIR LEVEL

The reservoir levels are monitored continuously on SCADA by level transmitters located in the valve tower of Wairoa Dam.

The daily average reservoir levels for the reporting period are shown in Figure 3-1. The full dataset is in Appendix B. The average level for Wairoa Dam ranged between 30.4 – 33.5 m.

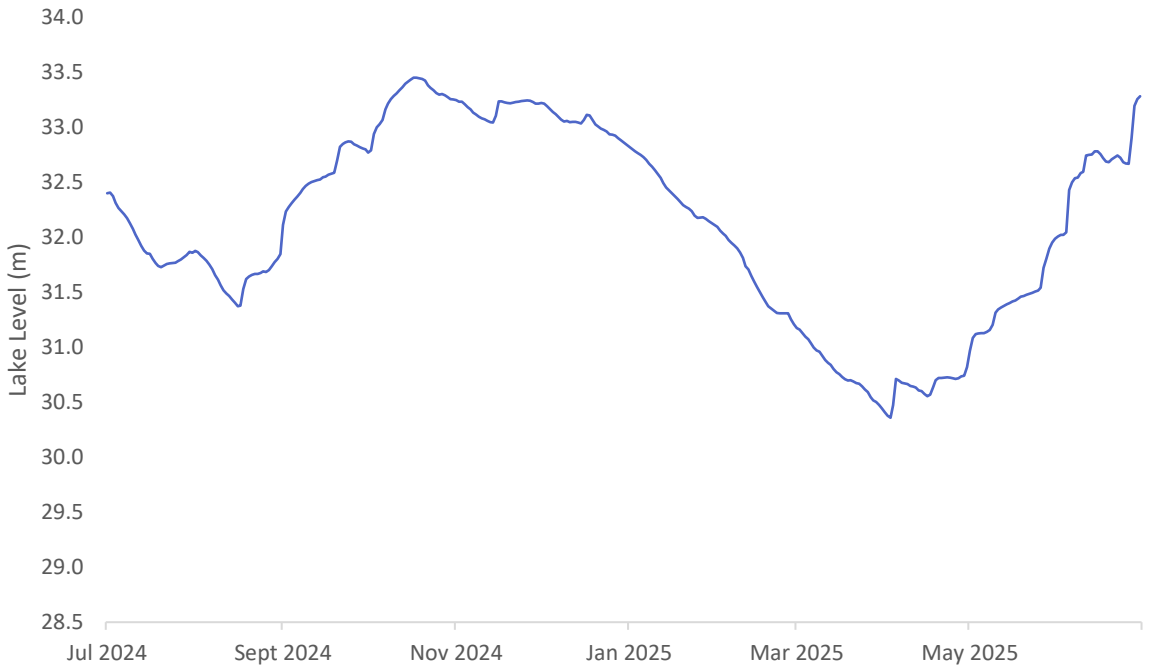

Figure 3-1: Reservoir daily average level for Wairoa Dam for the reporting period 2024-2025.

4 COMPENSATION FLOW

Consent DIS60382588 was granted in July 2022 to discharge a continuous environmental flow up to 60 L/s, and no more than the equivalent to 25% of the Wairoa River flow at the Auckland Council Tourist Road Hydrological Monitoring Station. This discharge from the Cosseys or Wairoa dams is only required when measured flow at Tourist Road was less than 340 L/s. From 1 May 2025 for the remainder of the monitoring period, conditions 4(i) to 4(iv) of the baseline consents were in effect due to the expiry of DIS60382588, requiring a minimum residual flow of 340 L/s at Tourist Rd, with no cap or maximum percentage composition of the total flow.

Compensation flow requirements are met by a combination of compensation flow releases and spillway flows and are shown in Figure 4-1 and the daily average flow rates with the combined compensation flow from both dams in Figure 4-2. Compensation flow from Wairoa Dam and the combined compensation flow from the Cosseys and Wairoa Dams are in Figure 4-3 and Figure 4-4 respectively. The full dataset is in Appendix C.

The measuring devices are Magflow meters located on the downstream face of the dam. The meter measures to an accuracy of at least ± 5%, are appropriately calibrated, and always maintained in working condition.

Throughout the 2024-2025 reporting period, daily average flow in the Wairoa River at Tourist Road was below 340 L/s on 10 and 11 March, 13 to 17 March and 24 March to 2 April 2025. On these dates, the combined maximum compensation flows released met the cap of 60 L/s as required by DIS60382588.

The flow of the Wairoa River reached its lowest daily average of 298 L/s on 16 March 2025. The mean daily average river flow was 1836 L/s, with a maximum daily average of 30,298 L/s on 27 June 2025.

Overall, compensation flow was fully compliant for the reporting period.

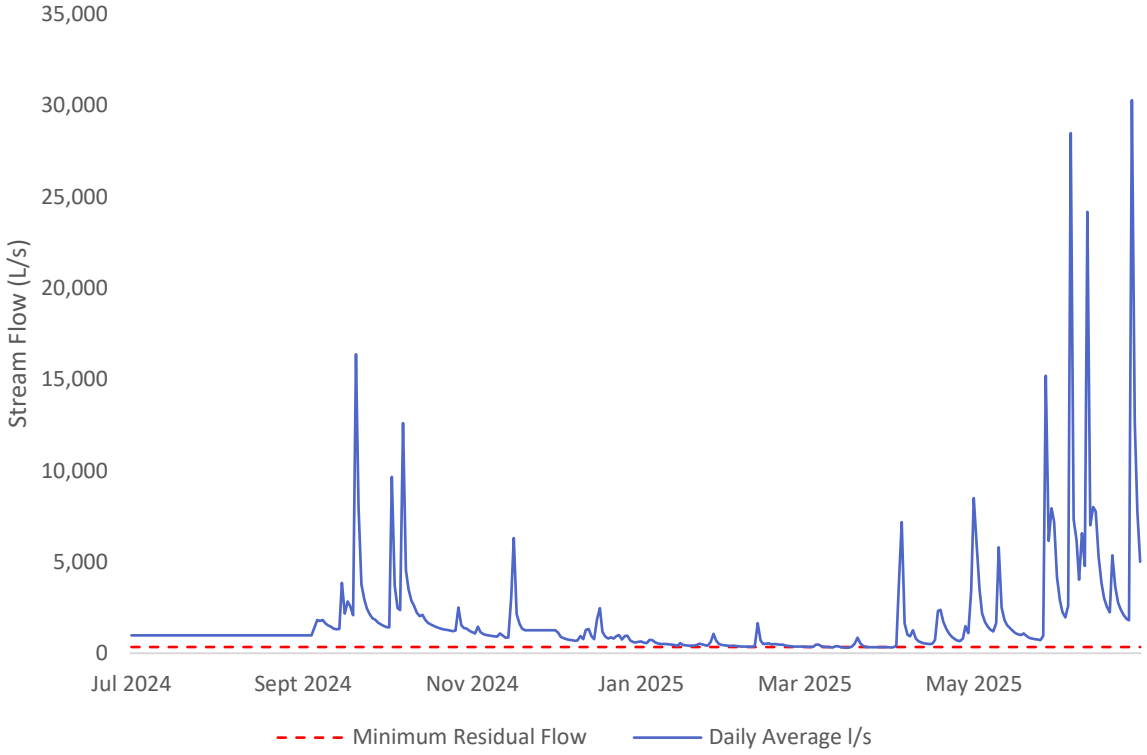

Figure 4-1: Wairoa River flow rate at Tourist Road Hydrological Monitoring Station for the reporting period 2024-2025.

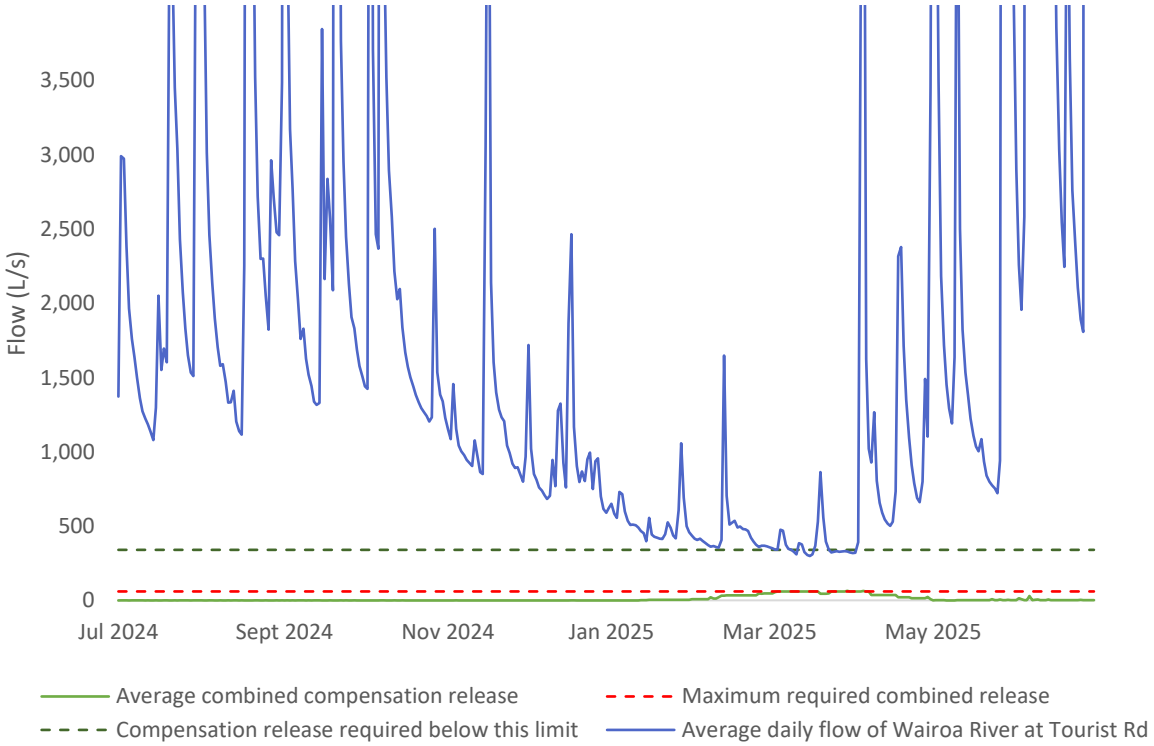

Figure 4-2: Flow rate of combined released compensation flow and Wairoa River for the reporting period 2024-2025.

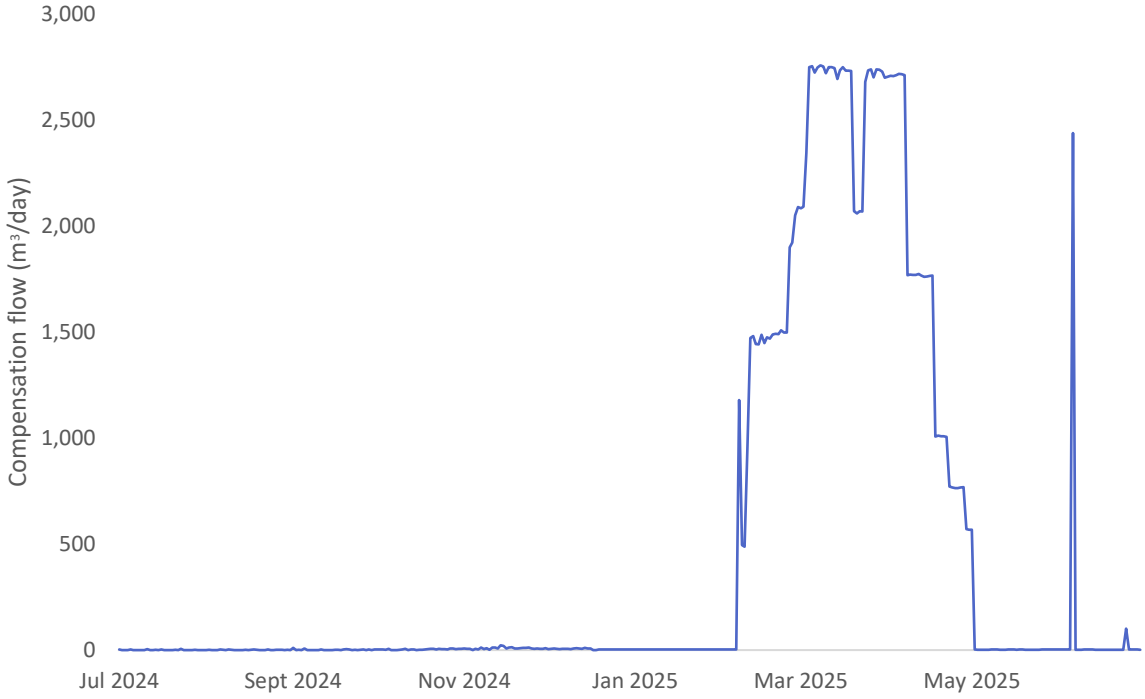

Figure 4-3: Wairoa Dam compensation flows for the reporting period 2024-2025.

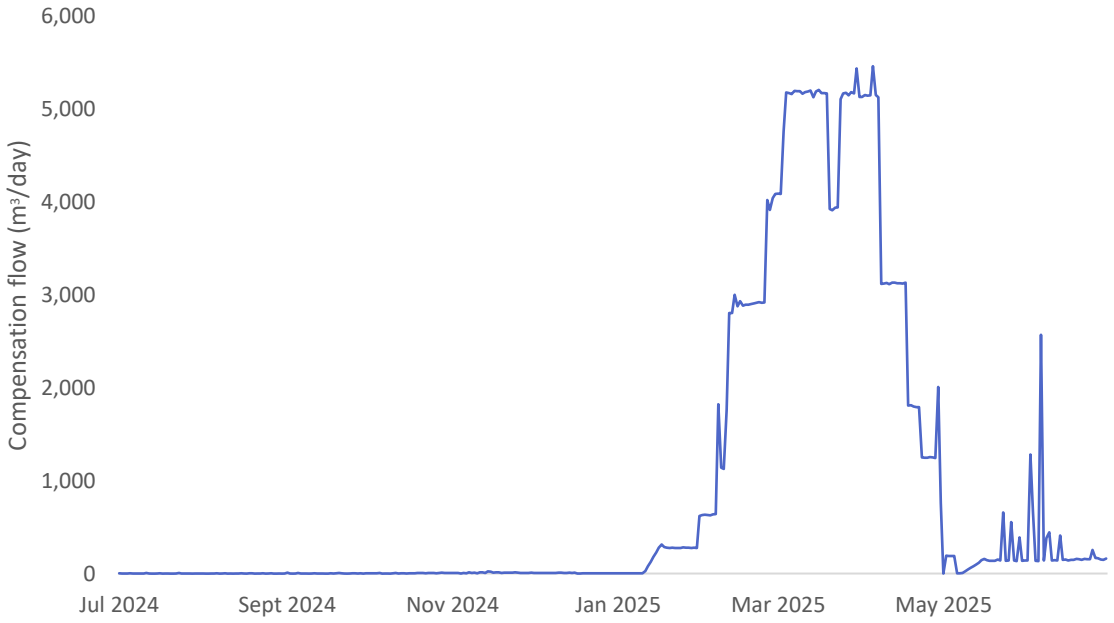

Figure 4-4: Cosseys Dam and Wairoa Dam combined compensation flows for the reporting period 2024-2025.

5 FISHERIES MANAGEMENT

Fisheries management downstream transfer of native fish is ongoing at Wairoa Dam. Ministry of Primary Industries approval has been granted for this work under Special Permit 737, which expired on 1 October 2025. The records from the 2024-2025 trap and haul season are detailed in the annual report to the Ministry of Primary Industries, which is included in appendix D.

Throughout the 2024-2025 trap and haul season, eight eels were caught in the dam, of which three showed signs of migration, and were transferred downstream. This is consistent with 2023-2024, which transferred two migrating eels, after a period of no eels caught in the dam for the two years prior.

6 FREE DISCHARGE VALVE OPERATIONS

The consent requires flushing flows to occur every month for Wairoa Dam from January to March to maintain the health of aquatic ecosystems and aesthetic values. As per the conditions of the consent, turbidity was measured downstream of the discharge point approximately 30 minutes before discharge commenced and between 60 and 120 minutes after the discharge valve has been opened.

Short discharges are often undertaken at the dam each year to open the discharge valve as part of routine maintenance. Discharges undertaken for maintenance are also sampled according to the flushing flow requirements.

The 2024-2025 discharges are detailed in Table 6-1. Auckland Council was notified more than 24 hours in advance for each release of flushing flows and maintenance discharge.

Table 6-1: Free discharge valve monitoring for Wairoa Dam.

Date	Duration of discharge	Turbidity before (NTU)	Turbidity during/after (NTU)
14 January 2025	3 hours	3.13	3.91
11 February 2025	3 hours	0.40	0.41
11 March 2025	3 hours	2.16	3.35

7 NETWORK EFFICIENCY AND CONSERVATION

Watercare has published the Auckland Water Efficiency Plan 2021 to 2025[1], which includes a section detailing its water efficiency programmes and achievements. In summary, Watercare's water efficiency strategy has four main pillars:

- **Municipal water efficiency programme**: related to reducing water use by Watercare itself, mainly through reuse at its treatment plants, and by Auckland Council, through initiatives targeted at saving 30% of water use.
- **Residential water efficiency programme**: includes working with schools and sports clubs to raise awareness and water-saving campaigns, and a partnership with EcoMatters to give households the opportunity to have their water use audited and receive a report on the water and dollar savings they can achieve through simple changes.
- **Commercial water efficiency programme:** involves working with key costumers to reduce demand from our largest users, through initiatives such as the digital meter roll-out project across high-use industrial users, schools and sports clubs.
- **Non-revenue water reduction programme**: related to initiatives focused on reducing three aspects of non-revenue water: leakage, under-reading of meters, and unauthorised use.

Watercare continues with its proactive leakage detection programme, which is effectively targeting areas for leakage surveying using its district meter areas and its Leakage Management System. We continue to optimise our water networks performance through our pressure management programme, which is reducing the number of leaks and their recurrence of them.

The average consumption of Aucklanders is 257 l/p/d which is within our target for water consumption.

More details on water efficiency initiatives, performance, challenges, targets, and strategies for the future are available directly in the Auckland Water Efficiency Plan 2021 to 2025.

8 DAM SAFETY

A Dam Safety Compliance Certificate signed by a Chartered Professional Engineer of sufficient experience is required to be submitted on an annual basis. This certificate was sent to Auckland Council on 29 September 2025 and is attached in Appendix E. The dam has been operated, maintained and monitored to ensure that it is structurally sound and poses no undue risk to life, property or the natural environment.

[1] https://waterefficiencyplan.watercare.co.nz/

9 ENVIRONMENTAL MONITORING

9.1 Overview

Condition 5 requires water quality, macroinvertebrate and habitat monitoring of six established sites in the Wairoa catchment, two located downstream of the Wairoa Dam exclusively, one located downstream of Cosseys Dam exclusively, two sites influenced by both dams, and a control site. Consent DIS60382588 has additional monitoring required by the adaptive management plan.

Watercare contracts Watercare Laboratory Services to undertake the environmental monitoring and reporting for the conditions required under the original consents. Auckland Council has been engaged to operate and maintain continuous temperature sensors required by the adaptive management plan, and Wildlands Consultants Ltd undertake the required fish and Hochstetter frog surveys. The additional survey reports are in Appendix F.

9.2 Monitoring sites

The location of the monitoring sites is shown in Figure 9-7. All monitoring sites are in riffle habitat.

9.2.1 Control

37°06'42.3"S 175°07'26.4"E

On a tributary of the Wairoa River near the Otau Rd carpark, the control site is located above a waterfall and culvert within native forest, shown in Figure 9-1. The flow rate at this site is significantly lower than at the downstream sites.

Figure 9-1: Control site, looking downstream (February 2025).

9.2.2 Site A

37°06’44.58600”S 175°06’04.83480 E

Site A, shown in Figure 9-2 is located on the main stem of the Wairoa River, downstream of Site F, the control site and the Wairoa Dam. Following Cyclone Gabrielle in February 2023, this site became inaccessible, and the characteristics of the site meant that it was no longer suitable for monitoring –

it was transformed from a riffle section to a deep pool with steep banks. From May 2025, a new location in a section of riffle habitat, approximately 800 m upstream of the original monitoring site, was established for ongoing monitoring. The new site is approximately 3 km downstream of Site F, and 3.8 km downstream of the Wairoa Dam.

Figure 9-2: Site A, looking upstream (May 2025).

9.2.3 Site C

37°03'36.6"S 175°05'08.1"E

Site C, shown in Figure 9-3, is downstream of both the Cosseys and Wairoa Dams and is located by the Cossey Access Road, 2.5 km downstream of the Cosseys Dam and 0.8 km downstream of Site E. Between Site E and Site C, the catchment is predominantly native bush catchment, with the exception of approximately 600 m of farmland with little to no riparian planting in the most downstream reach of Cosseys Stream before the site. Between Site A and Site C, approximately 10 km, farming is the most prevalent land use.

9.2.4 Site D

37°00'46.8"S 175°03'12.2"E

Site D is located at the Tourist Road bridge, near the hydrological monitoring station, shown in Figure 9-4. The location is downstream of both the Cosseys and Wairoa Dams. Site C on the Wairoa River is approximately 10.7 km upstream of Site D, Site A approximately 20.7 km upstream, and the Wairoa Dam 24.5 km upstream. From Cosseys Dam to Site D is approximately 13.2 km. The location's catchment is a mixture of farmland with some riparian planting, and native forest in the upper catchment within the Hunua Ranges.

Figure 9-3: Site C, looking upstream (February 2025).

Figure 9-4: Site D, looking upstream (February 2025).

9.2.5 Site E

37°03'52.5"S 175°05'31.0"E

Site E is located on the Cosseys Stream, by the Cossey/Massey loop walk crossing, shown in Figure 9-5. The site is approximately 1.7 km downstream of the Cosseys Dam, with a native forest catchment.

Figure 9-5: Site E, looking upstream (May 2025).

9.2.6 Site F

37˚06’43.64640 S 175˚07’21.60120 E

Site F, shown in Figure 9-6, is approximately 0.8 km downstream of the Wairoa Dam, and downstream of the confluence with the control site's tributary. It is located near the base of a waterfall, within a native forest catchment.

Figure 9-6: Site F, looking upstream (February 2025).

Figure 9-7: Wairoa catchment monitoring locations. Site D not pictured.

9.3 Methods

9.3.1 Water quality – discrete monitoring

Discrete water quality samples are collected monthly over summer, between December and May of each year. The parameters analysed at these sites are listed in Table 9-1. Sampling methodology and analysis techniques were carried out in accordance with APHA Standard Methods for the Examination of Water and Wastewater (2011), as per condition 5(vi).

Temperature and dissolved oxygen measurements are taken in situ using a calibrated YSI ProDSS meter. Periphyton composite samples are collected by scraping periphyton from 10 randomly selected rock surfaces[2].

Table 9-1: Monthly water quality parameters.

Parameter	Units
Temperature*	˚C
Suspended solids	g/m³
pH	pH Unit
Turbidity	NTU
Dissolved oxygen (DO)*	g/m³
Dissolved reactive phosphorus (DRP)	gP/m³
Ammonia nitrogen (NH4–N)	gN/m³
Nitrate nitrogen (NO3–N)	gN/m³
Periphyton (*Chlorophyll a)*	mg/m²

*Parameters recorded in the field (all others analysed at the laboratory)

Best endeavours are made to conduct sampling during periods of flow recession and when there had been rainfall of no greater than 2 mm over the previous 48 hours. When these conditions are unable to be met, sampling is completed before the end of the respective month. For the 2024-2025 monitoring period, the sampling dates and preceding rainfall totals are presented in Table 9-2.

Table 9-2: Discrete water quality sampling dates and rainfall for 2024-2025.

Date	Rainfall 48 hours prior (mm)
18 December 2024	27.5
21 January 2025	1.0
5 February 2025	0.5
6 March 2025	9.5
30 April 2025	27.0

[2] Biggs BJF, Kilroy C, 2000: Stream Periphyton Monitoring Manual. Prepared for Ministry for the Environment, Wellington, New Zealand.

9.3.2 Water quality - continuous monitoring

Condition 5(iv) requires continuous measurement of dissolved oxygen, pH, temperature and conductivity over a 5-day period in January/February at 5-yearly intervals. Data logs at 10-minute intervals. The most recent continuous monitoring was completed in 2021-2022. The next monitoring is required in 2026-2027.

Continuous temperature monitoring sensors for the adaptive management plan are located at the control site, Site A, Site C and Site E, for monitoring during the critical spring and summer period (1 November to 30 April). The data is telemetered to an online platform, where it is checked a maximum of every 14 days to determine any days when trigger levels were met.

9.3.3 Macroinvertebrate monitoring

Macroinvertebrate samples were collected once in winter (Jun-Jul) and in summer (Jan-Feb) each monitoring period. Five replicate samples were collected using kick-net sampling techniques[3]. Samples were preserved in 80% ethanol and invertebrates later identified at the laboratory.

In the 2024-2025 reporting period, macroinvertebrate monitoring occurred on 17 July 2024 and 20 February 2025.

9.4 Periphyton community composition

Percentage cover of periphyton was monitored in accordance with the rapid bioassessment protocols (RAM-2) method monthly during December 2024 to April 2025. Five stones from four transects were examined to define the periphyton community composition or category (colour, length) on the stone.

9.4.1 Fish survey

Surveys are carried out by Wildlands Consultants Ltd at one control site and two impact sites in the Wairoa River catchment. At each site, electric fishing is undertaken along a 150 m stretch. The methods are further detailed in the report, attached in Appendix F.

9.4.2 Hochstetter's frog surveys

Surveys are carried out by Wildlands Consultants Ltd along 50 m long transects at one control site and four impact sites in the Wairoa River catchment, and two control and three impact sites in the Cosseys Steam catchment. The methods used to survey for Hochstetter's frogs followed the protocol recommended by Bell (1996) and are further detailed in the report, attached in Appendix F.

[3] Stark et al. (2001). Protocols for sampling macroinvertebrates in wadeable streams

9.5 Results

9.5.1 Water quality – discrete monitoring

Physicochemical parameters (temperature, DO, pH, turbidity, suspended solids) show minor variation between the control and downstream sites, with slightly warmer water and lower DO downstream. pH remains near-neutral to slightly alkaline at all sites, and suspended solids and turbidity are modest throughout (typically < 20 mg/L and < 20 NTU), indicating good clarity and minimal sediment disturbance.

Nutrient levels at all sites are low and not expected to promote nuisance algal growth. Compared with NPS-FM 2020 attributes for rivers, all sites meet the A-band (lowest risk) for both nitrogen and phosphorus enrichment.

Chlorophyll *a* is very low across sites on average, with the highest biomass found at Site E. Overall, the results are orders of magnitude below the recommended maximum chlorophyll *a* value (50 mg/m^2) for the protection of benthic biodiversity[4].

Table 9-3: Summary (mean ± 95% confidence interval) of monthly water quality results for 2024-2025

Parameter	Unit	Control Site	Site A	Site C	Site D	Site E	Site F
Ammoniacal Nitrogen	mg/L	0.01 ± 0.009	0.019 ± 0.089	0.009 ± 0.007	0.01 ± 0.007	0.006 ± 0.001	0.009 ± 0.005
Chlorophyll A	mg/L	0 ± 0	N/A	0.1 ± 0	0.1 ± 0.1	0.2 ± 0.3	0.1 ± 0.2
DO	mg/L	9.7 ± 0.2	9.4 ± 5.7	9.8 ± 0.4	8.5 ± 0.6	9.8 ± 0.4	9.2 ± 0.5
DRP	mg/L	0.014 ± 0.003	0.014 ± 0	0.01 ± 0.004	0.013 ± 0.003	0.016 ± 0.008	0.011 ± 0.005
Nitrate	mg/L	0.055 ± 0.034	0.293 ± 3.335	0.083 ± 0.131	0.105 ± 0.174	0.019 ± 0.033	0.057 ± 0.034
Suspended Solids	mg/L	15.2 ± 14.8	12.1 ± 138.5	9.2 ± 9.4	7.8 ± 10.9	8.8 ± 11.8	7.2 ± 5.6
Temperature	°C	15.4 ± 1.8	17.1 ± 3.2	18.2 ± 1.5	18.5 ± 1.7	16.9 ± 1.5	16.6 ± 1.5
Turbidity	NTU	18 ± 22.8	20.4 ± 237	8.9 ± 10.9	9.3 ± 8.9	11.6 ± 15.2	10.9 ± 17.7
pH	pH unit	7.2 ± 0.2	7.1 ± 0.3	7.4 ± 0.2	7.1 ± 0.2	7.6 ± 0.6	7.2 ± 0.2

9.5.2 Water quality - continuous monitoring

The results for the continuous temperature monitoring are displayed in Figure 9-8. During the monitoring period, the control site sensor was stolen on 29 December 2024, and replaced on 27 January 2025, therefore data is missing for this period. Other small data gaps occur when batteries required replacing.

The level 1 trigger for temperature downstream of the dam was not met in the 2024-2025 period; therefore, no additional monitoring responses related to this threshold were required:

[4] https://environment.govt.nz/assets/Publications/Files/nz-periphyton-guide-jun00.pdf

"Daily maximum as Site A or E >20°C >7 occasions in critical spring and summer period, when daily maximum at Control site <20°C on the same 7 occasions; within any 28-day period."*

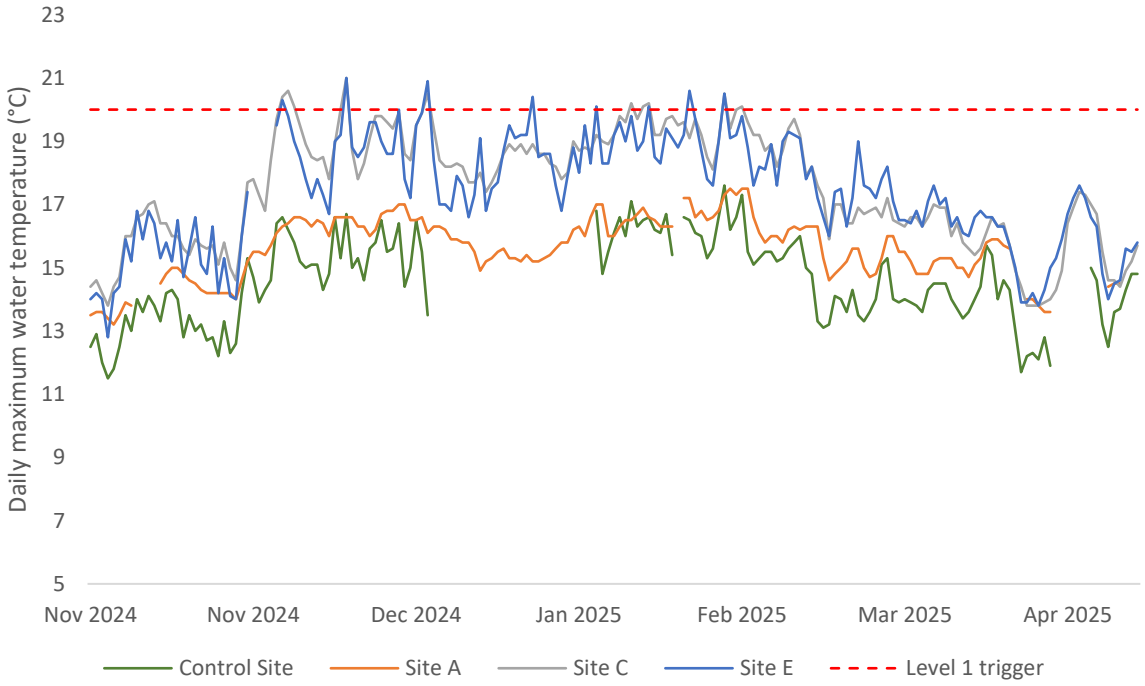

Figure 9-8: Daily maximum temperature monitoring in the Wairoa River and tributaries for the critical spring-summer period in 2024-2025.

9.5.3 Macroinvertebrate monitoring

Overall, the results indicate that macroinvertebrate community health varied among sites and between seasons.

The control site showed consistently high MCI and QMCI values, indicating "excellent" water quality and communities dominated by pollution-sensitive taxa. However, overall taxa richness and EPT diversity were low, likely reflecting limited habitat diversity or flow conditions rather than poor water quality.

During winter, Sites C–E had moderate to good water quality, with MCI and QMCI scores mostly within the "fair–good" range. EPT taxa and overall richness were moderate to high, suggesting relatively healthy but somewhat variable stream conditions.

In summer, MCI values at Sites C–E were lower, falling within the "fair" quality band (Stark & Maxted, 2007), while QMCI values suggested moderate to good ecological conditions. Site F showed slightly higher MCI than most downstream sites, indicating better quality.

EPT richness and total taxa richness were higher in summer than in winter across all sites, consistent with seasonal life cycles and higher biological activity during warmer months. Despite this, summer MCI and QMCI values were generally lower than winter, suggesting some seasonal stress or lower water quality during low flows.

Table 9-4: Summary results (mean ± 95% confidence interval) of macroinvertebrate community metrics for the Wairoa monitoring sites 2024-2025.

Season	Metric	Control Site	Site C	Site D	Site E	Site F
Winter	EPT taxa	1.7 ± 1.4	11 ± 6.6	8.7 ± 3.8	9.7 ± 5.2	1.7 ± 1.4
Summer	EPT taxa	7.7 ± 3.8	7.3 ± 2.9	9.7 ± 3.8	8.7 ± 6.3	10.7 ± 3.8
Winter	Individuals	3.3 ± 3.8	181.3 ± 212	206.3 ± 105.6	139.3 ± 181.4	N/A
Summer	Individuals	41 ± 28.6	242.7 ± 246.7	280.7 ± 209.9	194 ± 129.9	354 ± 366.4
Winter	MCI	145.7 ± 47.5	109 ± 9.9	109.3 ± 1.4	114.7 ± 8.7	N/A
Summer	MCI	131.7 ± 21.4	93 ± 9	102.7 ± 15.2	101.7 ± 11.2	109.7 ± 10
Winter	QMCI	7.3 ± 1.4	5 ± 0	6 ± 0	5 ± 0	N/A
Summer	QMCI	6.7 ± 1.4	4 ± 0	4.3 ± 1.4	4.3 ± 1.4	4.7 ± 1.4
Winter	Taxa richness	2.3 ± 1.4	17.3 ± 5.2	14.7 ± 5.7	16.3 ± 7.6	N/A
Summer	Taxa richness	14.7 ± 5.7	15.3 ± 3.8	16.7 ± 3.8	18 ± 9.9	18.3 ± 5.7

9.5.4 Periphyton community composition

Filamentous algae were monitored as part of the adaptive management plan in 2024-2025, presented in Table 9-5. Throughout the period, the levels remained below the level 1 trigger and as such, no additional monitoring or management responses were required:

"Monthly periphyton filamentous algae (>2 cm long) >30% substrate cover when control site is periphyton filamentous algae (>2 cm long) <30% substrate cover during critical spring and summer period."

Periphyton peaked at Site C in March 2025, with filamentous algae covering 23% of the river substrate. Site A was inaccessible throughout the monitoring period. Additionally, Site F was inaccessible in December 2024 as safe access had not yet been reinstated, and Sites C and D in April 2025 due to high river flows.

Table 9-5: Mean filamentous algae (>2 cm) substrate cover (%)

Date	Control site	Site C	Site D	Site E	Site F
18/12/2024	0	3	2	0.5	N/A
21/01/2025	1.5	3.5	3.75	0	0.25
5/02/2025	0	5.25	4	2	0
6/03/2025	0	23.45	7.9	3.8	0
30/04/2025	0	N/A	N/A	5.75	0.8

9.5.5 Trend analysis (2013-2025)

Nutrient concentrations (ammonia, nitrate, dissolved reactive phosphorus) remain low overall, with only minor site-specific changes. These parameters generally fit within A or B bands within the NPS-FM (2020), indicating good to excellent ecological condition at most sites. Chlorophyll *a* is generally decreasing, except at Site A, where it is increasing, indicating a localised nutrient or flow effect.

Dissolved oxygen has improved at several downstream sites (C-E). Suspended solids are increasing at the control and Site F only, whereas the other sites have no significant trend.

Most water quality parameters show no significant long-term trends, suggesting stable water quality over the 12-year period.

EPT richness was highest at the control site, indicating a high-quality, reference-like community. Downstream sites had fewer EPT taxa on average, consistent with mild to moderate ecological stress, but notably, all downstream sites (A–F) showed significant increasing trends. This pattern suggests a progressive improvement in biological condition through time across the catchment, particularly strong at Site F, which started with the lowest richness.

Total macroinvertebrate abundance (individuals) was variable across sites. The control site showed stable numbers, while Sites E and F exhibited increasing trends, possibly reflecting enhanced habitat stability or food availability. This suggests that conditions at the lower sites may be becoming more favourable for sustaining macroinvertebrate populations.

The control site consistently had very high MCI values, falling within the "excellent" water quality band (≥120; Stark & Maxted 2007). Downstream sites generally recorded lower MCI values, corresponding to "good" ecological quality (100–119). Only Site E showed a significant increasing trend, indicating improving water or habitat quality in the mid-lower catchment. Overall, there is no evidence of long-term degradation in MCI at any site.

The control site's QMCI score indicates excellent water quality, while downstream values (around 5) are consistent with good to moderate quality. A significant increasing trend at Site D suggests enhanced ecological condition, possibly due to reduced stressors or improving flow conditions. Other sites remained stable.

Taxa richness was similar between the control site and Site A, and slightly lower downstream. However, several sites (A, E, F) showed significant increases in taxa richness, reflecting greater biodiversity and improving ecosystem health in those reaches over time.

Overall, macroinvertebrate communities in the Wairoa catchment generally indicate good to excellent ecological condition, with low disturbance at the control site and gradually more impacted communities downstream. However, several downstream sites show positive long-term trends, suggesting ecological recovery or improving habitat quality in recent years.

Table 9-6: Summary results (mean ± 95% confidence interval) and Mann-Kendall trend analysis results of water quality parameters for the Wairoa monitoring sites (2013-2025).

Monitoring site	Metric	Unit	Mean ± 95% CI	Tau	p-value	Trend
Control Site	Ammoniacal Nitrogen	mg/L	0.007 ± 0.002	-0.1	0.31	No significant trend
Site A	Ammoniacal Nitrogen	mg/L	0.011 ± 0.002	0	0.98	No significant trend
Site C	Ammoniacal Nitrogen	mg/L	0.012 ± 0.002	-0.17	0.07	No significant trend
Site D	Ammoniacal Nitrogen	mg/L	0.009 ± 0.001	-0.02	0.8	No significant trend

Monitoring site	Metric	Unit	Mean ± 95% CI	Tau	p-value	Trend
Site E	Ammoniacal Nitrogen	mg/L	0.008 ± 0.002	0.03	0.72	No significant trend
Site F	Ammoniacal Nitrogen	mg/L	0.008 ± 0.002	0.09	0.59	No significant trend
Control Site	Chlorophyll A	mg/L	0.6 ± 0.9	-0.28	0	Decreasing
Site A	Chlorophyll A	mg/L	3.4 ± 1.5	0.24	0.02	Increasing
Site C	Chlorophyll A	mg/L	3.6 ± 1.4	-0.58	0	Decreasing
Site D	Chlorophyll A	mg/L	4.8 ± 2.1	-0.43	0	Decreasing
Site E	Chlorophyll A	mg/L	1.4 ± 0.6	-0.45	0	Decreasing
Site F	Chlorophyll A	mg/L	2.7 ± 1.3	-0.56	0	Decreasing
Control Site	DO	mg/L	9.7 ± 0.2	0.03	0.78	No significant trend
Site A	DO	mg/L	8.8 ± 0.2	0.07	0.49	No significant trend
Site C	DO	mg/L	9.5 ± 0.2	0.23	0.01	Increasing
Site D	DO	mg/L	8.3 ± 0.2	0.21	0.02	Increasing
Site E	DO	mg/L	9.6 ± 0.2	0.21	0.02	Increasing
Site F	DO	mg/L	9.8 ± 0.3	-0.14	0.38	No significant trend
Control Site	DRP	mg/L	0.016 ± 0.001	-0.19	0.04	Decreasing
Site A	DRP	mg/L	0.023 ± 0.003	-0.34	0	Decreasing
Site C	DRP	mg/L	0.018 ± 0.003	-0.27	0	Decreasing
Site D	DRP	mg/L	0.017 ± 0.002	-0.34	0	Decreasing
Site E	DRP	mg/L	0.015 ± 0.002	-0.14	0.13	No significant trend
Site F	DRP	mg/L	0.016 ± 0.006	0.08	0.6	No significant trend
Control Site	Nitrate	mg/L	0.048 ± 0.007	0.17	0.06	No significant trend
Site A	Nitrate	mg/L	0.142 ± 0.038	0.01	0.95	No significant trend
Site C	Nitrate	mg/L	0.125 ± 0.037	-0.02	0.85	No significant trend
Site D	Nitrate	mg/L	0.138 ± 0.044	0.05	0.57	No significant trend
Site E	Nitrate	mg/L	0.025 ± 0.014	0.04	0.69	No significant trend
Site F	Nitrate	mg/L	0.042 ± 0.013	0.38	0.02	Increasing
Control Site	pH	pH unit	7.3 ± 0.0	-0.42	0	Decreasing
Site A	pH	pH unit	7.3 ± 0.0	-0.37	0	Decreasing
Site C	pH	pH unit	7.5 ± 0.0	-0.15	0.1	No significant trend
Site D	pH	pH unit	7.2 ± 0.0	-0.3	0	Decreasing

Monitoring site	Metric	Unit	Mean ± 95% CI	Tau	p-value	Trend
Site E	pH	pH unit	7.6 ± 0.1	-0.22	0.01	Decreasing
Site F	pH	pH unit	7.6 ± 0.1	-0.56	0	Decreasing
Control Site	Suspended Solids	mg/L	17.1 ± 14.1	0.18	0.04	Increasing
Site A	Suspended Solids	mg/L	10.1 ± 9.6	0.19	0.06	No significant trend
Site C	Suspended Solids	mg/L	7.1 ± 2.2	0.16	0.07	No significant trend
Site D	Suspended Solids	mg/L	6.2 ± 1.7	0.11	0.23	No significant trend
Site E	Suspended Solids	mg/L	8.0 ± 4.6	0.08	0.36	No significant trend
Site F	Suspended Solids	mg/L	3.4 ± 1.5	0.35	0.02	Increasing
Control Site	Temperature	°C	14.2 ± 0.5	0.15	0.09	No significant trend
Site A	Temperature	°C	15.9 ± 0.7	0.16	0.11	No significant trend
Site C	Temperature	°C	17.4 ± 0.6	0.14	0.11	No significant trend
Site D	Temperature	°C	17.8 ± 0.6	0.1	0.28	No significant trend
Site E	Temperature	°C	16.4 ± 0.7	0.07	0.44	No significant trend
Site F	Temperature	°C	15.4 ± 0.7	0.12	0.43	No significant trend
Control Site	Turbidity	NTU	12.8 ± 5.0	0.09	0.3	No significant trend
Site A	Turbidity	NTU	7.7 ± 3.8	0.08	0.42	No significant trend
Site C	Turbidity	NTU	7.1 ± 2.4	0.14	0.12	No significant trend
Site D	Turbidity	NTU	7.0 ± 2.2	0.16	0.08	No significant trend
Site E	Turbidity	NTU	11.7 ± 7.1	0.17	0.05	No significant trend
Site F	Turbidity	NTU	5.5 ± 3.1	0.14	0.38	No significant trend

Table 9-7: Summary results (mean ± 95% confidence interval) and Mann-Kendall trend analysis results of macroinvertebrate community metrics for the Wairoa monitoring sites 2013-2025.

Monitoring site	Metric	Mean ± 95% CI	Tau	p-value	Trend
Control Site	EPT taxa	10.2 (± 1.1)	0.05	0.52	No significant trend
Site A	EPT taxa	8.2 (± 0.6)	0.23	0.01	Increasing
Site C	EPT taxa	7.0 (± 0.7)	0.21	0.01	Increasing
Site D	EPT taxa	7.6 (± 0.7)	0.19	0.02	Increasing
Site E	EPT taxa	7.0 (± 0.8)	0.28	0.00	Increasing
Site F	EPT taxa	5.4 (± 1.3)	0.59	0.00	Increasing
Control Site	Individuals	134.4 (± 24.5)	-0.04	0.61	No significant trend
Site A	Individuals	216.0 (± 38.4)	0.02	0.80	No significant trend

Monitoring site	Metric	Mean ± 95% CI	Tau	p-value	Trend
Site C	Individuals	182.4 (± 41.9)	0.13	0.11	No significant trend
Site D	Individuals	291.3 (±102.4)	0.04	0.64	No significant trend
Site E	Individuals	110.8 (± 20.1)	0.24	0.00	Increasing
Site F	Individuals	70.6 (± 21.1)	0.49	0.00	Increasing
Control Site	MCI	141.4 (± 2.3)	0.02	0.76	No significant trend
Site A	MCI	113.9 (± 2.1)	0.08	0.38	No significant trend
Site C	MCI	105.7 (± 2.3)	0.06	0.42	No significant trend
Site D	MCI	107.5 (± 2.2)	0.13	0.11	No significant trend
Site E	MCI	109.0 (± 3.5)	0.25	0.00	Increasing
Site F	MCI	106.1 (± 6.1)	-0.05	0.77	No significant trend
Control Site	QMCI	7.5 (± 0.2)	-0.08	0.38	No significant trend
Site A	QMCI	5.4 (± 0.2)	0.10	0.30	No significant trend
Site C	QMCI	5.0 (± 0.2)	0.11	0.23	No significant trend
Site D	QMCI	5.1 (± 0.2)	0.21	0.02	Increasing
Site E	QMCI	4.9 (± 0.2)	0.08	0.39	No significant trend
Site F	QMCI	5.0 (± 0.4)	-0.05	0.79	No significant trend
Control Site	Taxa richness	14.7 (± 1.4)	0.06	0.43	No significant trend
Site A	Taxa richness	15.0 (± 0.9)	0.19	0.03	Increasing
Site C	Taxa richness	12.7 (± 1.0)	0.13	0.12	No significant trend
Site D	Taxa richness	13.6 (± 0.9)	0.11	0.19	No significant trend
Site E	Taxa richness	12.3 (± 1.2)	0.26	0.00	Increasing
Site F	Taxa richness	11.2 (± 1.8)	0.64	0.00	Increasing

9.5.6 Fish survey

The full results of the monitoring are in the report (Appendix F). The key findings were:

- In the fish surveys, the total number of individuals, number of species and overall densities were greater at the impact sites than at the control sites.
- The overall fish densities for all three Wairoa River catchment sites increased.
- Fish IBI analysis found all sites except the Wairoa River control site to score as “excellent” (above 90th percentile of Auckland sites). Wairoa River control site scored “good” (above 60th percentile of Auckland sites). This is consistent with previous monitoring.
- Compared to the previous 2021 and 2023 surveys, the fish community appears to have remained relatively consistent
- There is no apparent adverse impact on fish communities due to the reduced compensation flow regimes from the dams. Fish communities continue to persist at all sites.

9.5.7 Hochstetter's frog surveys

The full results of the monitoring are in the report (Appendix F). The key findings were:

- In Cossey's Stream, frogs were found at all impact and control sites during the 2024-2025. This includes the first instance of a frog found at impact site C.
- No Hochstetter's frogs were found at any of the four Wairoa Dam impact sites or control sites during the two surveys in the Wairoa River for 2024-2025.
- No consistent changes in the number of frog detections at control and impact sites are evident at either Cossey Creek or the Wairoa River over time. Due to the cryptic nature of the species, lack of detection may be a part of normal variability when surveying.

10 CONCLUSION

This report presents annual monitoring results for the period 1 July 2024 to 30 June 2025 for the Wairoa Dam in accordance with consents 39472, 39473, 39474 and DIS60382588.

Daily average flow at Tourist Road Hydrological Monitoring Station was below 340 L/s on 16 days in March and April 2025. During this time, the maximum compensation flow requirements were met from Cosseys and Wairoa Dams to supplement river flows. There were no equipment failures or other maintenance activities undertaken in the reporting period that resulted in a discharge that had an adverse environment effect.

Overall, all consent conditions were compliant throughout the reporting period for the Wairoa Dam.

Appendix A. Daily water abstraction volumes

Date	Abstraction (m^3/day)	Date (continued)	Abstraction (m^3/day)
1/07/2024	36,881	1/01/2025	18,941
2/07/2024	38,709	2/01/2025	18,957
3/07/2024	73,235	3/01/2025	18,972
4/07/2024	70,746	4/01/2025	18,977
5/07/2024	47,052	5/01/2025	18,955
6/07/2024	40,768	6/01/2025	18,956
7/07/2024	42,917	7/01/2025	22,755
8/07/2024	52,580	8/01/2025	27,055
9/07/2024	61,188	9/01/2025	25,465
10/07/2024	54,394	10/01/2025	25,418
11/07/2024	66,103	11/01/2025	25,423
12/07/2024	56,304	12/01/2025	25,836
13/07/2024	55,064	13/01/2025	33,292
14/07/2024	50,870	14/01/2025	22,635
15/07/2024	50,829	15/01/2025	20,500
16/07/2024	50,522	16/01/2025	21,963
17/07/2024	66,380	17/01/2025	20,773
18/07/2024	44,618	18/01/2025	20,773
19/07/2024	52,329	19/01/2025	20,766
20/07/2024	41,785	20/01/2025	20,748
21/07/2024	20,162	21/01/2025	20,751
22/07/2024	20,186	22/01/2025	20,137
23/07/2024	20,194	23/01/2025	23,253
24/07/2024	20,190	24/01/2025	23,946
25/07/2024	9,675	25/01/2025	16,076
26/07/2024	1,068	26/01/2025	16,066
27/07/2024	1,095	27/01/2025	16,051
28/07/2024	1,142	28/01/2025	16,076
29/07/2024	24,241	29/01/2025	17,022
30/07/2024	41,796	30/01/2025	17,558
31/07/2024	43,134	31/01/2025	16,113
1/08/2024	33,119	1/02/2025	17,900
2/08/2024	54,916	2/02/2025	25,012
3/08/2024	37,585	3/02/2025	20,152
4/08/2024	39,105	4/02/2025	17,849

Date	Abstraction (m^3/day)	Date (continued)	Abstraction (m^3/day)
5/08/2024	45,724	5/02/2025	28,573
6/08/2024	49,681	6/02/2025	16,044
7/08/2024	55,555	7/02/2025	16,082
8/08/2024	65,911	8/02/2025	28,696
9/08/2024	51,631	9/02/2025	20,788
10/08/2024	59,951	10/02/2025	47,325
11/08/2024	50,100	11/02/2025	49,670
12/08/2024	40,111	12/02/2025	30,842
13/08/2024	40,204	13/02/2025	36,255
14/08/2024	40,157	14/02/2025	35,520
15/08/2024	42,079	15/02/2025	26,486
16/08/2024	38,424	16/02/2025	33,940
17/08/2024	30,192	17/02/2025	33,076
18/08/2024	30,233	18/02/2025	34,123
19/08/2024	31,145	19/02/2025	32,720
20/08/2024	23,065	20/02/2025	24,352
21/08/2024	18,383	21/02/2025	15,302
22/08/2024	20,986	22/02/2025	8,083
23/08/2024	22,762	23/02/2025	0
24/08/2024	14,275	24/02/2025	0
25/08/2024	14,421	25/02/2025	0
26/08/2024	29,109	26/02/2025	16,596
27/08/2024	17,390	27/02/2025	65,145
28/08/2024	7,061	28/02/2025	26,738
29/08/2024	1,216	1/03/2025	21,958
30/08/2024	0	2/03/2025	14,924
31/08/2024	1,061	3/03/2025	31,335
1/09/2024	1,066	4/03/2025	29,608
2/09/2024	1,089	5/03/2025	19,635
3/09/2024	0	6/03/2025	33,166
4/09/2024	1,031	7/03/2025	24,933
5/09/2024	0	8/03/2025	17,276
6/09/2024	1,099	9/03/2025	14,509
7/09/2024	1,120	10/03/2025	34,886
8/09/2024	1,038	11/03/2025	25,941

Date	Abstraction (m^3/day)	Date (continued)	Abstraction (m^3/day)
9/09/2024	6,114	12/03/2025	10,881
10/09/2024	9,495	13/03/2025	17,806
11/09/2024	9,467	14/03/2025	35,879
12/09/2024	13,876	15/03/2025	17,307
13/09/2024	20,223	16/03/2025	12,805
14/09/2024	20,173	17/03/2025	31,949
15/09/2024	20,224	18/03/2025	18,873
16/09/2024	20,218	19/03/2025	13,928
17/09/2024	20,248	20/03/2025	9,153
18/09/2024	20,219	21/03/2025	14,647
19/09/2024	20,213	22/03/2025	9,181
20/09/2024	21,277	23/03/2025	9,195
21/09/2024	20,524	24/03/2025	33,695
22/09/2024	20,501	25/03/2025	13,353
23/09/2024	20,534	26/03/2025	28,327
24/09/2024	20,573	27/03/2025	36,955
25/09/2024	35,869	28/03/2025	12,803
26/09/2024	43,419	29/03/2025	16,535
27/09/2024	30,715	30/03/2025	16,369
28/09/2024	30,797	31/03/2025	32,931
29/09/2024	29,471	1/04/2025	27,564
30/09/2024	40,824	2/04/2025	20,429
1/10/2024	29,511	3/04/2025	25,492
2/10/2024	1,043	4/04/2025	15,477
3/10/2024	1,057	5/04/2025	26,651
4/10/2024	1,078	6/04/2025	22,245
5/10/2024	1,088	7/04/2025	23,042
6/10/2024	1,099	8/04/2025	14,741
7/10/2024	1,096	9/04/2025	15,120
8/10/2024	1,151	10/04/2025	11,939
9/10/2024	0	11/04/2025	9,122
10/10/2024	1,089	12/04/2025	14,866
11/10/2024	1,165	13/04/2025	16,252
12/10/2024	1,120	14/04/2025	10,896
13/10/2024	1,117	15/04/2025	25,490

Date	Abstraction (m^3/day)	Date (continued)	Abstraction (m^3/day)
14/10/2024	1,109	16/04/2025	15,568
15/10/2024	1,101	17/04/2025	9,116
16/10/2024	1,130	18/04/2025	9,081
17/10/2024	15,620	19/04/2025	9,075
18/10/2024	25,086	20/04/2025	9,125
19/10/2024	25,082	21/04/2025	9,104
20/10/2024	25,081	22/04/2025	9,086
21/10/2024	53,716	23/04/2025	7,323
22/10/2024	51,907	24/04/2025	7,282
23/10/2024	40,030	25/04/2025	9,566
24/10/2024	39,995	26/04/2025	9,561
25/10/2024	40,009	27/04/2025	9,691
26/10/2024	39,990	28/04/2025	9,581
27/10/2024	39,982	29/04/2025	9,596
28/10/2024	39,983	30/04/2025	9,602
29/10/2024	39,974	1/05/2025	9,546
30/10/2024	32,305	2/05/2025	9,527
31/10/2024	21,560	3/05/2025	12,959
1/11/2024	30,780	4/05/2025	9,381
2/11/2024	30,733	5/05/2025	9,399
3/11/2024	30,740	6/05/2025	4,523
4/11/2024	39,268	7/05/2025	0
5/11/2024	38,638	8/05/2025	0
6/11/2024	40,707	9/05/2025	0
7/11/2024	42,108	10/05/2025	0
8/11/2024	32,491	11/05/2025	0
9/11/2024	33,978	12/05/2025	0
10/11/2024	25,824	13/05/2025	0
11/11/2024	26,757	14/05/2025	0
12/11/2024	26,208	15/05/2025	0
13/11/2024	23,592	16/05/2025	0
14/11/2024	20,595	17/05/2025	0
15/11/2024	20,600	18/05/2025	0
16/11/2024	25,119	19/05/2025	0
17/11/2024	23,547	20/05/2025	0

Date	Abstraction (m^3/day)	Date (continued)	Abstraction (m^3/day)
18/11/2024	25,129	21/05/2025	0
19/11/2024	15,986	22/05/2025	0
20/11/2024	16,610	23/05/2025	0
21/11/2024	9,483	24/05/2025	0
22/11/2024	9,510	25/05/2025	0
23/11/2024	9,537	26/05/2025	0
24/11/2024	9,500	27/05/2025	0
25/11/2024	9,450	28/05/2025	0
26/11/2024	13,849	29/05/2025	0
27/11/2024	25,060	30/05/2025	0
28/11/2024	25,052	31/05/2025	0
29/11/2024	25,061	1/06/2025	0
30/11/2024	25,041	2/06/2025	12,029
1/12/2024	21,175	3/06/2025	25,496
2/12/2024	25,044	4/06/2025	23,087
3/12/2024	36,589	5/06/2025	16,822
4/12/2024	38,268	6/06/2025	19,634
5/12/2024	32,845	7/06/2025	23,274
6/12/2024	31,708	8/06/2025	23,566
7/12/2024	31,386	9/06/2025	31,761
8/12/2024	29,874	10/06/2025	50,461
9/12/2024	26,268	11/06/2025	70,906
10/12/2024	21,123	12/06/2025	67,816
11/12/2024	30,304	13/06/2025	38,886
12/12/2024	28,902	14/06/2025	46,109
13/12/2024	20,659	15/06/2025	56,086
14/12/2024	19,841	16/06/2025	71,882
15/12/2024	20,343	17/06/2025	59,368
16/12/2024	17,879	18/06/2025	44,046
17/12/2024	14,883	19/06/2025	37,758
18/12/2024	17,837	20/06/2025	36,842
19/12/2024	41,203	21/06/2025	13,879
20/12/2024	27,084	22/06/2025	30,225
21/12/2024	20,799	23/06/2025	64,587
22/12/2024	20,797	24/06/2025	49,930

Date	Abstraction (m^3/day)	Date (continued)	Abstraction (m^3/day)
23/12/2024	20,759	25/06/2025	29,621
24/12/2024	20,772	26/06/2025	29,628
25/12/2024	20,767	27/06/2025	29,726
26/12/2024	18,008	28/06/2025	29,708
27/12/2024	18,956	29/06/2025	29,733
28/12/2024	18,984	30/06/2025	24,149
29/12/2024	18,968		
30/12/2024	18,966		
31/12/2024	18,920		

Appendix B. Daily average reservoir level

Date	Reservoir level (m)	Date (continued)	Reservoir level (m)
1/07/2024	32.399	1/01/2025	32.822
2/07/2024	32.405	2/01/2025	32.801
3/07/2024	32.374	3/01/2025	32.780
4/07/2024	32.313	4/01/2025	32.765
5/07/2024	32.267	5/01/2025	32.748
6/07/2024	32.237	6/01/2025	32.728
7/07/2024	32.209	7/01/2025	32.703
8/07/2024	32.172	8/01/2025	32.668
9/07/2024	32.127	9/01/2025	32.641
10/07/2024	32.078	10/01/2025	32.610
11/07/2024	32.025	11/01/2025	32.574
12/07/2024	31.974	12/01/2025	32.539
13/07/2024	31.922	13/01/2025	32.492
14/07/2024	31.878	14/01/2025	32.453
15/07/2024	31.854	15/01/2025	32.425
16/07/2024	31.850	16/01/2025	32.400
17/07/2024	31.803	17/01/2025	32.374
18/07/2024	31.766	18/01/2025	32.348
19/07/2024	31.739	19/01/2025	32.318
20/07/2024	31.727	20/01/2025	32.293
21/07/2024	31.743	21/01/2025	32.274
22/07/2024	31.757	22/01/2025	32.260
23/07/2024	31.764	23/01/2025	32.236
24/07/2024	31.766	24/01/2025	32.196
25/07/2024	31.768	25/01/2025	32.175
26/07/2024	31.783	26/01/2025	32.178
27/07/2024	31.799	27/01/2025	32.183
28/07/2024	31.817	28/01/2025	32.167
29/07/2024	31.838	29/01/2025	32.148
30/07/2024	31.867	30/01/2025	32.129
31/07/2024	31.860	31/01/2025	32.113
1/08/2024	31.875	1/02/2025	32.095
2/08/2024	31.864	2/02/2025	32.060
3/08/2024	31.835	3/02/2025	32.034
4/08/2024	31.811	4/02/2025	32.014

Date	Reservoir level (m)	Date (continued)	Reservoir level (m)
5/08/2024	31.787	5/02/2025	31.975
6/08/2024	31.752	6/02/2025	31.949
7/08/2024	31.710	7/02/2025	31.925
8/08/2024	31.655	8/02/2025	31.899
9/08/2024	31.613	9/02/2025	31.863
10/08/2024	31.565	10/02/2025	31.812
11/08/2024	31.519	11/02/2025	31.735
12/08/2024	31.488	12/02/2025	31.706
13/08/2024	31.466	13/02/2025	31.650
14/08/2024	31.434	14/02/2025	31.596
15/08/2024	31.406	15/02/2025	31.546
16/08/2024	31.374	16/02/2025	31.500
17/08/2024	31.379	17/02/2025	31.454
18/08/2024	31.529	18/02/2025	31.411
19/08/2024	31.619	19/02/2025	31.373
20/08/2024	31.643	20/02/2025	31.351
21/08/2024	31.657	21/02/2025	31.333
22/08/2024	31.666	22/02/2025	31.312
23/08/2024	31.668	23/02/2025	31.308
24/08/2024	31.674	24/02/2025	31.308
25/08/2024	31.689	25/02/2025	31.309
26/08/2024	31.685	26/02/2025	31.309
27/08/2024	31.701	27/02/2025	31.253
28/08/2024	31.736	28/02/2025	31.210
29/08/2024	31.773	1/03/2025	31.174
30/08/2024	31.802	2/03/2025	31.161
31/08/2024	31.848	3/03/2025	31.129
1/09/2024	32.112	4/03/2025	31.096
2/09/2024	32.233	5/03/2025	31.073
3/09/2024	32.276	6/03/2025	31.038
4/09/2024	32.310	7/03/2025	30.998
5/09/2024	32.342	8/03/2025	30.972
6/09/2024	32.371	9/03/2025	30.958
7/09/2024	32.403	10/03/2025	30.922
8/09/2024	32.437	11/03/2025	30.885

Date	Reservoir level (m)	Date (continued)	Reservoir level (m)
9/09/2024	32.466	12/03/2025	30.857
10/09/2024	32.486	13/03/2025	30.840
11/09/2024	32.501	14/03/2025	30.803
12/09/2024	32.512	15/03/2025	30.773
13/09/2024	32.518	16/03/2025	30.755
14/09/2024	32.526	17/03/2025	30.730
15/09/2024	32.546	18/03/2025	30.709
16/09/2024	32.552	19/03/2025	30.697
17/09/2024	32.568	20/03/2025	30.701
18/09/2024	32.577	21/03/2025	30.689
19/09/2024	32.587	22/03/2025	30.675
20/09/2024	32.697	23/03/2025	30.667
21/09/2024	32.822	24/03/2025	30.646
22/09/2024	32.847	25/03/2025	30.616
23/09/2024	32.863	26/03/2025	30.593
24/09/2024	32.871	27/03/2025	30.547
25/09/2024	32.870	28/03/2025	30.516
26/09/2024	32.846	29/03/2025	30.503
27/09/2024	32.834	30/03/2025	30.477
28/09/2024	32.820	31/03/2025	30.444
29/09/2024	32.809	1/04/2025	30.410
30/09/2024	32.798	2/04/2025	30.378
1/10/2024	32.770	3/04/2025	30.359
2/10/2024	32.791	4/04/2025	30.473
3/10/2024	32.938	5/04/2025	30.712
4/10/2024	32.999	6/04/2025	30.698
5/10/2024	33.030	7/04/2025	30.677
6/10/2024	33.066	8/04/2025	30.671
7/10/2024	33.162	9/04/2025	30.664
8/10/2024	33.216	10/04/2025	30.649
9/10/2024	33.257	11/04/2025	30.641
10/10/2024	33.286	12/04/2025	30.632
11/10/2024	33.309	13/04/2025	30.608
12/10/2024	33.336	14/04/2025	30.601
13/10/2024	33.364	15/04/2025	30.576

Date	Reservoir level (m)	Date (continued)	Reservoir level (m)
14/10/2024	33.395	16/04/2025	30.556
15/10/2024	33.417	17/04/2025	30.569
16/10/2024	33.434	18/04/2025	30.637
17/10/2024	33.451	19/04/2025	30.699
18/10/2024	33.450	20/04/2025	30.720
19/10/2024	33.446	21/04/2025	30.722
20/10/2024	33.440	22/04/2025	30.724
21/10/2024	33.425	23/04/2025	30.725
22/10/2024	33.382	24/04/2025	30.723
23/10/2024	33.359	25/04/2025	30.717
24/10/2024	33.336	26/04/2025	30.713
25/10/2024	33.311	27/04/2025	30.717
26/10/2024	33.297	28/04/2025	30.735
27/10/2024	33.303	29/04/2025	30.741
28/10/2024	33.290	30/04/2025	30.819
29/10/2024	33.273	1/05/2025	30.968
30/10/2024	33.257	2/05/2025	31.083
31/10/2024	33.253	3/05/2025	31.118
1/11/2024	33.246	4/05/2025	31.124
2/11/2024	33.232	5/05/2025	31.127
3/11/2024	33.232	6/05/2025	31.129
4/11/2024	33.209	7/05/2025	31.141
5/11/2024	33.184	8/05/2025	31.157
6/11/2024	33.163	9/05/2025	31.203
7/11/2024	33.135	10/05/2025	31.315
8/11/2024	33.117	11/05/2025	31.344
9/11/2024	33.096	12/05/2025	31.362
10/11/2024	33.081	13/05/2025	31.376
11/11/2024	33.072	14/05/2025	31.390
12/11/2024	33.058	15/05/2025	31.403
13/11/2024	33.047	16/05/2025	31.415
14/11/2024	33.043	17/05/2025	31.424
15/11/2024	33.105	18/05/2025	31.442
16/11/2024	33.236	19/05/2025	31.461
17/11/2024	33.234	20/05/2025	31.467

Date	Reservoir level (m)	Date (continued)	Reservoir level (m)
18/11/2024	33.227	21/05/2025	31.476
19/11/2024	33.221	22/05/2025	31.487
20/11/2024	33.219	23/05/2025	31.496
21/11/2024	33.223	24/05/2025	31.506
22/11/2024	33.231	25/05/2025	31.516
23/11/2024	33.233	26/05/2025	31.540
24/11/2024	33.238	27/05/2025	31.722
25/11/2024	33.240	28/05/2025	31.805
26/11/2024	33.244	29/05/2025	31.897
27/11/2024	33.242	30/05/2025	31.952
28/11/2024	33.229	31/05/2025	31.987
29/11/2024	33.216	1/06/2025	32.007
30/11/2024	33.214	2/06/2025	32.022
1/12/2024	33.221	3/06/2025	32.022
2/12/2024	33.214	4/06/2025	32.046
3/12/2024	33.193	5/06/2025	32.430
4/12/2024	33.165	6/06/2025	32.500
5/12/2024	33.138	7/06/2025	32.536
6/12/2024	33.120	8/06/2025	32.542
7/12/2024	33.095	9/06/2025	32.583
8/12/2024	33.070	10/06/2025	32.596
9/12/2024	33.053	11/06/2025	32.743
10/12/2024	33.057	12/06/2025	32.750
11/12/2024	33.045	13/06/2025	32.751
12/12/2024	33.048	14/06/2025	32.782
13/12/2024	33.048	15/06/2025	32.781
14/12/2024	33.043	16/06/2025	32.755
15/12/2024	33.036	17/06/2025	32.721
16/12/2024	33.066	18/06/2025	32.687
17/12/2024	33.114	19/06/2025	32.682
18/12/2024	33.108	20/06/2025	32.709
19/12/2024	33.066	21/06/2025	32.726
20/12/2024	33.027	22/06/2025	32.744
21/12/2024	33.007	23/06/2025	32.724
22/12/2024	32.989	24/06/2025	32.682

Date	Reservoir level (m)	Date (continued)	Reservoir level (m)
23/12/2024	32.976	25/06/2025	32.671
24/12/2024	32.962	26/06/2025	32.669
25/12/2024	32.936	27/06/2025	32.902
26/12/2024	32.933	28/06/2025	33.196
27/12/2024	32.923	29/06/2025	33.256
28/12/2024	32.902	30/06/2025	33.282
29/12/2024	32.882		
30/12/2024	32.863		
31/12/2024	32.843		

Appendix C. Compensation flows

Date	Wairoa Dam compensation release (m^3/day)	Combined Cossey and Wairoa Dams compensation flow (L/s)	Wairoa River at Tourist Road daily average Flow (L/s)
1/07/2024	2.3	0.0	1,373
2/07/2024	0.0	0.0	2,991
3/07/2024	0.0	0.0	2,974
4/07/2024	0.0	0.0	2,388
5/07/2024	2.3	0.0	1,965
6/07/2024	0.0	0.0	1,760
7/07/2024	0.0	0.0	1,637
8/07/2024	0.0	0.0	1,499
9/07/2024	0.0	0.0	1,361
10/07/2024	0.0	0.0	1,272
11/07/2024	4.6	0.1	1,224
12/07/2024	0.0	0.0	1,186
13/07/2024	0.5	0.0	1,137
14/07/2024	0.9	0.0	1,079
15/07/2024	0.0	0.0	1,297
16/07/2024	2.3	0.0	2,050
17/07/2024	0.5	0.0	1,551
18/07/2024	0.0	0.0	1,696
19/07/2024	0.0	0.0	1,603
20/07/2024	0.5	0.0	4,383
21/07/2024	0.9	0.0	4,467
22/07/2024	0.0	0.0	3,451
23/07/2024	5.5	0.1	3,040
24/07/2024	0.0	0.0	2,430
25/07/2024	0.0	0.0	2,076
26/07/2024	0.0	0.0	1,829
27/07/2024	0.0	0.0	1,649
28/07/2024	0.9	0.0	1,534
29/07/2024	0.0	0.0	1,509
30/07/2024	0.0	0.0	5,411
31/07/2024	0.0	0.0	5,999
1/08/2024	0.0	0.0	6,263
2/08/2024	0.9	0.0	4,263
3/08/2024	0.5	0.0	3,015
4/08/2024	0.0	0.0	2,460
5/08/2024	0.0	0.0	2,137
6/08/2024	2.3	0.0	1,898
7/08/2024	0.9	0.0	1,705
8/08/2024	0.0	0.0	1,580
9/08/2024	3.7	0.0	1,590
10/08/2024	0.9	0.0	1,471

Date	Wairoa Dam compensation release (m^3/day)	Combined Cossey and Wairoa Dams compensation flow (L/s)	Wairoa River at Tourist Road daily average Flow (L/s)
11/08/2024	0.0	0.0	1,331
12/08/2024	0.5	0.0	1,333
13/08/2024	0.0	0.0	1,412
14/08/2024	0.0	0.0	1,204
15/08/2024	1.4	0.0	1,138
16/08/2024	0.0	0.0	1,115
17/08/2024	0.9	0.0	2,252
18/08/2024	2.3	0.0	12,162
19/08/2024	1.4	0.0	7,784
20/08/2024	0.5	0.0	5,447
21/08/2024	0.0	0.0	3,525
22/08/2024	0.0	0.0	2,719
23/08/2024	2.3	0.0	2,298
24/08/2024	0.5	0.0	2,301
25/08/2024	0.0	0.0	2,054
26/08/2024	1.4	0.0	1,822
27/08/2024	0.9	0.0	2,964
28/08/2024	0.9	0.0	2,714
29/08/2024	0.0	0.0	2,477
30/08/2024	0.9	0.0	2,459
31/08/2024	0.0	0.0	3,487
1/09/2024	10.1	0.1	14,179
2/09/2024	0.0	0.0	4,633
3/09/2024	0.9	0.0	3,172
4/09/2024	0.0	0.0	2,771
5/09/2024	6.9	0.1	2,284
6/09/2024	0.0	0.0	2,019
7/09/2024	0.0	0.0	1,759
8/09/2024	0.0	0.0	1,829
9/09/2024	0.5	0.0	1,627
10/09/2024	0.0	0.0	1,519
11/09/2024	2.7	0.0	1,443
12/09/2024	0.0	0.0	1,338
13/09/2024	0.0	0.0	1,317
14/09/2024	0.0	0.0	1,329
15/09/2024	0.5	0.0	3,846
16/09/2024	0.9	0.0	2,163
17/09/2024	1.4	0.0	2,838
18/09/2024	0.0	0.0	2,571
19/09/2024	3.7	0.0	2,089
20/09/2024	5.0	0.1	16,376

Date	Wairoa Dam compensation release (m^3/day)	Combined Cossey and Wairoa Dams compensation flow (L/s)	Wairoa River at Tourist Road daily average Flow (L/s)
21/09/2024	2.3	0.0	8,010
22/09/2024	0.0	0.0	3,766
23/09/2024	0.9	0.0	2,954
24/09/2024	0.0	0.0	2,448
25/09/2024	1.4	0.0	2,129
26/09/2024	2.3	0.0	1,906
27/09/2024	0.0	0.0	1,830
28/09/2024	2.3	0.0	1,688
29/09/2024	0.5	0.0	1,577
30/09/2024	2.3	0.0	1,508
1/10/2024	3.7	0.0	1,441
2/10/2024	3.2	0.0	1,425
3/10/2024	2.7	0.0	9,661
4/10/2024	1.4	0.0	3,708
5/10/2024	5.5	0.1	2,464
6/10/2024	0.5	0.0	2,368
7/10/2024	0.0	0.0	12,612
8/10/2024	0.0	0.0	4,552
9/10/2024	0.9	0.0	3,524
10/10/2024	2.3	0.0	2,894
11/10/2024	6.0	0.1	2,581
12/10/2024	0.0	0.0	2215
13/10/2024	2.3	0.0	2,028
14/10/2024	2.3	0.0	2,095
15/10/2024	0.0	0.0	1,837
16/10/2024	1.4	0.0	1,670
17/10/2024	1.4	0.0	1,573
18/10/2024	3.7	0.0	1,501
19/10/2024	4.6	0.1	1,441
20/10/2024	6.0	0.1	1,384
21/10/2024	5.5	0.1	1,334
22/10/2024	3.7	0.0	1,296
23/10/2024	5.5	0.1	1,270
24/10/2024	5.0	0.1	1,241
25/10/2024	4.6	0.1	1,203
26/10/2024	2.7	0.0	1,233
27/10/2024	7.3	0.1	2,501
28/10/2024	8.2	0.1	1,536
29/10/2024	5.0	0.1	1,385
30/10/2024	5.5	0.1	1,340
31/10/2024	6.0	0.1	1,228

Date	Wairoa Dam compensation release (m^3/day)	Combined Cossey and Wairoa Dams compensation flow (L/s)	Wairoa River at Tourist Road daily average Flow (L/s)
1/11/2024	6.9	0.1	1,148
2/11/2024	5.5	0.1	1,086
3/11/2024	6.0	0.1	1,457
4/11/2024	0.0	0.0	1,155
5/11/2024	5.5	0.1	1,041
6/11/2024	3.7	0.0	1,004
7/11/2024	11.9	0.1	978
8/11/2024	5.0	0.1	946
9/11/2024	9.2	0.1	924
10/11/2024	1.4	0.0	904
11/11/2024	12.4	0.1	1,077
12/11/2024	12.4	0.1	966
13/11/2024	6.9	0.1	863
14/11/2024	22.0	0.3	851
15/11/2024	19.7	0.2	3,059
16/11/2024	8.2	0.1	6,316
17/11/2024	12.4	0.1	2,140
18/11/2024	12.8	0.1	1,602
19/11/2024	6.9	0.1	1,400
20/11/2024	8.2	0.1	1,284
21/11/2024	9.6	0.1	1,233
22/11/2024	10.1	0.1	1,207
23/11/2024	10.1	0.1	1,043
24/11/2024	11.9	0.1	992
25/11/2024	8.2	0.1	920
26/11/2024	6.0	0.1	891
27/11/2024	6.9	0.1	895
28/11/2024	5.5	0.1	844
29/11/2024	6.0	0.1	799
30/11/2024	9.2	0.1	966
1/12/2024	5.0	0.1	1,720
2/12/2024	6.0	0.1	1,021
3/12/2024	6.9	0.1	851
4/12/2024	5.5	0.1	812
5/12/2024	5.0	0.1	760
6/12/2024	5.5	0.1	738
7/12/2024	5.5	0.1	708
8/12/2024	5.5	0.1	682
9/12/2024	5.0	0.1	705
10/12/2024	8.2	0.1	945
11/12/2024	9.6	0.1	768

Date	Wairoa Dam compensation release (m^3/day)	Combined Cossey and Wairoa Dams compensation flow (L/s)	Wairoa River at Tourist Road daily average Flow (L/s)
12/12/2024	6.9	0.1	1,277
13/12/2024	6.0	0.1	1,325
14/12/2024	10.1	0.1	926
15/12/2024	6.9	0.1	759
16/12/2024	8.2	0.1	1,864
17/12/2024	0.0	0.0	2,464
18/12/2024	0.0	0.0	1,168
19/12/2024	3.2	0.0	904
20/12/2024	3.2	0.0	796
21/12/2024	3.2	0.0	868
22/12/2024	2.7	0.0	803
23/12/2024	2.7	0.0	949
24/12/2024	3.2	0.0	995
25/12/2024	2.7	0.0	749
26/12/2024	2.7	0.0	938
27/12/2024	2.7	0.0	955
28/12/2024	2.7	0.0	700
29/12/2024	3.2	0.0	616
30/12/2024	2.7	0.0	590
31/12/2024	2.7	0.0	623
1/01/2025	2.7	0.0	651
2/01/2025	2.7	0.0	582
3/01/2025	2.7	0.0	556
4/01/2025	2.7	0.0	731
5/01/2025	2.7	0.0	716
6/01/2025	2.7	0.0	599
7/01/2025	2.7	0.0	537
8/01/2025	2.3	0.0	507
9/01/2025	2.7	0.0	510
10/01/2025	2.7	0.0	505
11/01/2025	2.7	0.3	491
12/01/2025	2.7	0.9	468
13/01/2025	2.7	1.5	453
14/01/2025	2.7	2.1	399
15/01/2025	2.7	2.6	556
16/01/2025	2.7	3.2	444
17/01/2025	2.7	3.6	428
18/01/2025	2.7	3.3	421
19/01/2025	2.7	3.2	415
20/01/2025	2.7	3.2	414
21/01/2025	2.7	3.2	446

Date	Wairoa Dam compensation release (m^3/day)	Combined Cossey and Wairoa Dams compensation flow (L/s)	Wairoa River at Tourist Road daily average Flow (L/s)
22/01/2025	2.7	3.2	526
23/01/2025	2.7	3.2	489
24/01/2025	2.7	3.2	438
25/01/2025	2.7	3.3	417
26/01/2025	2.7	3.2	607
27/01/2025	2.7	3.2	1,057
28/01/2025	2.7	3.2	692
29/01/2025	2.7	3.2	499
30/01/2025	2.7	3.2	459
31/01/2025	2.7	7.2	434
1/02/2025	2.7	7.3	416
2/02/2025	2.7	7.3	406
3/02/2025	2.7	7.3	414
4/02/2025	3.2	7.2	400
5/02/2025	2.7	7.4	387
6/02/2025	2.7	7.4	373
7/02/2025	1179.2	21.1	360
8/02/2025	495.8	13.2	366
9/02/2025	487.5	13.0	360
10/02/2025	959.0	20.4	355
11/02/2025	1472.6	32.5	407
12/02/2025	1482.2	32.5	1,649
13/02/2025	1444.2	34.7	705
14/02/2025	1443.3	33.3	510
15/02/2025	1488.2	34.0	523
16/02/2025	1448.8	33.4	536
17/02/2025	1475.4	33.5	491
18/02/2025	1470.3	33.5	497
19/02/2025	1490.0	33.6	480
20/02/2025	1492.3	33.7	477
21/02/2025	1491.4	33.7	467
22/02/2025	1509.7	33.9	422
23/02/2025	1499.2	33.8	395
24/02/2025	1499.2	33.8	374
25/02/2025	1900.6	46.5	360
26/02/2025	1923.1	45.3	368
27/02/2025	2052.2	46.8	369
28/02/2025	2090.1	47.3	363
1/03/2025	2085.1	47.4	358
2/03/2025	2092.4	47.3	350
3/03/2025	2344.2	55.1	341

Date	Wairoa Dam compensation release (m^3/day)	Combined Cossey and Wairoa Dams compensation flow (L/s)	Wairoa River at Tourist Road daily average Flow (L/s)
4/03/2025	2750.2	60.0	343
5/03/2025	2754.8	59.9	476
6/03/2025	2724.6	59.8	470
7/03/2025	2749.8	60.2	374
8/03/2025	2759.4	60.1	347
9/03/2025	2753.4	60.1	343
10/03/2025	2722.3	59.8	327
11/03/2025	2751.6	60.0	311
12/03/2025	2751.2	60.1	385
13/03/2025	2745.7	60.2	376
14/03/2025	2694.9	59.4	324
15/03/2025	2735.6	60.1	306
16/03/2025	2751.2	60.3	298
17/03/2025	2734.2	59.9	309
18/03/2025	2734.2	59.9	367
19/03/2025	2733.3	59.9	529
20/03/2025	2071.4	45.4	864
21/03/2025	2060.9	45.3	557
22/03/2025	2071.4	45.6	395
23/03/2025	2070.0	45.7	343
24/03/2025	2681.6	59.1	322
25/03/2025	2735.1	59.9	327
26/03/2025	2740.2	59.9	331
27/03/2025	2702.2	59.6	327
28/03/2025	2740.2	60.0	329
29/03/2025	2738.3	59.9	330
30/03/2025	2729.2	63.0	329
31/03/2025	2701.3	59.4	323
1/04/2025	2706.3	59.4	318
2/04/2025	2710.9	59.7	321
3/04/2025	2708.6	59.6	392
4/04/2025	2712.7	59.6	4,163
5/04/2025	2719.6	63.2	7,180
6/04/2025	2718.2	59.7	1,625
7/04/2025	2713.2	59.4	1,022
8/04/2025	1769.3	36.1	929
9/04/2025	1771.5	36.1	1,266
10/04/2025	1770.2	36.2	805
11/04/2025	1770.6	36.1	656
12/04/2025	1774.3	36.3	589
13/04/2025	1767.4	36.3	545

Date	Wairoa Dam compensation release (m^3/day)	Combined Cossey and Wairoa Dams compensation flow (L/s)	Wairoa River at Tourist Road daily average Flow (L/s)
14/04/2025	1761.0	36.2	516
15/04/2025	1762.8	36.2	502
16/04/2025	1766.1	36.1	530
17/04/2025	1767.9	36.3	734
18/04/2025	1007.5	20.9	2,316
19/04/2025	1011.7	21.0	2,379
20/04/2025	1009.4	20.8	1,713
21/04/2025	1009.4	20.8	1,350
22/04/2025	1005.7	20.7	1,093
23/04/2025	771.3	14.5	911
24/04/2025	767.7	14.4	788
25/04/2025	764.5	14.4	689
26/04/2025	764.5	14.5	660
27/04/2025	766.8	14.5	799
28/04/2025	769.0	14.4	1,491
29/04/2025	571.3	23.3	1,103
30/04/2025	568.1	8.8	3,457
1/05/2025	567.6	0.0	8,504
2/05/2025	2.3	2.2	5,977
3/05/2025	1.4	2.2	3,496
4/05/2025	1.4	2.2	2,183
5/05/2025	1.4	2.2	1,717
6/05/2025	1.4	0.0	1,453
7/05/2025	1.4	0.0	1,293
8/05/2025	2.3	0.1	1,190
9/05/2025	2.3	0.3	1,637
10/05/2025	2.3	0.5	5,795
11/05/2025	1.4	0.7	2,502
12/05/2025	1.4	0.9	1,823
13/05/2025	1.4	1.1	1,533
14/05/2025	2.3	1.3	1,383
15/05/2025	2.3	1.7	1,223
16/05/2025	2.3	1.8	1,110
17/05/2025	1.4	1.7	1,037
18/05/2025	2.3	1.6	1,003
19/05/2025	2.3	1.6	1,086
20/05/2025	1.4	1.6	935
21/05/2025	1.4	1.8	841
22/05/2025	1.4	1.6	798
23/05/2025	1.4	7.6	775
24/05/2025	1.4	1.6	753

Date	Wairoa Dam compensation release (m^3/day)	Combined Cossey and Wairoa Dams compensation flow (L/s)	Wairoa River at Tourist Road daily average Flow (L/s)
25/05/2025	1.4	1.6	720
26/05/2025	2.3	6.4	942
27/05/2025	2.3	1.6	15,209
28/05/2025	2.3	1.6	6,144
29/05/2025	2.3	4.5	7,940
30/05/2025	2.3	1.6	7,208
31/05/2025	2.3	1.6	4,177
1/06/2025	2.3	1.6	2,901
2/06/2025	2.3	14.8	2,257
3/06/2025	2.3	7.7	1,956
4/06/2025	2.3	1.6	2,583
5/06/2025	2.3	1.6	28,495
6/06/2025	2440.3	29.8	7,319
7/06/2025	1.4	1.6	6,207
8/06/2025	1.4	4.4	4,033
9/06/2025	1.4	5.1	6,574
10/06/2025	2.3	1.6	4,781
11/06/2025	2.3	1.7	24,174
12/06/2025	2.3	1.6	7,003
13/06/2025	2.3	4.7	8,012
14/06/2025	1.4	1.7	7,758
15/06/2025	1.4	1.7	5,298
16/06/2025	1.4	1.6	3,858
17/06/2025	1.4	1.7	3,033
18/06/2025	1.4	1.7	2,545
19/06/2025	1.4	1.8	2,245
20/06/2025	1.4	1.8	5,371
21/06/2025	1.4	1.7	3,650
22/06/2025	1.4	1.8	2,760
23/06/2025	1.4	1.8	2,404
24/06/2025	1.4	1.8	2,108
25/06/2025	101.6	3.0	1,891
26/06/2025	2.3	2.0	1,808
27/06/2025	2.3	1.9	30,298
28/06/2025	2.3	1.7	12,655
29/06/2025	2.3	1.7	7,796
30/06/2025	1.4	1.9	5,020
	0.0		

Appendix D. Native fisheries annual MPI report

Auckland Water Supply Dams
2024-2025 Native Fisheries Annual Report

Final - August 2025

Watercare

QUALITY INFORMATION

Document	Annual Report
Date	8 August 2025
Name and position of originator	Emma Baker, Environmental Scientist
Report directory	\\water.internal\ORG\Ops\Water Supply\Headworks\SDGEN\00 - Site General\Compliance\Trap and Haul\Ministry of Fisheries Reports

REVISION HISTORY

Rev	Revision Date	Name	Position	Signature
1	24/07/2025	Michiel Jonker	Environmental Care Manager	
2	05/08/2025	AJ Grobler	Operations Controller	
3	08/08/2025	Brendon Dockary	Operations Controller	

APPROVED

Date	Name	Position	Signature
08/08/2025	Michiel Jonker	Environmental Care Manager	

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1 INTRODUCTION

Watercare Services Limited (Watercare) currently undertakes a Native Fisheries Management Programme utilising 'trap and haul' methods at eight of the water supply dams. Ministry of Primary Industries approval has been granted for this work under Special Permit 737 (expires on 1 October 2025; Appendix A) and Fish Transfer Authorisation NFT325. The permit covers the upstream and downstream trap and haul activities for dams in the Auckland and Waikato regions:

- Hunua Ranges:
  - Hays Creek Dam
  - Cosseys Dam
  - Wairoa Dam
  - Upper Mangatawhiri Dam
  - Mangatangi Weir
- Waitākere Ranges:
  - Lower Nihotupu Dam
  - Lower Huia Dam
  - Waitākere Dam

New permits will be applied for to continue trap and haul from the 2025-2026 season onwards.

This report provides details of the programme for the period 1 July 2024 to 30 June 2025, in fulfilment of conditions 27, 28 and 29 of Special Permit 737.

2 UPSTREAM TRANSFER

Trapping for elver and other freshwater fish was conducted at the following sites for the purpose of upstream transfer:

- Lower Nihotupu Dam
- Waitākere Dam
- Hays Creek Dam
- Cosseys Dam
- Mangatangi weir

Trapping (upstream transfer) at Lower Huia Dam has proven unsuccessful in the past and is no longer undertaken.

2.1 Collection methods

During the 2024-2025 trap and haul season, two traps were deployed in the Waitākere Ranges and three in the Hunua Ranges. The design and methodology of each trap followed those outlined in Watercare's Native Fisheries Program – Operations Manual for Undertaking Trap and Haul.

During rainfall events, traps were taken out of service as part of standard operations. Additionally, over the Christmas holiday period, the Hunua dams' traps were not in service due to low staff availability.

2.2 Fish species, elvers and approximate total weight

The estimated weight of each catch is based on the number of individuals caught, the expected weight for each species (1 g per elver and 0.5 g per juvenile galaxiid) and the measured size of the individuals. The data provided in Table 2-1 to Table 2-5 fulfil conditions 28a, 28b and 28f.

All elvers and galaxiids were released directly into the respective dams upstream of the trapping sites or above the Mangatangi weir.

Table 2-1: Approximate total weight of each species collected at Lower Nihotupu Dam during the 2024-2025 upstream trap and haul season.

Date	Elver (g)	Galaxiids (g)
20/10/2024	5	100.0
24/10/2024	-	10.0
30/10/2024	6	3.5
3/11/2024	40	1.0
7/11/2024	38	-
13/11/2024	12	-
18/11/2024	14	9.0
25/11/2024	80	30.0
28/11/2024	50	2.0
3/12/2024	200	-
6/12/2024	250	6.0
9/12/2024	300	2.5
10/12/2024	50	0.5

Date	Elver (g)	Galaxiids (g)
15/12/2024	40	1.5
22/12/2024	100	-
22/12/2024	50	-
2/01/2025	480	-
5/01/2025	107	3.0
9/01/2025	100	-
14/01/2025	60	-
16/01/2025	100	0.5
23/01/2025	120	2.0
28/01/2025	230	-
3/02/2025	200	16.0
6/02/2025	85	-
11/02/2025	48	-
17/02/2025	30	-
7/03/2025	28	-
10/04/2025	14	-
Total	**2,837**	**178.0**

Table 2-2: Approximate total weight of each species collected at Waitākere Dam during the 2024-2025 upstream trap and haul season.

Date	Elver (g)	Galaxiids (g)
10/11/2024	5	-
18/11/2024	7	-
2/12/2024	23	1.0
11/12/2024	22	2.0
19/12/2024	12	1.0
27/12/2024	3	1.5
29/12/2024	3	1.0
29/12/2024	35	-
3/01/2025	170	-
6/01/2025	12	-
7/01/2025	100	-
9/01/2025	50	-
13/01/2025	110	-
14/01/2025	5	7.5
16/01/2025	200	-
20/01/2025	24	-
21/01/2025	104	-

Date	Elver (g)	Galaxiids (g)
2/02/2025	35	-
7/02/2025	300	-
10/02/2025	140	-
17/02/2025	350	-
27/02/2025	200	-
4/03/2025	64	-
10/03/2025	184	-
12/03/2025	11	-
18/03/2025	64	-
26/03/2025	38	-
30/03/2025	44	-
16/04/2025	15	-
Total	**2,330**	**14.0**

Table 2-3: Approximate total weight of each species collected at Hays Creek Dam during the 2024-2025 upstream trap and haul season.

Date	Elver (g)	Galaxiids (g)
21/10/2024	-	1.0
28/10/2024	-	1.5
31/10/2024	-	0.5
1/11/2024	-	1.0
2/11/2024	-	2.0
4/11/2024	-	1.0
4/11/2024	-	0.5
5/11/2024	-	2
22/12/2024	52	-
27/12/2024	49	-
30/12/2024	69	-
31/12/2024	16	-
7/01/2025	17	-
13/01/2025	15	-
13/01/2025	200	0.5
15/01/2025	14	-
6/02/2025	84	-
19/02/2025	46	-
20/02/2025	25	-
24/02/2025	12	-
3/03/2025	3	-

Date	Elver (g)	Galaxiids (g)
4/03/2025	6	-
9/03/2025	6	-
Total	**614**	**10.0**

Table 2-4: Approximate total weight of each species collected at Cosseys Dam during the 2024-2025 upstream trap and haul season.

Date	Elver (g)	Galaxiids (g)
29/10/2024	3	-
7/11/2024	2	-
14/11/2024	2	-
2/12/2024	16	-
3/12/2024	5	-
3/12/2024	16	-
16/12/2024	12	-
26/12/2024	10	-
29/12/2024	26	-
31/12/2024	18	-
5/01/2025	16	-
7/01/2025	12	-
14/01/2025	12	-
27/01/2025	66	-
4/02/2025	24	-
12/02/2025	5	-
18/02/2025	11	-
19/02/2025	11	-
21/02/2025	15	-
10/03/2025	34	-
14/03/2025	3	-
18/03/2025	4	-
Total	**323**	**0.0**

Table 2-5: Approximate total weight of each species collected at Mangatangi weir during the 2024-2025 upstream trap and haul season.

Date	Elver (g)	Galaxiids (g)
8/10/2024	1	-
30/10/2024	1	-
13/11/2024	1	-
17/11/2024	2	-
20/11/2024	4	-

Date	Elver (g)	Galaxiids (g)
25/11/2024	4	-
26/11/2024	4	-
29/11/2024	6	-
1/12/2024	50	-
9/12/2024	1	-
11/12/2024	23	0.5
13/12/2024	24	-
16/12/2024	19	-
23/12/2024	3	-
24/12/2024	4	-
30/12/2024	11	1.0
31/12/2024	13	-
2/01/2025	7	-
3/01/2025	11	-
5/01/2025	13	0.5
8/01/2025	14	-
10/01/2025	5	-
20/01/2025	55	5.5
27/01/2025	78	1.5
28/01/2025	13	-
29/01/2025	35	-
30/01/2025	3	-
3/02/2025	15	0.5
7/02/2025	24	-
16/02/2025	4	-
21/02/2025	7	0.5
28/02/2025	3	-
10/03/2025	1	-
Total	**459**	**10**

2.3 Juvenile eel length

Condition 28c requires the weight of juvenile eels (i.e., greater than 20 g in weight) collected for transfer to be measured. The length was measured instead of weight, consistent with previous years' practices. The data is provided in Table 2-6.

Table 2-6: Length of juvenile eels reported during the 2024-2025 upstream trap and haul season

Location	Date	Length of juvenile eel (mm)
Waitākere	23/10/2024	250

2.4 Bycatch species and weight

The most caught bycatch species were the Kōura (*Paranephrops planifrons*) and bullies (*Gobiomorphus spp*). All bycatch species were caught in the permanent fish trap structures located at the base of the dams. On average, the bullies are estimated to weigh 2.5 g, and smelt (*Retropinna retropinna*) approximately 0.5 g, though no smelt were caught during this trap and haul season. When the bully species could not be identified, they were assumed to be common bullies. The results of the bycatch are presented in Table 2-7.

Table 2-7: Approximate total weight of bycatch reported during the 2024-2025 upstream trap and haul season.

Location	Date	Species (number if weight unknown)	Weight (g)
Lower Nihotupu	20/10/2024	Common bully	2.5
	24/10/2024	Common bully	2.5
	3/11/2024	Common bully	65.0
	7/11/2024	Common bully	17.5
	13/11/2024	Common bully	12.5
	25/11/2024	Common bully	27.5
	3/12/2024	Common bully	7.5
	3/12/2024	Common bully	15
	9/12/2024	Common bully	7.5
	10/12/2024	Common bully	17.5
	15/12/2024	Common bully	2.5
	22/12/2024	Common bully	2.5
	22/12/2024	Common bully	12.5
	14/01/2025	Common bully	2.5
	16/01/2025	Common bully	2.5
	7/03/2025	Common bully	2.5
	10/04/2025	Common bully	25.0
Waitākere	18/11/2024	Common bully	2.5
	29/12/2024	Common bully	10.0
	3/01/2025	Common bully	5.0
	10/02/2025	Common bully	7.5
Hays Creek	1/12/2024	Common bully	2.5
	7/01/2025	Common bully	2.5
Mangatangi	8/10/2025	Common bully	15.0
		Kōura (1)	n/a
	11/10/2025	Common bully	5.0
	14/10/2025	Common bully	2.5
	18/10/2024	Common bully	2.5
	22/10/2024	Kōura (1)	n/a

Location	Date	Species (number if weight unknown)	Weight (g)
	22/10/2024	Common bully	2.5
	22/10/2024	Redfin bully (1)	2.5
	24/10/2024	Kōura (1)	n/a
	29/10/2024	Kōura (1)	n/a
	29/10/2024	Common bully	7.5
	1/11/2024	Redfin bully	2.5
	4/11/2024	Common bully	2.5
	6/11/2024	Common bully	2.5
	8/11/2024	Common bully	5.0
	11/11/2024	Common bully	15.0
	13/11/2024	Common bully	15.0
	18/11/2024	Common bully	7.5
	20/11/2024	Common bully	7.5
	21/11/2024	Kōura (1)	n/a
	25/11/2024	Common bully	7.5
	26/11/2024	Kōura (1)	n/a
	26/11/2024	Common bully	17.5
	1/12/2024	Kōura (10)	n/a
	1/12/2024	Common bully	30.0
	1/12/2024	Common bully	22.5
	6/12/2024	Kōura (1)	n/a
	9/12/2024	Common bully	37.5
	11/12/2024	Common bully	42.5
	13/12/2024	Kōura (2)	n/a
	13/12/2024	Common bully	32.5
	16/12/2024	Common bully	40.0
	18/12/2024	Common bully	15.0
	23/12/2024	Common bully	12.5
	24/12/2024	Kōura (1)	n/a
	24/12/2024	Common bully	105.0
	27/12/2024	Common bully	117.5
	30/12/2024	Common bully	170.0
	31/12/2024	Common bully	27.5
	3/01/2025	Common bully	45.0
	6/01/2025	Common bully	75.0
	8/01/2025	Common bully	32.5
	10/01/2025	Common bully	12.5
	21/01/2025	Common bully	27.5

Location	Date	Species (number if weight unknown)	Weight (g)
	27/01/2025	Kōura (1)	n/a
	27/01/2025	Common bully	45.0
	29/01/2025	Common bully	37.5
	3/02/2025	Common bully	12.5
	7/02/2025	Common bully	120.0
	10/02/2025	Common bully	25.0
	16/02/2025	Common bully	42.5
	18/02/2025	Common bully	25.0
	21/02/2025	Common bully	175.0
	24/02/2025	Common bully	20.0
	28/02/2025	Kōura (1)	n/a
	28/02/2025	Common bully	10.0
	3/03/2025	Common bully	12.5
	6/03/2025	Kōura (1)	n/a
	10/03/2025	Kōura (1)	n/a
	10/03/2025	Common bully	7.5
	21/03/2025	Kōura (2)	n/a
	24/03/2025	Common bully	15.0
	24/03/2025	Kōura (2)	n/a
	26/03/2025	Kōura (4)	n/a
	31/03/2025	Kōura (3)	n/a
Total			**1,767.5**

2.5 Fish deaths

Fish deaths were observed on a number of occasions during the upstream trapping season, detailed in Table 2-8. When the bully species could not be identified, they were assumed to be common bullies. Fish deaths primarily occurred inside the permanent fish trap structures, however, deceased juvenile brown trout (*Salmo trutta*) were located on the netted ramp leading to the tank at the Mangatangi weir, and some elvers were found in the trap's outlet structure at Waitākere Dam.

Table 2-8: Fish deaths during the 2024-2025 upstream trap and haul.

Location	Date	Species	Number
Lower Nihotupu	30/10/2024	Galaxiid	5
	3/11/2024	Common bully	5
Waitākere	7/01/2025	Elver	1
	7/02/2025	Elver	2
	10/03/2025	Elver	12
	16/04/2025	Elver	4
Hays Creek	29/10/2024	Galaxiids	3
	31/10/2024	Galaxiids	1

Location	Date	Species	Number
	2/11/2024	Galaxiids	1
Cosseys	30/12/2024	Elver	1
Mangatangi	20/11/2024	Brown trout	1
	21/11/2024	Brown trout	6
	25/11/2024	Brown trout	1
	26/11/2024	Brown trout	10
	29/11/2024	Brown trout	9
	2/12/2024	Brown trout	4
	2/12/2024	Elver	3

3 DOWNSTREAM TRANSFER

3.1 Collection methods

Net setting for eels was conducted at the following eight sites for the purpose of downstream transfer:

- Lower Nihotupu Dam
- Lower Huia Dam
- Waitākere Dam
- Hays Creek Dam
- Cosseys Dam
- Wairoa Dam
- Upper Mangatāwhiri Dam
- Mangatangi Dam

Fyke nets are used as the downstream eel trapping method. They are long cylindrical netting bags with netting cones, designed for easy entry but a difficult exit. Two fyke nets were deployed near the dam face in all permitted water supply dams overnight, collected on the dates listed in Table 3-1 during the eel migration season. Migrating eels exhibit distinctive morphological features and can therefore be identified from non-migrating eels during the trapping process.

3.2 Migrating eel

Condition 28h requires reporting on several aspects of the downstream eel transfer process, including the total weight, approximate number, and species of adult migrating eels collected for transfer. It also requires the date of collection, comments on the prevailing flow conditions (e.g., normal, flood), the site of release, and the percentage of eels caught that were successfully transferred and released.

Table 3-1 provides most of the data required by this condition. There were 19 migrating eels caught in the 2024-2025 trap and haul season, this is an increase compared to the 11 eels caught in 2023-2024. Any migrant eels caught were transferred downstream on the day of capture and the remainder of the catch was released back into dams. Flow conditions were normal on the days trapping occurred.

Table 3-1: Total weight per day, eel species and approximate numbers caught for transfer, and the number and percentage of adult migrating eels transferred.

Location	Date	Total	Species		Weight (g)		Length (mm)		Migrators	
		Eels	Longfin	Shortfin	Average	Largest	Average	Largest	Count	(%)
Lower Nihotupu	4/03/2025	3	0	3	340	510	550	600	0	0
	25/03/2025	6	3	3	400	600	550	750	2	33.3
	15/04/2025	0	0	0	0	0	0	0	0	0
	6/05/2025	4	1	3	1162.5	2,900	712.5	950	2	50
	27/05/2025	3	2	1	4066.7	7,700	1000	1,400	2	66.7
Lower Huia	2/04/2025	0	0	0	0	0	0	0	0	0
	23/04/2025	0	0	0	0	0	0	0	0	0
	13/05/2025	0	0	0	0	0	0	0	0	0

Location	Date	Total Eels	Species		Weight (g)		Length (mm)		Migrators	
			Longfin	Shortfin	Average	Largest	Average	Largest	Count	(%)
	22/05/2025	0	0	0	0	0	0	0	0	0
	27/06/2025	0	0	0	0	0	0	0	0	0
Waitākere	20/03/2025	1	0	1	750	750	700	700	0	0
	5/06/2025	0	0	0	0	0	0	0	0	0
Hays Creek	19/03/2025	0	0	0	0	0	0	0	0	0
	24/04/2025	7	4	3	1000	2,900	671.4	1,100	1	14.3
	28/05/2025	4	4	0	1,780	3,555	1,000	1,500	0	0
	30/05/2025	4	4	0	3,650	6,850	912.5	1,300	1	25
Cosseys	12/03/2025	2	2	0	2,025	3,000	750	900	0	-
	14/03/2025	5	5	0	3,253	9,000	780	950	1	20
	15/04/2025	0	0	0	0	0	0	0	0	-
	18/04/2025	1	1	0	1,634	1,634	800	800	0	-
	20/05/2025	1	1	0	400	400	400	400	0	-
	21/05/2025	2	2	0	1142.5	1,600	825	900	0	-
	26/06/2025	3	3	0	569.7	956	500	800	0	-
Wairoa	5/03/2025	1	1	0	5,900	5,900	1,270	1,270	1	100
	7/03/2025	1	1	0	1,525	1,525	570	570	1	100
	9/04/2025	4	4	0	4,050.5	6,702	1,026.25	1,205	0	-
	11/04/2025	0	0	0	0	0	0	0	0	-
	14/05/2025	1	1	0	3,000	3,000	950	950	0	-
	16/05/2025	1	1	0	3,674	3,674	1,200	1,200	1	100
Mangatāwhiri	7/05/2025	3	3	0	2,803	5,675	916.7	1,200	1	33.3
	9/05/2025	6	6	0	617	985	520	600	0	-
	11/06/2025	0	0	0	0	0	0	0	0	-
	13/06/2025	0	0	0	0	0	0	0	0	-
Mangatangi	26/03/2025	1	1	0	1,950	1,950	960	960	0	-
	27/03/2025	0	0	0	0	0	0	0	0	-
	2/05/2025	7	7	0	1,205	2,390	714.3	900	6	85.7

3.3 Bycatch species and weight

Perch (*Perca fluviatilis*), rudd (*Scardinius erythrophthalamus*) and carp (*Cyprinus rubrofuscus*) were caught in the dams as part of the downstream transfer and weighed onsite.

Table 3-2: Approximate total weight of the bycatch reported during the 2024-2025 downstream trap and haul season.

Location	Date	Species	Weight (g)
Lower Nihotupu	25/03/2025	Perch	50
		Rudd	100
Hays Creek	30/05/2025	Carp	150
Cosseys	26/06/2025	Perch	300

Location	Date	Species	Weight (g)
Upper Mangatāwhiri	2/04/2025	Common bully	34

3.4 Fish deaths

Fish deaths occurred on two occasions as part of the downstream transfer operations. One deceased rudd was found at Cosseys Dam on 21 May 2025, and two carp were found on 30 May 2025 at Hays Creek Dam.

4 SUMMARY

Upstream transfer of migrating species occurred at five Watercare dams for the 2024-2025 season: Lower Nihotupu Dam, Waitākere Dam, Hays Creek Dam, Cosseys Dam and at the Mangatangi weir. All transferred both galaxiids and elvers, with Lower Nihotupu having the greatest catch rates, consistent with previous years. Notably, a significant number of bullies were also caught at the Mangatangi weir.

The downstream transfer of migrating species was undertaken at eight Watercare dams for the season: Lower Nihotupu Dam, Lower Huia Dam and Waitākere Dam in the Waitākere Ranges and Hays Creek dam, Cosseys Dam, Wairoa Dam, Upper Mangatawhiri Dam and at the Mangatangi weir in the Hunua Ranges. Eels (migratory and non-migratory) were caught on at least one occasion at most dams, with the exception of Lower Huia Dam. Migrating eels were caught at all five Hunua Ranges dams, and only at Lower Nihotupu Dam in the Waitākere Ranges.

Appendix A. Ministry of Primary Industries Special Permit 737

Fisheries New Zealand
Tini a Tangaroa

SPECIAL PERMIT (737)

The Director-General of the Ministry for Primary Industries (**MPI**) acting through his delegated officer (**Director-General**) and pursuant to section 97(1) of the *Fisheries Act 1996* (**the Act**), hereby issues a special permit to:

Watercare Services Limited
Private Bag 92521
Wellesley Street
Auckland 1141

Client Number: 9720100

and agents, representatives and employees of, as part of their association with Watercare Services Limited (**the permit holder**), subject to the following conditions specified below.

Purpose

1. This special permit is issued for the following purpose specified in section 97(1)(c) of the Act:
    a) to allow persons or agencies to take aquatic life and relocate it to a suitable habitat where this is necessary or required to mitigate adverse effects of habitat modification on the aquatic life.
2. The permit holder is permitted to take, transfer, and release native fish of the following species: shortfin and longfin eels (*Anguilla* spp.), *Galaxias* spp., *Gobiomorphus* spp., and torrentfish (*Cheimarrichthys fosteri*), irrespective of size for the above purpose.

Term of Permit

3. This special permit revokes and replaces special permit 610 and any previous amendments.
4. This special permit is valid from the date of signature until 1 October 2025, unless sooner varied or revoked.

Permitted Activities

5. This special permit allows the taking (as defined in section 2 of the Act) of aquatic life, for the purposes of relocating aquatic life, to mitigate adverse effects of habitat modification, carried out by the permit holder.

6. Fishing under the authority of this special permit for upstream migration may only be taken from the following waterways:
    a) Hūnua area:

i) Cosseys Stream or its tributaries downstream of the Cosseys Dam;

ii) Hays Creek or its tributaries downstream of the Hays Creek Dam;

iii) Mangatangi stream or its tributaries downstream of the Mangatangi Weir.

b) Waitākere area:

i) Huia Stream, downstream of the lower Huia Dam;

ii) Nihotupu Stream, downstream of the lower Nihotupu Dam, near the spillway;

iii) Waitākere River, downstream of the Waitākere Dam.

7. Fishing under the authority of this special permit may be undertaken for downstream migrant eels from the following waterways:

a) Hūnua area:

i) Cosseys Reservoir upstream of the Cosseys Dam;

ii) Hays Creek Reservoir upstream of the Hays Creek Dam;

iii) Wairoa Reservoir upstream of the Wairoa Dam;

iv) Mangatangi Reservoir upstream of the Mangatangi Dam;

v) Mangatawhiri Reservoir upstream of the Upper Mangatawhiri Dam.

b) Waitakere area:

i) Lower Huia Reservoir, upstream of the Huia Dam;

ii) Lower Nihotupu Reservoir, upstream of the Nihotupu Dam;

iii) Waitākere Reservoir, upstream of the Waitakere Dam.

8. New sites or species may only be added under the authority of this special permit through an amendment to the special permit. An application for inclusion of new site or species must be lodged with the Customary Fisheries and Spatial Allocations Manager (see Schedule One for contact details).

9. The permit holder is to obtain written approval from the taiāpure management committee or Tangata Kaitiaki/Tiaki prior to fishing in any taiāpure–local fisheries or mātaitai area. The permit holder should contact the relevant Fisheries Compliance Team Manager (see contact details in Schedule One) for current details of taiāpure-local fisheries or mātaitai reserves in the area where collection is proposed.

10. The permit holder is to consult with Waikato-Tainui before fishing in Waikato Tainui's rohe (illustrated as area A on the Iwi map attached in Schedule Two). The permit holder should avoid fishing in wāhi tapu areas within area A. To determine areas of significance to Iwi, the permit holder is advised to contact local marae in areas where fishing is to take place. Local marae details can be obtained from Waikato Raupatu River Trust [ph. (07) 858 0400].

11. Any transfer of native fish may only be undertaken with an appropriate approval pursuant to section 26ZM(2) of the *Conservation Act 1987*, or any statutory re-enactment or amendment of that provision.

Fishing Conditions

12. No fish, aquatic life, or seaweed may be taken for personal use or collection, to provide for broodstock for commercial production, or for sale, bait or berley, while fishing under the authority of this special permit.

13. For the purpose of fishing pursuant to this special permit, the permit holder is authorised to use:

    a) Fyke nets irrespective of mesh size (escapement tubes blocked if required);

    b) A floating pontoon set trap with wings and holding pen;

    c) Dip nets irrespective of mesh size;

    d) Mesh liners may be used on fyke nets to meet the desired net mesh size;

    e) A fish trap with a ramp, shaded holding tank and using a fish attractant;

    f) Any other catching device as approved by the Customary Fisheries and Spatial Allocations Manager;

    g) Any suitable vessel.

14. Any fishing equipment left unattended must be clearly labelled with the permit holder's name and the words: "Fisheries New Zealand Special Permit No. 737".

15. Explosive or toxic gas, or toxic, poisonous, or narcotic substance must not be used to take native fish under the authority of this special permit unless prior written approval is obtained from the Customary Fisheries and Spatial Allocations Manager, Fisheries New Zealand.

16. Any vessel(s) nominated to fish under the authority of this special permit must not engage in commercial fishing for any species under the authority of a fishing permit, issued under section 91 of the Act, while fishing under the authority of this special permit. Unless written approval is obtained from a Regional Fisheries Compliance Team Manager prior to fishing. For the purposes of interpretation, 'commercial fishing' is defined as the taking of fish, aquatic life, or seaweed within New Zealand fisheries waters for the purpose of sale.

Disposal Conditions

17. Any bycatch species caught while fishing under the authority of this special permit shall be released at the point of capture with the exception of dead, diseased or unwanted aquatic life[1]. The permit holder shall take measures as appropriate to minimise the capture of non-target species (eg, trout). These may include appropriate placement of fishing gear and using grills or coarse mesh.

18. The permit holder must not use any fish or aquatic life taken under this permit for personal use or collection, to stock a fish farm or use as food on a fish farm, for consumption, or for bait.

19. Native fish that cannot be returned alive to the environment (including dead, diseased or contaminated eels), must be humanely killed and disposed of in a biosecure manner, after relevant data has been collected, as per appendices.

[1] Unwanted aquatic life as defined in section 2 of the *Fisheries Act 1996*.

Upstream migrants

20. Fish taken under this special permit may be held in a 'holding pen' at the point of capture for a period of no more than 7 days. Fishing equipment should be inspected more frequently during peak migration or following floods. Releases of fish may not be made beyond any natural barrier (as natural recruitment processes should determine passage beyond these points).

Downstream migrants

21. Eels taken under this special permit as adult downstream migrants may be held at the specific capture sites for a maximum of 72 hours from the time of capture and are to be released as follows:

    a) Eels taken from the lower Nihotupu Reservoir: either below the Nihotupu Dam or in the Huia Stream below the lower Huia Dam;

    b) Eels taken from all other reservoirs: at a point in the river catchment from which they were taken where their subsequent migration is unhindered by any manmade barrier.

22. All non-migrant eels collected shall be released upstream of the collection point.

Biosecurity Conditions

23. In order to eliminate the risk of transferring species declared as noxious or unwanted organisms within the aquatic environment, the permit holder must screen catch for signs of disease or morbidity and any unwanted aquatic life before transportation.

24. During the collection fish, aquatic life, or seaweed the permit holder shall ensure that no aquatic plant, noxious fish, or unwanted organism, including eggs and larvae of noxious fish or unwanted organisms, is introduced into any other waterway, either from the water holding the collected fish, aquatic life, or seaweed, or enmeshed in fishing gear.

25. To prevent the spread of unwanted aquatic plants and animals, all equipment used in the collection and removal of fish, aquatic life or seaweed must be thoroughly checked, cleaned and dried before and after being used for fishing under this special permit:

    a) all equipment used in the transport, holding and release of aquatic life should be treated, as outlined below, before being used again:

        i. all non-fibrous (metal and plastic) smooth surfaced equipment is to be thoroughly cleaned using freshwater (chlorinated town supply water, bore water or collected rain water); and

        ii. any non-fibrous smooth surfaced equipment that can retain water such as under seals and hollows within handles etc. must be dismantled in such a way that all surfaces can be thoroughly cleaned using freshwater (chlorinated town supply water, bore water or collected rain water); and

    b) all other equipment must be:

        i. immersed for a minimum of 30 seconds, in a water bath heated to at least 50° C; or

ii. immersed in water, for a minimum of 5 minutes containing at least 35 g of sodium chloride per litre.

26. The permit holder must notify Biosecurity New Zealand's emergency hotline (0800 809 966) as soon as practicable should it observe unwanted or unusual organisms, including any distressed, diseased, or moribund aquatic life during any of its operations. None of the above organisms or contaminated water, should be released into any waterway and samples should be kept for Biosecurity New Zealand investigation. Samples should be chilled not frozen, or as advised after contacting Biosecurity New Zealand.

Reporting Requirements

27. The permit holder shall supply an annual report of all work undertaken under the authority of this special permit to the Customary Fisheries and Spatial Allocations Manager, Fisheries New Zealand (see contact details in Schedule One). This report shall be supplied no later than the 31st of August of each year. A nil return shall be made if no collection activities are undertaken by the 31st August of each year.

28. The report should contain the following information:

Upstream transfers

a) the species and approximate total weight of each species collected for transfer, and the date of collection;

b) the total weight of elvers (ie, less than 20 g in weight) collected for transfer, and the date of collection;

c) the total weight of juvenile eels (ie, greater than 20 g in weight) collected for transfer, and the date of collection;

d) the species and total weight of each bycatch species caught, and which method or specific trap resulted in their capture;

e) numbers of each species that die before release of the fish can occur;

f) the total weight of each species released at each respective release site, the location of the site, and date of respective releases;

g) the number and type of collection mechanisms employed, and any factors that reduced collection efficiency.

Downstream transfers

h) the total weight, approximate number and species of adult migrating eels collected for transfer, and the date of collection, including comment on the flow conditions that prevailed on that date (eg, normal, flood), the site of release, and the percentage caught that were transferred and released;

i) the species and total weight of each bycatch species caught, and which method or specific trap resulted in their capture;

j) numbers of each species that die before release of the fish can occur;

k) the number and type of collection mechanisms employed, and a brief description of how they work.

29. To obtain useful data for the management of native eel fisheries, the permit holder is also required to:

a) record the number and total weight of shortfin and longfin elvers in a representative sample of the catch (100 elvers) at 15 day intervals, when catch allows. For the purpose of this data collection elvers are those up to 20 g in weight;

b) supply electronic records (in Excel or txt format) on fish caught for entry into the New Zealand Freshwater Fish or eel recruitment database (currently maintained by NIWA) to Fisheries New Zealand with the annual report required by condition 27.

30. For any projects, or part projects that are carried out in Waikato-Tainui's rohe (area A in Schedule Two) a summary report of those projects must be submitted to Waikato Raupatu River Trust annually (see contact details in Schedule One).

31. For the purpose of this permit, the permit holder is not required to meet the requirements of the *Fisheries (Reporting) Regulations 2017* and the *Fisheries (Geospatial Position Reporting) Regulations 2017*.

General Conditions

32. Except as otherwise expressly provided, the provisions of the Act or any regulation, notice, direction, restriction, requirement, or condition under the Act will apply to any fishing, or any person engaged in fishing, under this special permit.

33. The permit holder must ensure that all personnel, read, understand and are fully conversant with the conditions of the special permit before the taking aquatic life commences under this special permit.

34. This special permit must be held at the permit holder's premises. The permit holder of their employees or agents at the location, must have a copy of this special permit in their possession while collecting aquatic life under the authority of this special permit. In all cases, copies of this special permit must be produced for sighting on request by a Fishery Officer.

35. The Director-General (or his delegate) may amend, add or revoke any conditions to this special permit, or revoke this special permit by notice in writing to the permit holder.

36. This special permit does not preclude the permit holder from complying with any other statutory requirement from any other governing agency.

37. No fishing undertaken, or catch taken or otherwise possessed under this special permit shall give rise to any right, privilege, or expectation or preference in regard to the granting of any future permit, license, authorisation, quota, catch history, individual catch entitlement or other right whatsoever under the Act.

38. Failure to comply with the conditions of this special permit can, at the discretion of the delegated officer, result in the revocation of the permit. Every person commits an offence who contravenes any term or condition placed on this special permit and is liable to a fine not exceeding $100 000.

DATED at Nelson on the 9th of June 2020.

David Scranney
Manager Customary Fisheries and Spatial Allocations
Acting pursuant to a delegation issued under Section 41 of the State Sector Act 1988.

SCHEDULE ONE:
Contact Details

Fisheries New Zealand Manager Customary Fisheries and Spatial Allocations can be contacted by the following:

Nelson	David Scranney Tel (03) 548 1069 Email: David.Scranney@mpi.govt.nz cc. Christine.Bowden@mpi.govt.nz

Fisheries Compliance Regional Manager can be contacted by the following:

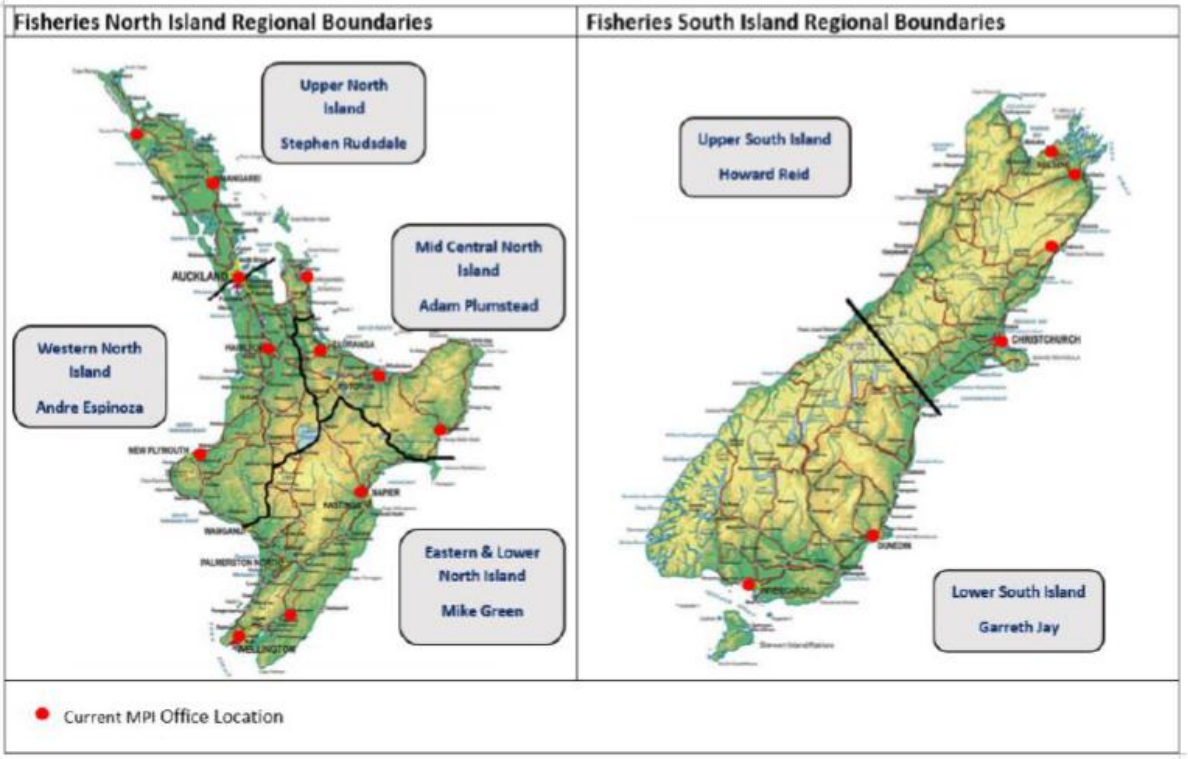
Upper North Island	Stephen Rudsdale Tel (09) 470 0580 Email Stephen.Rudsdale@mpi.govt.nz cc. Charlene.Sutton@mpi.govt.nz
Western North Island	Andre Espinoza Tel (09) 820 7742 Email: Andre.Espinoza@mpi.govt.nz cc. Louise.Kay@mpi.govt.nz

Waikato-Tainui River Iwi can be contacted on the following:

Hamilton	Taroi Rawiri Waikato-Tainui Environmental Manager Waikato Raupatu River Trust Private Bag 3344 Hamilton Tel: (07) 858 0400 Email: taroi.rawiri@tainui.co.nz

NIWA agent for otolith submissions can be contacted by the following:

Christchurch	Dr Shannan Crow NIWA 10 Kyle Street Riccarton Tel: 027 291 9119 Email: shannan.crow@niwa.co.nz


Fisheries North Island Regional Boundaries
Upper North Island
Stephen Rudsdale
Mid Central North Island
Adam Plumstead
Western North Island
Andre Espinoza
Eastern & Lower North Island
Mike Green
AUCKLAND
Fisheries South Island Regional Boundaries
Upper South Island
Howard Reid
Lower South Island
Garreth Jay
CHRISTCHURCH
Current MPI Office Location

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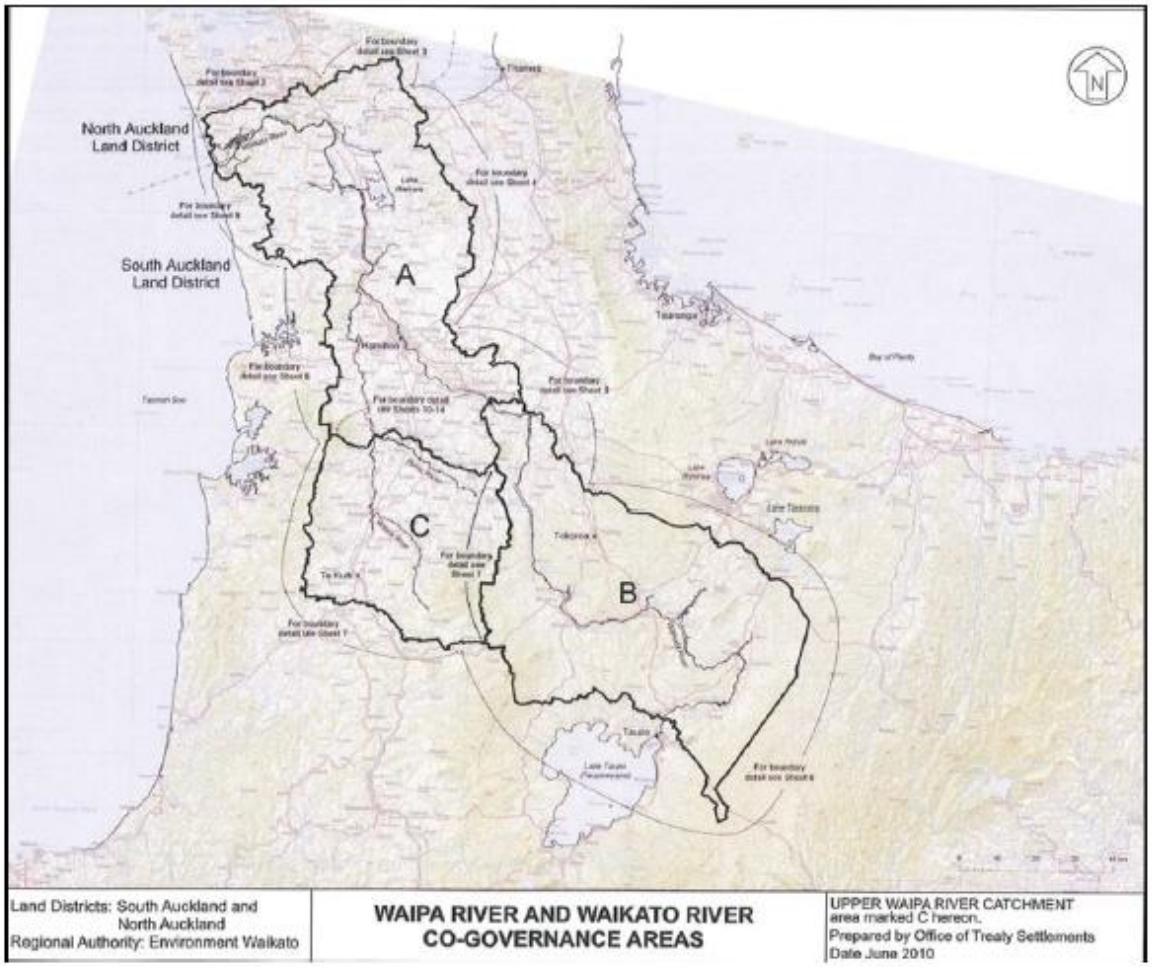
SCHEDULE TWO
Map of Waikato co-governance areas; Waikato-Tainui's rohe is area A



Appendix E. Dam safety compliance certificate

23 September 2025

Shreesh Basnyat
Dam Safety Manager
Watercare Services Limited
73 Remuera Road
Remuera
Auckland 1050

Dear Shreesh,

2025 Annual Dam Safety Compliance Certificate for Ardmore, Cosseys, Wairoa, Rosedale, Hays Creek, Mangakura No.1 and Mangakura No.3 dams.

Purpose

This letter forms the annual dam compliance certificate for Watercare's dam Resource Consent requirements (Appendix A) as per the brief (Appendix B). This letter covers the following dam sites, henceforth referred to as the dams:

- Ardmore Attenuation Dams
- Cosseys
- Wairoa
- Rosedale
- Hays Creek
- Mangakura Dam No.1 and Dam No.3

This assessment is based on evidence of the respective 2025 Intermediate Dam Safety Reviews and dam safety surveillance information to 17 September 2025[1], and a sighting of the Emergency Preparedness Plan Section A, Section B for Ardmore Attenuation Dams and the Procedure Manual for Wairoa Dam as example documents. The EPP Section A was updated in August 2025. We maintain a high-level overview of Watercare's Dam Safety Management System. The Dam Safety Assurance Programmes for Cosseys, Wairoa, Rosedale and Hays Creek Dams were certified by a DSI Recognised Engineer in accordance with the Building (Dam Safety) Regulations 2022 in June and July 2025.

Dam Safety Management System

Watercare's Dam Safety Management System for the dams is documented in:

- The Dam Safety Management Systems standard operating procedure.
- The scope of services for dam safety assurance (Surveillance and Intermediate Dam Safety Reviews).
- Procedures Manuals detailing operations, maintenance and surveillance requirements.
- Emergency Preparedness Plans – generic to all Watercare dams with site-specific appendices.

These measures are consistent with the NZ Dam Safety Guidelines (NZSOLD 2024) and are appropriate to the respective dam Potential Impact Classifications (PIC).

[1] The Mangakura Dam No. 1 and Dam No. 3, Ardmore Attenuation Dams and Hays Creek Dam IDSR reports were in progress at the time of writing this letter.

Potential Impact Classifications

Potential Impact Classifications (PIC) of the dams are in the table below.

Dam	PIC	Reference for latest PIC assessment or comment (e.g. CDSR)
Ardmore Attenuation Dams	Medium	Ardmore Dams – Dam-Break Flood Hazard Assessment and Potential Impact Classification, Damwatch Engineering. 2024
Cosseys	High	Potential Impact Classification of 13 Watercare Dams. Damwatch, July 2024.
Mangakura No.1 Dam	Low	Potential Impact Classification of 13 Watercare Dams. Damwatch, July 2024.
Mangakura No.3 Dam	Low	Potential Impact Classification of 13 Watercare Dams. Damwatch, July 2024.
Wairoa	High	Potential Impact Classification of 13 Watercare Dams. Damwatch, July 2024.
Rosedale	High	Potential Impact Classification Assessment, Watercare Northern Auckland Wastewater Dams, Rileys, July 2024.
Hays Creek	High	Potential Impact Classification of 13 Watercare Dams. Damwatch, July 2024.

Routine Surveillance

Cosseys, Wairoa, Rosedale and Mangakura No.3 dams continue to be monitored under a routine surveillance programme.

Enhanced Surveillance

The following dams are currently under enhanced surveillance.

Hays Creek Dam

Hays Creek Dam is under enhanced surveillance due to a potential dam safety deficiency arising from uncertainty surrounding piezometric levels and material properties of the downstream shoulder[2]. Watercare have acted on several risk reductions and also planned further action for future financial years, including:

- A new weir was installed to improve observation and measurement of chimney drain seepage. The new weir replaced an existing weir that was susceptible to flooding and stormwater flow. The new weir has been observed to be susceptible to sedimentation since installation and investigations have been undertaken. Through investigations it has been found that the likely source of sediment is from backflowing water during storm events and/or sediment emerging from upstream joints. Watercare investigations are ongoing with a current focus to confirm the source of the sediment in a period of sustained drier weather, followed by appropriate remediation works.
- A stability assessment has been planned for FY2027, or once a site-specific seismic study has been completed.

Ardmore Dams No. 1 and 2

Ardmore Dams No. 1 and 2 were placed under enhanced surveillance in 2005 because seepages from unknown sources were identified at both dams.

[2] Hays Creek Dam Comprehensive Dam Safety Review, Pickford Consulting Ltd & Hydropower Engineering Ltd, March 2018

In April 2016 the surveillance was revised from daily to twice weekly following a surveillance frequency review. The surveillance level remains enhanced as a potential dam safety deficiency still exists (risk of internal erosion) as confirmed by the 2019 Comprehensive Dam Safety Review[3] and supported by the 2023 Comprehensive Dam Safety Review[4].

In January 2025 the surveillance frequency was increased from twice weekly to daily following the observation of a wet spot at the toe of Dam No. 1. A filter blanket with drain was constructed over the wet area beginning on 24 January and additional gravel placed over a further wet area on 19 February. There have been no significant adverse trends or anomalies in instrument data. Enhanced surveillance reduced from daily to three-weekly in June 2025 following 4 months with no other abnormal observations. Watercare have initiated investigations to better understand the mechanism for the seepage, with remedial works subsequently proposed as appropriate.

Mangakura No. 1 Dam

Enhanced surveillance of Mangakura No.1 Dam is undertaken because there are potential dam safety deficiencies relating to cracking at the crest, upper embankment stability, effective length of the spillway crest, potential spillway leakage, identification of voids beneath the spillway invert and overtopping the spillway chute. Enhanced surveillance was moved from daily to twice daily in January 2024 following the commencement of the upgrade works. The upgrade works were completed in September 2024 and addressed the potential dam safety deficiencies relating to cracking at the crest and upper embankment stability. Enhanced surveillance moved to a daily frequency in June 2024 and then to weekly in December 2024.

Review Criteria

This certificate uses the NZ Dam Safety Guidelines (NZSOLD 2024) as the basis for its review of Watercare's Dam Safety Management System.

Review of Operation, Maintenance and Monitoring with Respect to Dam Safety

On the basis of the 2025 Intermediate Dam Safety Reviews' performance evaluations and our familiarity with the dams, we assess that the dams are operated, maintained and monitored to ensure that they are structurally sound and do not pose unacceptable risks to life, property or the natural environment. They are operating within acceptable dam safety limits in accordance with NZ Dam Safety Guidelines (NZSOLD 2024).

Certification

We confirm in this letter, for the dams listed, that Watercare's dam safety and surveillance measures meet the relevant Resource Consent requirements (Appendix A).

Yours sincerely,

Katy Cottingham

Katy Cottingham
Principal Dam Safety Engineer

[3] Ardmore Dams 2019 Comprehensive Dam Safety Review, Damwatch Engineering Limited, May 2019
[4] Ardmore Dams Comprehensive Dam Safety Review 2023, Stantec, July 2024

Appendix A: Watercare Dam Resource Consent Conditions relevant to this Certificate

12(i) The dams and associated structures shall be operated, maintained and monitored to ensure that they are structurally sound, pose no undue risk to life, property or the natural environment and are able to perform satisfactorily to their approved design standard.

12(ii) The Mangakura No. 1 dam, spillway, and associated structures shall be inspected quarterly and during and after extreme weather events.

12(iii) The dam, spillway, and associated structures shall be inspected annually by an appropriately qualified and experienced engineering professional to check the structural integrity and functioning of the dam and associated structures, and to advise on any upgrade or maintenance works that are required.

12(iv) Dam safety and surveillance measures (the measures) shall be identified and documented in accordance with the publication “New Zealand Dam Safety Guidelines” (New Zealand Society of Large Dams) to ensure the dam is able to perform satisfactorily and in accordance with the NZSOLD guidelines. These measures shall be appropriate for the dam’s Potential Impact Classification.

12(v) The documented measures required by condition (iv) shall be updated without delay to incorporate any required remedial measures or additional actions identified by the Dam Safety Assurance Programme or Annual Dam Compliance Certificate.

12(vi) The updated measures required by condition (iv) and (v) shall be implemented thereafter.

12(vii) State whether there are any non-compliances with these conditions, specifying whether any of the non-compliance items are a dam safety deficiency and identify any changes (with timescales for implementation) to measures necessary to address any non-compliance.

Appendix B: Watercare's Brief

Summary

An annual dam safety compliance certificate for part of Watercare's dam inventory is required in order to meet Watercare's dam safety consent compliance.

Background

Those dams covered by this compliance certificate comprise:

- Ardmore Attenuation Dams,
- Cosseys,
- Wairoa,
- Rosedale,
- Hays Creek, and
- Mangakura dams No's 1 and 3

Watercare's dam safety and surveillance measures for each dam are documented in:

- The Dam Safety Management Systems standard operating procedure;
- The scope of services for dam safety assurance (surveillance and Intermediate dam safety reviews);
- Procedures manuals detailing operations, maintenance and surveillance requirements; and
- Emergency preparedness plans – generic to all Watercare dams with site-specific appendices.

Appendix F. reports Wildlands fish and Hochstetter's Frog survey

Fish Surveys in the Waitākere and Wairoa River Catchments: February – March 2025

Contract Report No. 7476

Providing outstanding ecological services to sustain and improve our environments

Wildlands

Fish Surveys in the Waitākere and Wairoa River Catchments: February – March 2025

Contract Report No. 7476

April 2025

Project Team:

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Reviewed and approved for release by:

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Wildland Consultants Ltd
29/04/2025

Wildlands
Ecology and Restoration

Cite this report as follows:

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Contents

1.0 Introduction

Watercare Services Limited has gained resource consent to reduce the environmental compensation flows that are required to be released from three water-supply dams, Wairoa and Cosseys Dams in the Hunua Ranges and Waitākere Dam in the Waitākere Ranges (consents DIS60382588 and DIS60382532 respectively). The discharges are required to maintain healthy freshwater ecosystems downstream of the dams. As such, a reduction in these compensation flows has the potential to result in adverse impacts on the resident fish populations within the downstream catchments. Wildland Consultants Ltd (Wildlands) have been contracted to undertake quantitative fish surveys within both catchments.

This report describes the methods and the results of the quantitative fish surveys undertaken at five sites within the Waitākere River, Wairoa River, and Cosseys Creek catchments during February and March 2025.

2.0 Methods

2.1 Site selection

A total of three impact sites, one within each of the respective sub-catchments below Waitākere Dam (Site B), Cosseys Dam (Site E), and Wairoa Dam (Site F) were selected to evaluate the impact of the reduction in environmental compensation flows on the resident fish communities (Figures 1 and 2). Quantitative fish surveys and physical habitat assessments were undertaken at each of these sites, which are a sub-set of existing sites that have been used to monitor macroinvertebrate communities and water quality. Monitoring Sites A, C, and D were not used for this survey work.

Quantitative fish surveys were also carried out at two control sites, one located in the Wairoa River catchment, which also includes the Cosseys Creek sub-catchment, and the other in the Waitākere River catchment (Figures 1 and 2). Because these sites are not affected by any reduction in environmental compensation flows, they were used to compare the fish community structure with the impact sites.

2.2 Quantitative fish surveys

The fish surveys were undertaken using a NIWA EFM300 electric fishing machine to gather data on the species diversity, relative abundance, and density of the fish communities at each site. At each site, a 150-metre section of stream was isolated using temporary barriers at the upstream and downstream ends to prevent fish from escaping or entering the reach (Plate 1).

Three electric fishing passes were then carried out within the 150-metre section, with aquatic fauna netted and placed in aerated buckets during each pass. Following each pass, all fish captured were identified and measured before being released back into the stream, outside of the fish barriers. After the three passes were completed, the fish barriers were removed.

Although they are not fish, kōura/freshwater crayfish (*Paranephrops planifrons*) are a standard inclusion in freshwater fish surveys in New Zealand and were therefore included in the reporting and analysis for this project as well. They are a keystone species in freshwater aquatic communities, and their presence indicates good water quality, making them a useful component of the freshwater community to include in the analysis. Freshwater shrimp (*Paratya curvirostris*) were also noted as they were a significant component of the community in Cossey Creek.

Parameters recorded at each site included pH, water temperature, and wetted width of the channel. Fish surveys were carried out between 26 February and 14 March 2025.

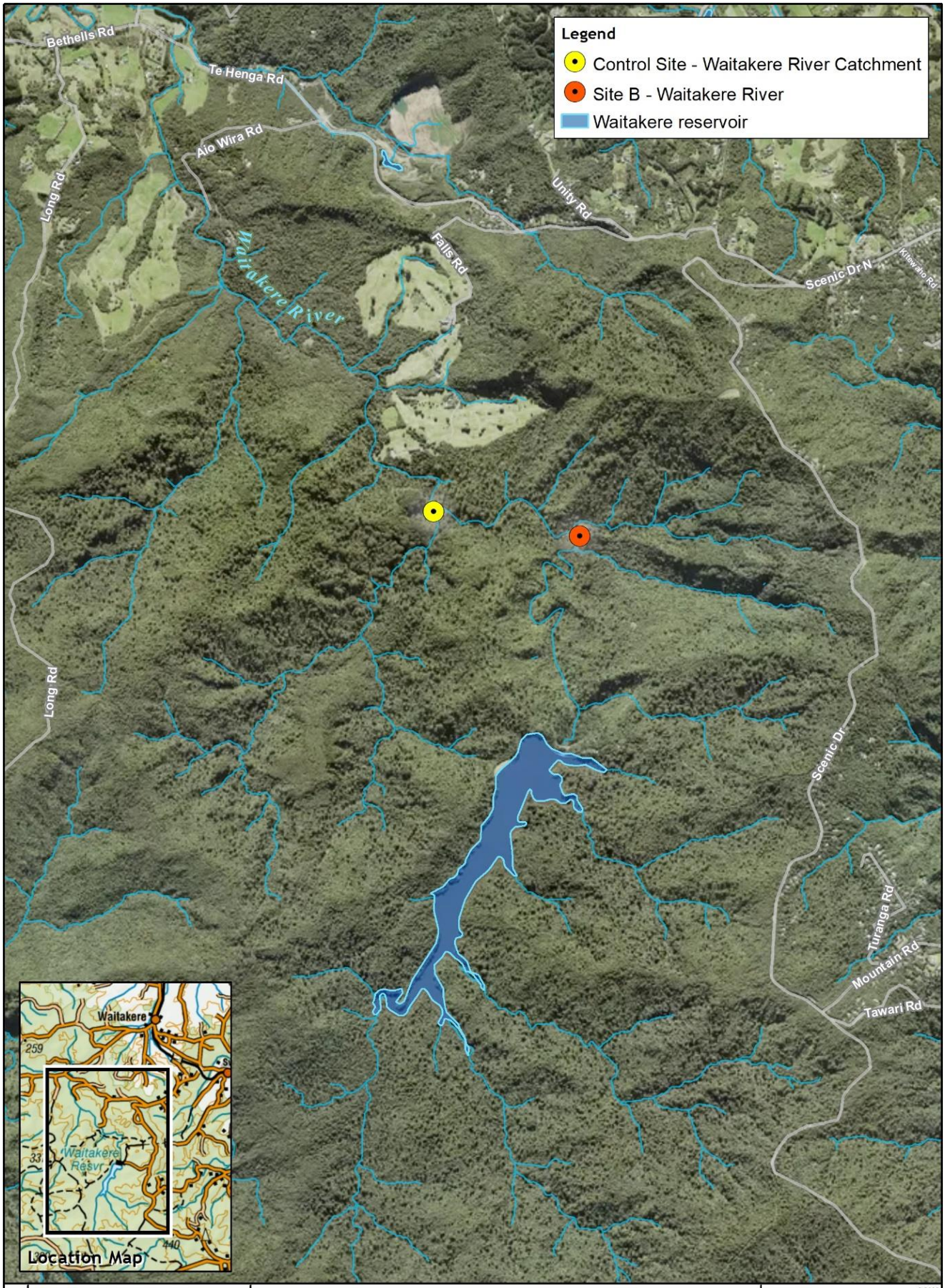

Figure 1. Location of fish survey sites in Waitakere River Catchment

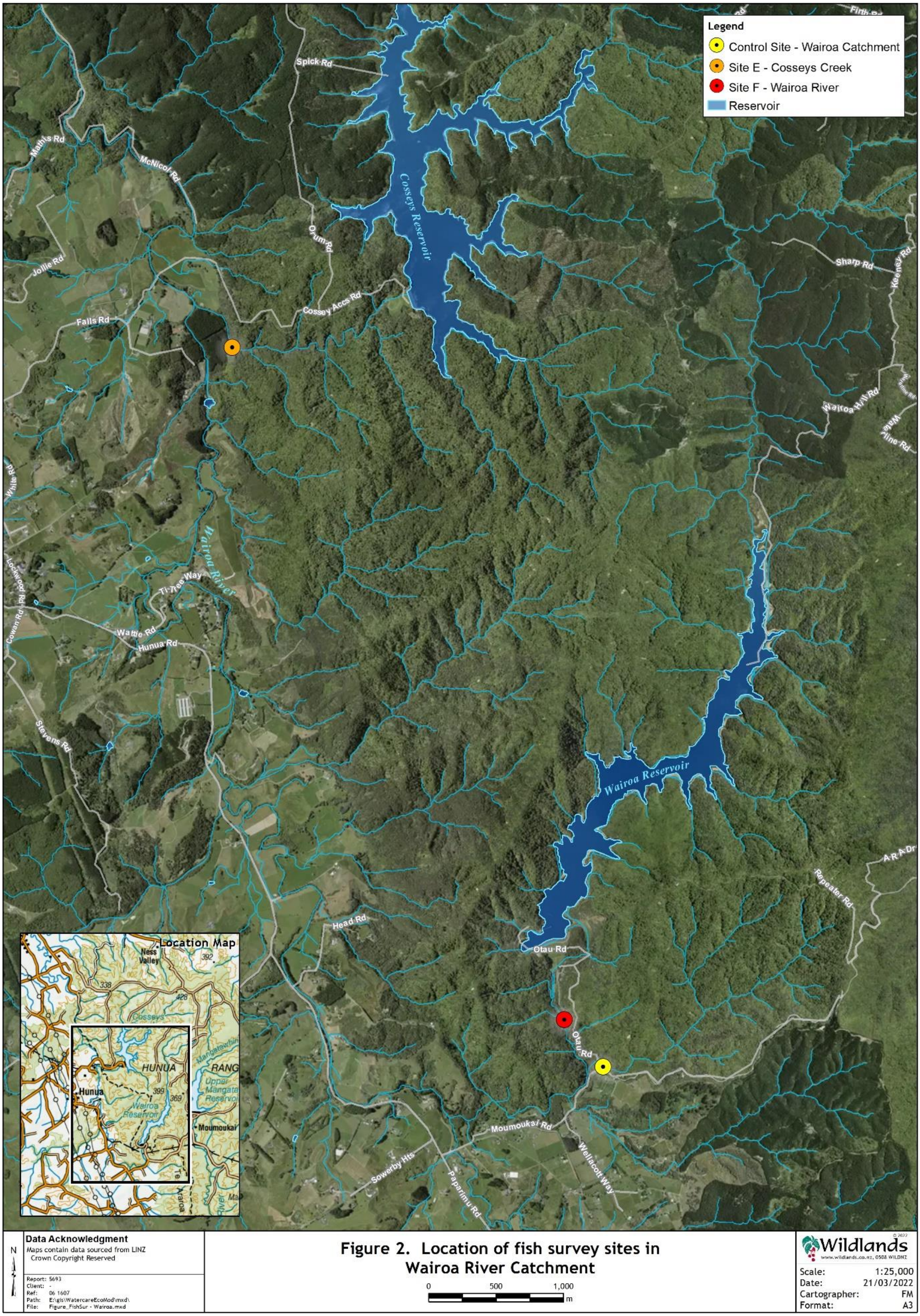

Figure 2. Location of fish survey sites in Wairoa River Catchment

Plate 1 – Temporary fish barrier installed at Site B – Waitākere River. 4 March 2025.

2.3 Biosecurity

To prevent the spread of unwanted freshwater organisms to other waterways, strict biosecurity protocols were observed, including:

- All water from the capture location was discharged at the site.
- As far as practicable, all plant fragments, debris, and mud were removed from fishing equipment before leaving the site. Equipment was also visually inspected for freshwater gold clams (*Corbicula fluminea*) at the end of each use.
- All equipment that came into contact with water at the site was cleaned before and after use following standard 'Check, Clean, Dry' procedures developed by the Ministry for Primary Industries and the Department of Conservation.
- Equipment was thoroughly dried and left for a minimum of 48 hours before moving between sites.

Standard kauri dieback protocols were also followed when entering and exiting all sites, including thorough cleaning of footwear and other equipment that had been in contact with the ground or potentially infected catchments. As kauri dieback is yet to be identified in Hunua Ranges Regional Park, the Wairoa catchment sites were completed first in order to minimise the risk of spread.

2.4 Fish Index of Biotic Integrity

A Fish Index of Biotic Integrity (IBI) was developed for the Auckland Region in 2004 by Dr Mike Joy, based on a methodology that had originated in the USA in the mid-1980s (Joy 2010). This method allows the biological condition of a site to be assessed by using data on the number of fish species present in relation to the site's elevation and distance from the sea. These metrics are used because New Zealand's fish fauna is predominantly migratory, and therefore, fish assemblages are highly correlated with proximity to the marine environment.

A Fish IBI score was calculated for each site using a spreadsheet into which the presence/absence data for the fish species recorded was entered, along with the site's elevation in metres and its distance from the coast in kilometres. Using this data the spreadsheet produces an IBI score, out of 60, for each site. This score can then be interpreted into integrity classes that describe the quality of the freshwater environment at each site based on the indigenous fish community (Table 1).

Table 1 – Attributes and integrity classes for the Auckland IBI (adapted from Joy 2010).

Total IBI Score	Integrity Class	Attributes
48-60	Excellent	Comparable to the best situations without human disturbance; all regionally expected species for the stream position are present. Site is above the 90th percentile of Auckland sites.
36-47	Good	Site is above the 60th percentile of Auckland sites but species richness and habitat or migratory fish access reduced, site shows some signs of stress.
24-35	Fair	Site is scores higher than the 30th percentile of all sites but less than the 60th. Some stressors present, biotic integrity impaired.
1-23	Poor	Site is above 10th percentile and less than 30th Species richness is drastically reduced and biotic integrity harmed. Habitat and/or migratory fish access is impacted.
0	No indigenous fish	Site is grossly impacted or migratory fish access is non-existent.

2.5 Species density and relative abundance

The density for each species, and overall density per site, was calculated by dividing the number of individuals recorded by the area fished at each site. The area fished was estimated by multiplying the length of the stream reach (up to 150 metres) by the average wetted width for the site. The metric for relative abundance was calculated by dividing the number of individuals recorded for a species by the total number of individuals recorded at the site, thereby showing the proportion of the fish community that the species makes up.

3.0 Survey site descriptions

3.1 Waitākere River Catchment

Two survey sites were located within the Waitākere River catchment, both of which are within Waitākere Ranges Regional Park.

3.1.1 Control Site – Waitākere River catchment

Coordinates: NZTM 1735618 5916380

The control site for the Waitākere River catchment is located on Cascades Stream, above the confluence with the Waitākere River. This site is hard-bottomed, with a mix of cobble and boulder substrates (Plate 2), and is located at an elevation of 43 metres above sea level and approximately 12 kilometres inland from the coast.

Terrestrial habitat within this area was dominated by indigenous forest species, with an understorey of abundant ponga (*Cyathea dealbata*), nīkau (*Rhopalostylis spida*), Kiekie (*Freycinetia banksia*) and kiokio (Parablechnum-zelandiae)

Plate 2 – Control Site – Waitākere River Catchment, view looking upstream.
14 March 2025.

The average stream width at this site was 4.95 metres, while the water temperature was 15.2°C with a pH of 7.98 (Table 2).

3.1.2 Site B - Waitākere River

Coordinates: NZTM 1736338 5916259

Site B is located on the Waitākere River upstream from the confluence with Anderson Stream and roughly one kilometre downstream of Waitākere Dam. The site is located at an elevation of 67 metres above sea level and 13 kilometres from the coast.

The site is a hard-bottom stream and features a variety of boulders, cobbles, and woody debris, providing an ideal habitat for aquatic fauna. The terrestrial habitat within this area was dominated by indigenous forest species, with an understorey of abundant mamaku (Sphaeropteris medullaris), ponga, kiekie, and kiokio. The stream had an average wetted width of five metres, a water temperature of 17.3°C, and pH of 7.41 (Table 2; Plate 3).

Plate 3 – Site B - Waitākere River looking upstream. 4 March 2025.

3.2 Wairoa River Catchment

3.2.1 Control Site - Wairoa River catchment

Coordinates: NZTM 1788723 5890562

The Wairoa River catchment control site is located on an unnamed tributary that joins the Wairoa River near Otau Crossing. This reach is upstream of a large waterfall and culvert at an elevation of 135 metres above sea level and 33 kilometres from the coast. Montbretia (*Crocosmia ×crocosmiiflora*), blackberry (*Rubus fruticosus* agg.) and Himalayan honeysuckle (*Leycesteria formosa*) were common in the understorey along the stream banks, with indigenous tree species providing canopy cover.

Within the survey reach, the stream was shallow with mostly small pools present. Nīkau seedlings were occasionally present within the channel, suggesting that there had been periods were the channel was dry. The substrate was predominantly stoney with areas of sand (Plate 4). The channel was around two metres wide, and the water temperature was 13.7°C with a pH of 7.37 (Table 2).

Plate 4 – Wairoa River, catchment control site, view looking upstream. 27 February 2025.

3.2.2 Site E - Cosseys Creek

Coordinates: NZTM 1785973 5895899

Site E is located on Cosseys Creek, approximately 1.5 kilometres downstream from Cosseys Reservoir. It is positioned at 45 metres elevation above sea level and around 22 kilometres from the coast.

Terrestrial habitat within this area largely comprised indigenous vegetation with a predominantly open canopy (Plate 5). Some pest plant species were present along the riparian margin, including montbretia and Chinese privet (*Ligustrum sinense*). The stream has a rocky substrate and a variety of boulders and woody debris, providing ideal aquatic fauna habitat. The average wetted width of the channel was 5.44 metres (Table 2), and the water temperature was 17.9°C with a pH of 7.69. Mats of algae covered the rocky substrate in shallow areas.

Plate 5 – Site E – Cosseys Creek, view looking upstream. 3 March 2025.

3.2.3 Site F – Wairoa River

Coordinates: NZTM 1788436 5890912

Site F is located in the upper reaches of the Wairoa River, adjacent to Otau Road and approximately 400 metres downstream of Wairoa Reservoir at an elevation of 162 metres above sea level and at a distance of 33 kilometres from the coast.

Vegetation within this area was dominated by indigenous forest species, with an understorey of abundant ponga. Some exotic and pest plant species are present along the banks, with African club moss (*Selaginella kraussiana*) forming a dense ground cover. The substrate mostly comprised rocks and mud/silt, while the channel width was approximately 4.5 metres at the widest point, with large pools. Dense algal swathes of a *Chara* species were common within the channel, as well as duckweed (*Lemna minor*). The bridge that extended across the stream was in the process of being replaced at the time of the survey. A small section of the stream was obstructed by scaffolding and was difficult to survey (Plate 6).

At this site the stream had a pH of 6.98 and a temperature of 20.2°C (Table 2).

Plate 6 – Stream habitat at Site F – Wairoa River, view looking upstream. Note the small area obstructed by scaffolding. 26 February 2025.

Table 2 – Parameters recorded at the Waitākere and Wairoa River catchment monitoring sites.

Site	Survey Date	Water Temp (°C)	pH	Average Wetted Width (m)	Reach Length (m)	Est. Stream Area Fished (m^2)
Control Site – Waitākere River Catchment	14/03/2025	15.2	7.98	4.95	150	742.5
Site B – Waitākere River	04/03/2025	17.3	7.41	5	150	750
Control Site – Wairoa River Catchment	27/02/2025	13.7	7.37	2.16	150	324
Site E – Cosseys Creek	3/03/2025	17.9	7.69	5.44	150	816
Site F – Wairoa River	26/02/2025	20.2	6.98	3.38	150	507

4.0 Results

4.1 Waitākere River Catchment

4.1.1 Control Site – Waitākere River Catchment

A total of 59 fish and three kōura were recorded within the Waitākere River Control Site (Table 3). This included nine different fish species. Common bullies (*Gobiomorphus cotidianus*) and elvers (*Anguilla* sp.) were present at the highest density and relative abundance (Table 3). Overall fauna densities averaged 0.084 individuals/m^2. One perch (*Perca fluviatilis*) was also caught.

Table 3 – Aquatic fauna recorded at the Waitākere River Catchment control site.

Common Name	Species	Total	Size Range (mm)	Density (individ./m^2)	Relative Abundance
Longfin eel	*Anguilla dieffenbachii*	13	150-700	0.018	0.210
Unidentified elver	*Anguilla* sp.	16	80-200	0.022	0.258
Kōaro	*Galaxias brevipinnis*	3	105-150	0.004	0.048
Banded kōkopu	*Galaxias fasciatus*	1	65	0.001	0.016
Īnanga	*Galaxias maculatus*	2	80-85	0.003	0.032
Cran's bully	*Gobiomorphus basalis*	5	65-75	0.007	0.081
Common bully	*Gobiomorphus cotidianus*	16	45-70	0.022	0.258
Giant bully	*Gobiomorphus gobiodies*	1	100	0.001	0.016
Smelt	*Retropinna retropinna*	1	95	0.001	0.016
Kōura/freshwater crayfish	*Paranephrops planifrons*	3	20-70	0.004	0.048
Perch	*Perca fluviatilis*	1	65	0.001	0.016
Total		**62**		**0.084**	

4.1.2 Site B – Waitākere River

Five indigenous and one exotic freshwater species were recorded at Site B (Table 4). A total of 71 individual fish and four kōura were captured, resulting in an overall density of 0.1 individuals/m² (Table 8). Īnanga (*Galaxias maculatus*) made up almost a quarter of the total number of fish captured at this site, at a density of 0.024 fish/m². Eels were also frequently captured, with elvers and adult longfin eels (*Anguilla dieffenbachii*) comprising over a third of the total number of fish. Six perch were also caught.

Table 4 – Aquatic fauna recorded at Site B – Waitākere River.

Common Name	Species	Total	Size Range (mm)	Density (individ./m²)	Relative Abundance
Longfin eel	*Anguilla dieffenbachii*	15	200-1200	0.020	0.200
Unidentified elver	*Anguilla* sp.	17	70-250	0.023	0.227
Īnanga	*Galaxias maculatus*	18	55-100	0.024	0.240
Unidentified bully	*Gobiomorphus sp.*	2	40	0.003	0.027
Common bully	*Gobiomorphus cotidianus*	11	45-65	0.015	0.147
Banded kōkopu	*Galaxias fasciatus*	2	130-140	0.003	0.027
Kōura/freshwater crayfish	*Paranephrops planifrons*	4	25-60	0.005	0.053
Perch	*Perca fluviatilis*	6	65-80	0.008	0.080
Total		**75**		**0.100**	

4.2 Wairoa River Catchment

4.2.1 Control Site – Wairoa River Catchment

The overall number of fish at the Wairoa River control site was low, with a total of 20 individuals recorded comprising only longfin eels (Table 5). Kōura were also present at a range of size classes. Including the kōura, the overall density was 0.123 individuals/m².

Table 5 – Aquatic fauna recorded at the Wairoa River Catchment control site.

Common Name	Species	Total	Size Range (mm)	Density (individ./m²)	Relative Abundance
Longfin eel	*Anguilla dieffenbachii*	20	90-1300	0.062	0.5
Kōura/freshwater crayfish	*Paranephrops planifrons*	20	40-70	0.062	0.5
Total		**40**		**0.123**	

4.2.2 Site E – Cosseys Creek

Eight indigenous and one exotic freshwater species were recorded at Site E - Cosseys Creek (Table 6). Bullies (*Gobiomorphus* spp.) were abundant, with redfin (*G. huttoni*) and common bullies each comprising almost a quarter of all fish caught. Torrentfish (*Cheimarrichthys fosteri*) and longfin eels were also common. Freshwater shrimp were also abundant, but were not targeted for capture. Some shrimp were observed carrying eggs. One large perch measuring 34 centimetres was also caught.

Table 6 – Aquatic fauna recorded at Site E – Cosseys Creek.

Common Name	Species	Total	Size Range (mm)	Density (individ./m²)	Relative Abundance
Longfin eel	*Anguilla dieffenbachii*	15	100-1400	0.018	0.066
Unidentified elver	*Anguilla* sp.	12	85-200	0.015	0.053
Torrentfish	*Cheimarrichthys fosteri*	22	45-110	0.027	0.096
Īnanga	*Galaxias maculatus*	7	60-90	0.009	0.031
Common bully	*Gobiomorphus cotidianus*	47	30-70	0.058	0.206
Redfin bully	*Gobiomorphus huttoni*	55	40-80	0.067	0.241
Unidentified bully	*Gobiomorphus* sp.	49	20-60	0.060	0.215
Kōura/freshwater crayfish	*Paranephrops planifrons*	17	20-80	0.021	0.075
Common smelt	*Retropinna retropinna*	3	75-90	0.004	0.013
Perch	*Perca fluviatilis*	1	340	0.001	0.004
Total		**228**		**0.279**	

4.2.3 Site F – Wairoa River

A total of 288 fish of at least three species and seven kōura, were captured at Site F - Wairoa River, with a comparatively high density of 0.582 individuals/m² (Table 7). There were a large number of elvers at the site, comprising almost 70% of all fish caught. Banded kōkopu (*Galaxias fasciatus*) and bullies were also frequently captured.

Table 7 – Aquatic fauna recorded at Site F – Wairoa River.

Common Name	Species	Total	Size Range (mm)	Density (individ./m²)	Relative Abundance
Longfin eel	*Anguilla dieffenbachii*	16	250-800	0.032	0.054
Unidentified elver	*Anguilla* sp.	204	80-110	0.402	0.692
Banded kōkopu	*Galaxias fasciatus*	21	60-180	0.041	0.071
Common bully	*Gobiomorphus cotidianus*	8	40-70	0.016	0.027
Unidentified bully	*Gobiomorphus* sp.	39	25-50	0.077	0.132
Kōura/freshwater crayfish	*Paranephrops planifrons*	7	40-100	0.014	0.024
Total		**295**		**0.582**	

4.3 Comparisons between control and impact sites

4.3.1 Number of species and density

In both catchments, total number of individuals and overall densities were greater at the impact sites than at the control sites (Table 8).

Table 8 – Comparison of species density for all sites.

Catchment	Site	No. Species[1]	Total no. Individuals	Overall Density (individ./m²)
Waitākere River	Control	10	62	0.084
	Site B – Waitākere River	6	75	0.100
Wairoa River	Control	2	40	0.123
	Site E – Cosseys Creek	9	228	0.279
	Site F – Wairoa River	4	295	0.582

4.3.2 Species recorded

Eleven species of fish and two freshwater invertebrate species were recorded across all sites (Table 9). The only species common to all five sites were longfin eel and kōura. Adult shortfin eels were not recorded in this survey, but this species may have been present at all sites in the form of unidentified elvers. Giant bully (*Gobiomorphus gobiodies*) were recorded for the first time in any of the surveys at the Waitākere control site.

Five species with a threat classification of 'At Risk' were recorded (giant bully, īnanga, kōaro, longfin eel, and torrentfish). One exotic fish species (perch) was also recorded.

The Waitākere control site had the most species recorded with ten, while the control site for the Wairoa River catchment had the least, with two.

A selection of photos showing the fish species caught during the surveys are provided in Appendix 1.

4.3.3 Fish Index of Biotic Integrity

Four sites (including all three of the impact sites) scored within the 'excellent' integrity class, with scores ranging from 50 to 58 (Table 10). This means that the number of indigenous fish species recorded at each site is consistent with high-quality instream habitat and indicates a lack of downstream barriers to fish migration. This allows a full complement of indigenous species to utilise these sites, relative to their elevation and distance from the coast.

[1] Unidentified species were not counted as a separate category for this metric.

Table 9 – Aquatic species that could be definitively identified at all sites, including threat classifications[1].

Common Name	Species	Threat Classification[2]	Waitākere River Catchment		Wairoa River Catchment		
			Control	Site B - Waitākere	Control	Site E – Cosseys Creek	Site F – Wairoa River
Longfin eel	*Anguilla dieffenbachii*	At Risk-Declining	✓	✓	✓	✓	✓
Torrentfish	*Cheimarrichthys fosteri*	At Risk-Declining				✓	
Kōaro	*Galaxias brevipinnis*	At Risk-Declining	✓				
Banded kōkopu	*Galaxias fasciatus*	Not Threatened	✓				✓
Īnanga	*Galaxias maculatus*	At Risk-Declining	✓	✓		✓	
Cran's bully	*Gobiomorphus basalis*	Not Threatened	✓	✓			
Common bully	*Gobiomorphus cotidianus*	Not Threatened	✓	✓		✓	✓
Giant bully	*Gobiomorphus gobiodies*	At Risk-Naturally Uncommon	✓				
Redfin bully	*Gobiomorphus huttoni*	Not Threatened				✓	
Kōura/freshwater crayfish	*Paranephrops planifrons*	Not Threatened	✓	✓	✓	✓	✓
Freshwater shrimp	*Paratya curvirostris*	Not Threatened				✓	
Common smelt	*Retropinna retropinna*	Not Threatened	✓			✓	
Perch	*Perca fluviatilis*	Introduced	✓	✓		✓	
Total no. species			**10**	**6**	**2**	**9**	**4**

[1] Excludes unidentified eels and bullies

[2] All threat classifications are per Dunn *et al.* (2018), except for kōura and freshwater shrimp which are per Grainger *et al.* (2018).

The Wairoa River control site scored within the 'good' integrity class, which is consistent with the results from the previous two surveys. As there is a large waterfall and culvert downstream of the assessed reach, the species that can reach the stream are limited to fish that can climb (e.g. banded kōkopu and kōaro). There was also evidence that stretches of the stream may have run dry at some point during the summer, which could have further reduced fish diversity.

Table 10 – Fish IBI scores.

Catchment	Site	IBI score	Integrity Class
Waitākere River	Control - Waitākere River Catchment	58	Excellent
	Site B - Waitākere River	50	Excellent
Wairoa River	Control - Wairoa River Catchment	44	Good
	Site E - Cosseys Creek	54	Excellent
	Site F - Wairoa River	54	Excellent

4.4 Comparisons between years

The results of the surveys undertaken between 2021 and 2025 (Wildland Consultants 2021, 2023, and 2024) demonstrate that the fish community has persisted in all of the streams, but with some changes (Table 11).

The IBI score has remained at the "Excellent" integrity class for all of the impact sites, with only small fluctuations in score (Figure 3 and 6). However, with the exception of the Waitākere control site, the number of species present in all the streams decreased in this survey compared to the previous 2024 survey (Figure 4 and 7). Notably, species diversity has been slowly decreasing between 2021 and 2025 in both the Wairoa control site and Site F.

The overall fish density at both the Waitākere River Catchment sites have decreased slightly (Figure 5). The overall fish densities for all three Wairoa River Catchment sites shows a positive trend, with the densities recorded in 2025 higher than in the original 2021 surveys (Figure 8).

The species composition has remained mostly indigenous in all streams, however some exotic species have been caught across the surveys. No exotic fish species were recorded at any of the sites in 2023, while in 2021 a single rudd (*Scardinius erythrophthalmus*) was recorded at Site E – Cosseys Creek. Perch were caught in both streams in the Waitākere River Catchment in 2024, and a single rainbow trout (*Oncorhynchus mykiss*) was caught in Cosseys Creek. In 2025, a large perch was caught in Cosseys Creek, and several small perch were caught within the Waitākere River Catchment.

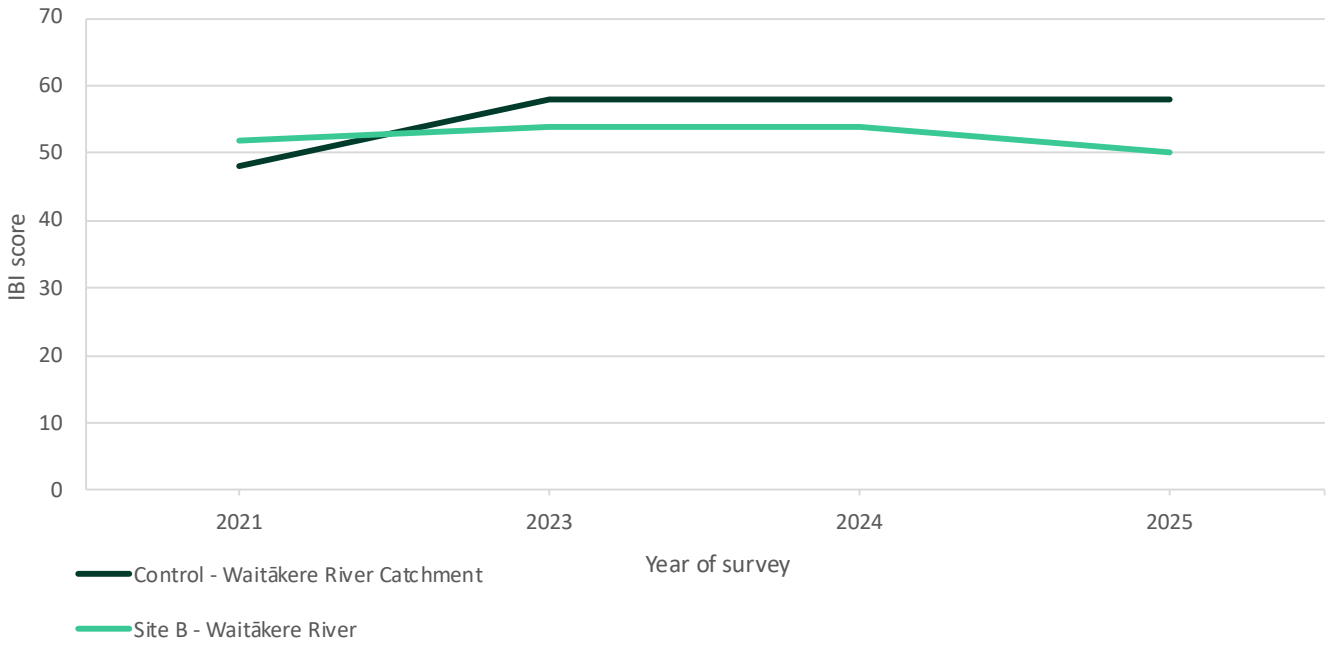

Figure 3 – Fish Index of Biotic Integrity (IBI) scores from the Waitākere River Catchment streams surveyed between 2021 and 2025.

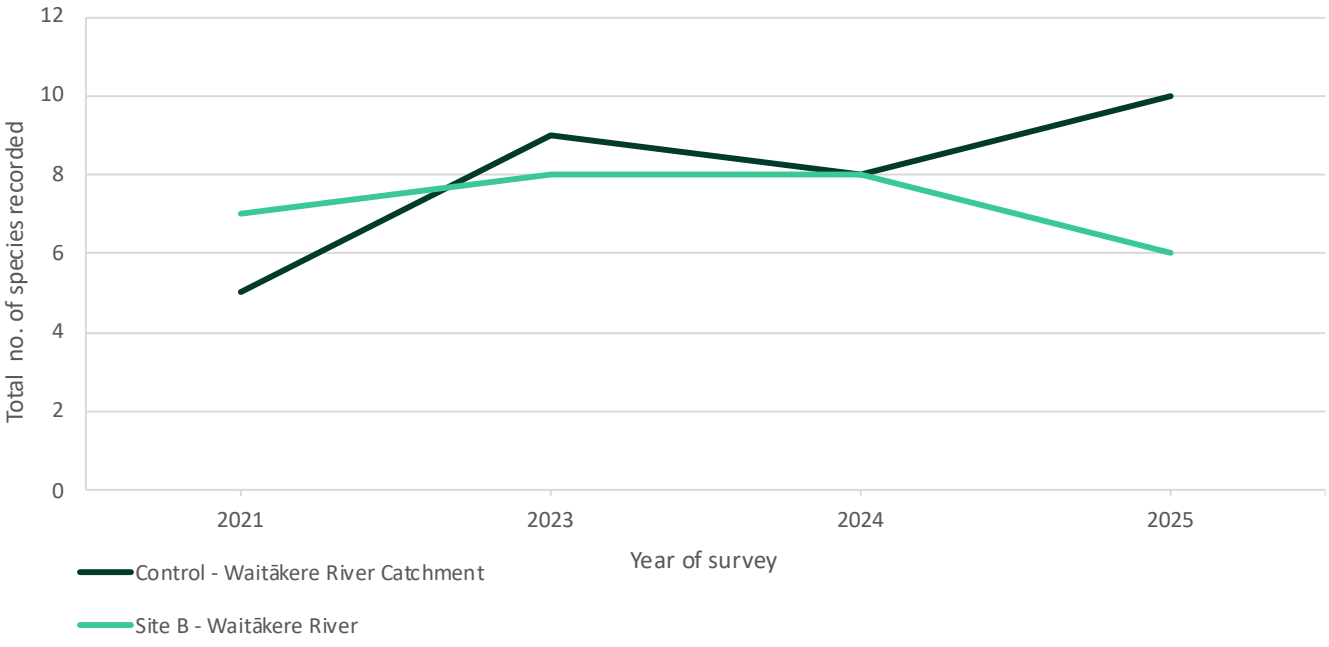

Figure 4 – The total number of species recorded from the Waitākere River Catchment streams surveyed between 2021 and 2025.

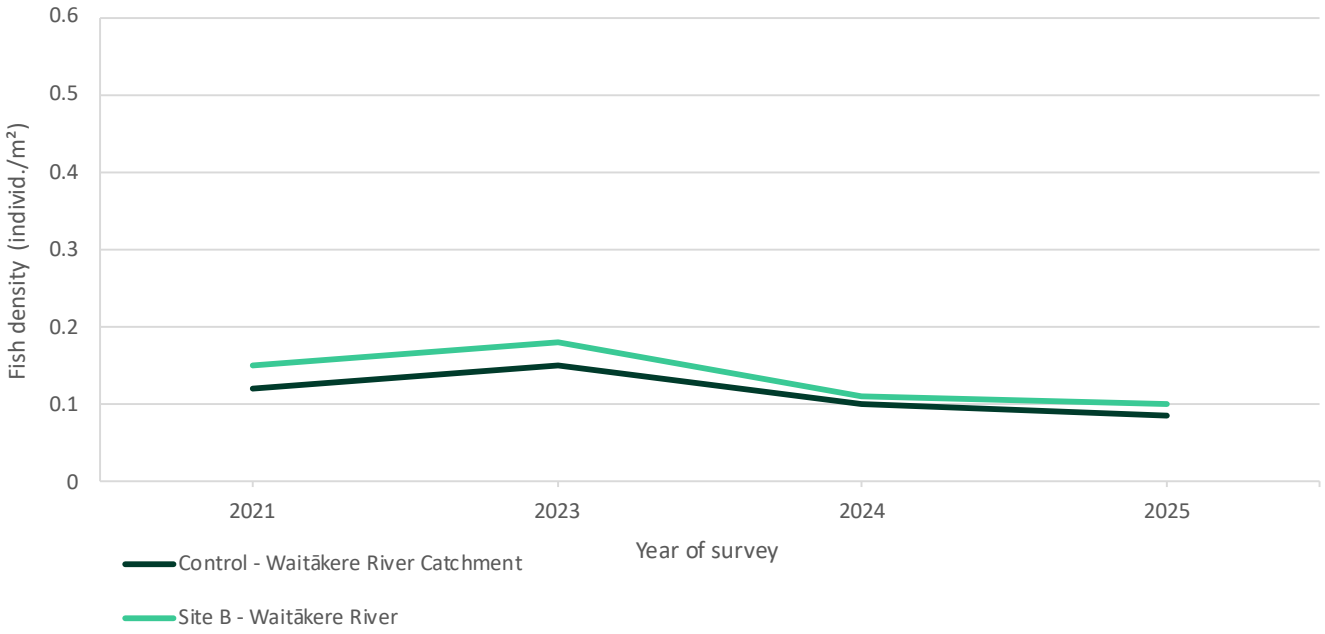

Figure 5 – Overall fish density (individuals per m^2) recorded from the Waitākere River Catchment streams surveyed between 2021 and 2025.

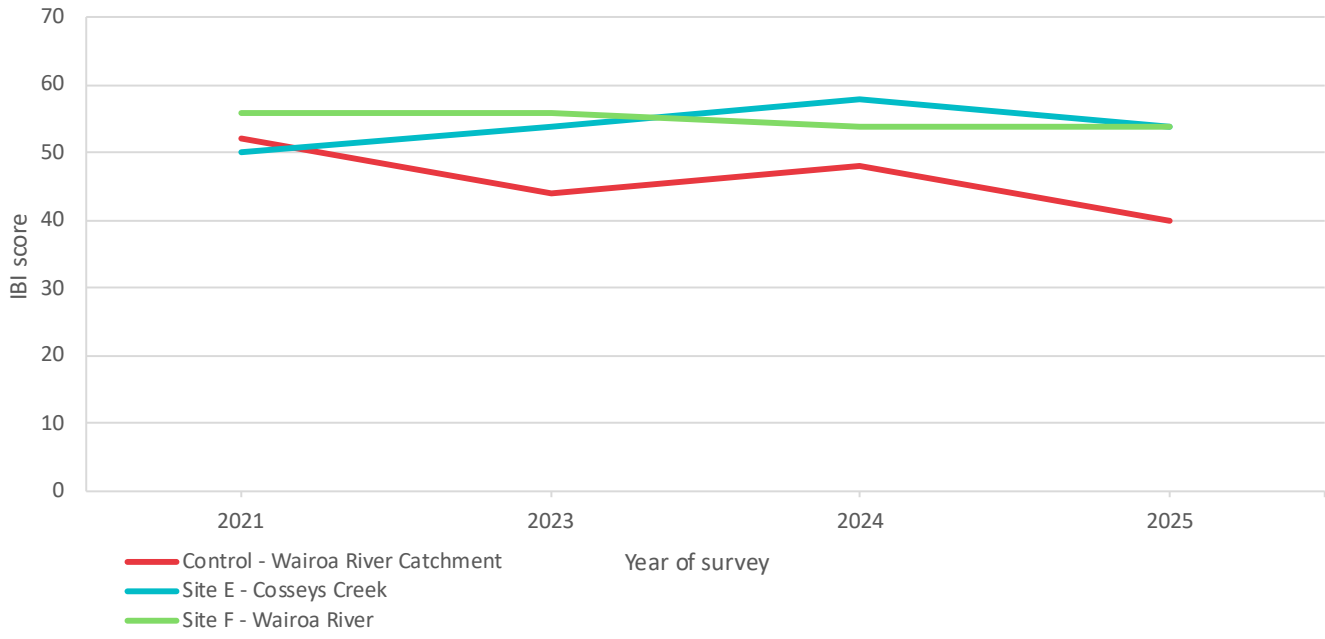

Figure 6 – Fish Index of Biotic Integrity (IBI) scores from the Wairoa River Catchment streams surveyed between 2021 and 2025.

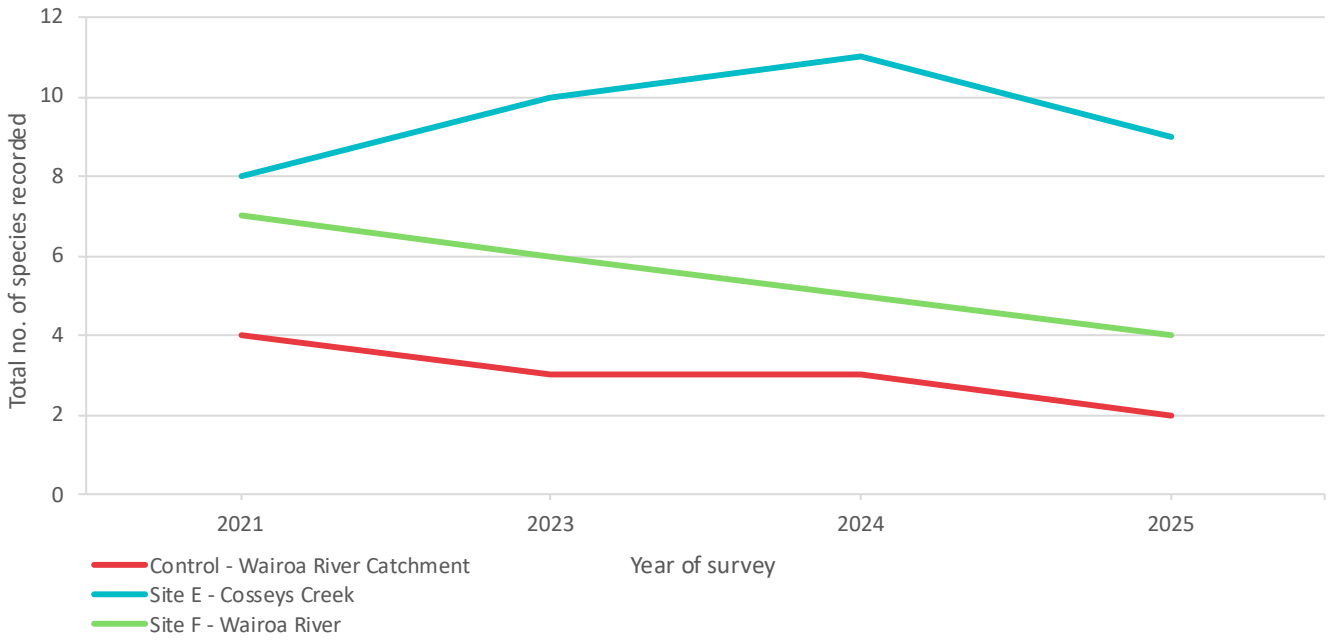

Figure 7 – The total number of species recorded from the Wairoa River Catchment streams surveyed between 2021 and 2025.

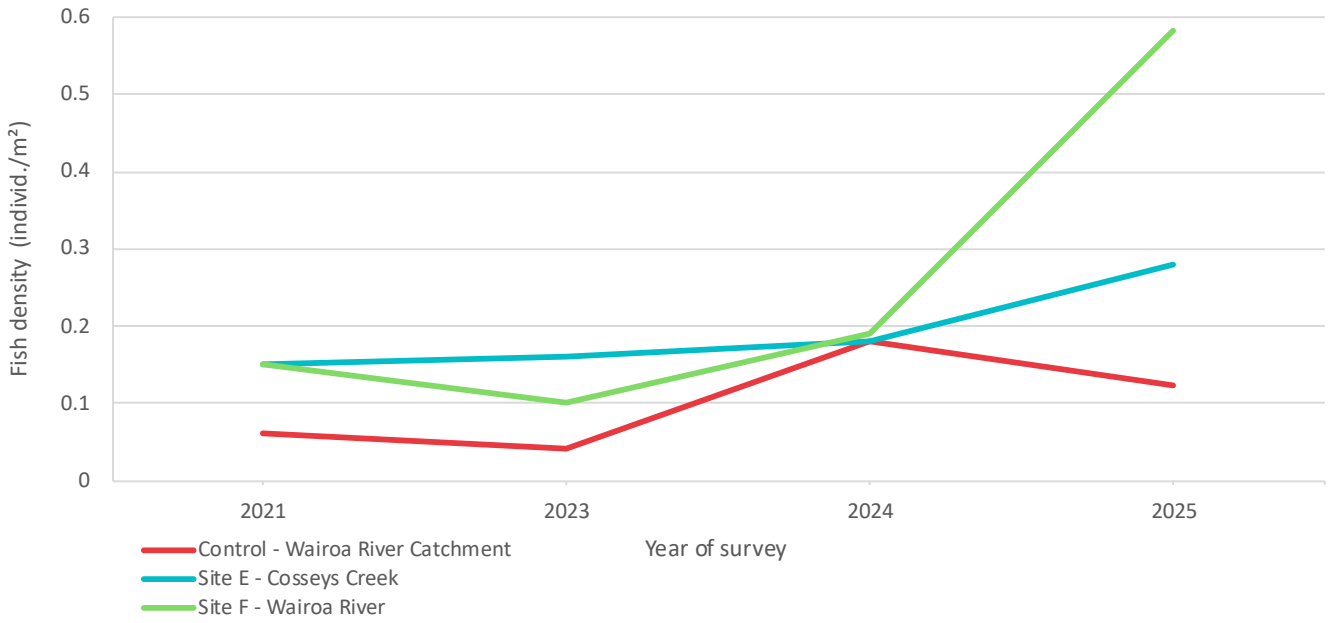

Figure 8 – Overall fish density (individuals per m^2) recorded from the Wairoa River Catchment streams surveyed between 2021 and 2025.

Table 11 – Comparison of fish survey results between 2021 and 2025.

Catchment	Site	IBI score				Total no. of species				Overall fish density (individuals/m^2)			
		2021	2023	2024	2025	2021	2023	2024	2025	2021	2023	2024	2025
Waitākere River	Control - Waitākere River Catchment	48	58	58	58	5	9	8	10	0.12	0.15	0.10	0.084
	Site B - Waitākere River	52	54	54	50	7	8	8	6	0.15	0.18	0.11	0.1
Wairoa River	Control - Wairoa River Catchment	52	44	48	44	4	3	3	2	0.06	0.04	0.18	0.123
	Site E - Cosseys Creek	50	54	58	54	8	10	11	9	0.15	0.16	0.18	0.279
	Site F - Wairoa River	56	56	54	54	7	6	5	4	0.15	0.10	0.19	0.582

5.0 Summary and conclusions

From this data, there is no clear adverse impact on fish communities due to the reduced compensation flow regimes from the dams. Fish communities continue to persist at all sites. Impact sites from Wairoa, Cosseys, and Waitākere Dams all showed a greater or similar diversity of species, higher number of individuals, and overall higher fish density compared to the control sites, while all sites scored within the 'excellent' or 'good' category for the Fish IBI.

There appears to be a gradual decline in species diversity at both the Wairoa control site and Site F – Wairoa River. Species diversity in the 2025 survey was also lower for all sites except the Waitākere control site. The cause of this is unknown, and may just reflect yearly variations in species' abundance, with low abundance species less likely to be captured during the surveys. Water levels were also noticably lower than previous years at the time of the 2025 survey, which may have impacted the fish community. The number of perch caught this year was also higher than previous surveys, and perch were caught for the first time in Wairoa River Catchment. Increased predation of indigenous fish by exotic species could also contribute to lower diversity.

Acknowledgments

We thank the client, Emma Baker of Watercare Services Ltd, for site access and client liaison.

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Appendix 1

A selection of images of fish and freshwater invertebrate species captured during the site surveys.

Kōaro (*Galaxias brevipennis*)

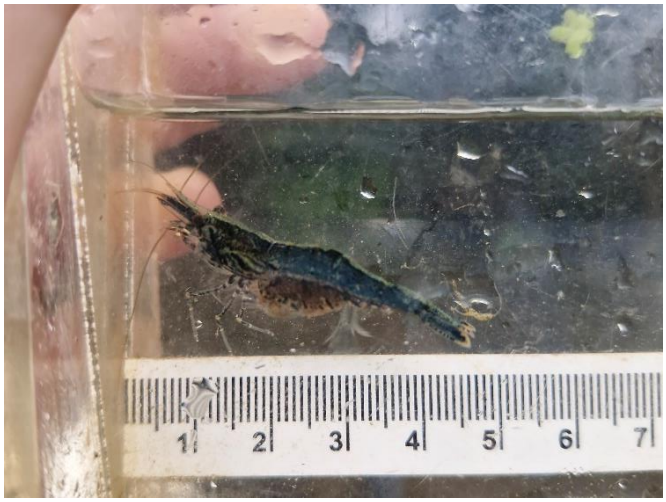
Banded kōkopu (*Galaxias fasciatus*)

Redfin bully (*Gobiomorphus huttoni*)

Kōura (*Paranephrops planifrons*)

Giant bully (*Gobiomorphus gobiodies*)

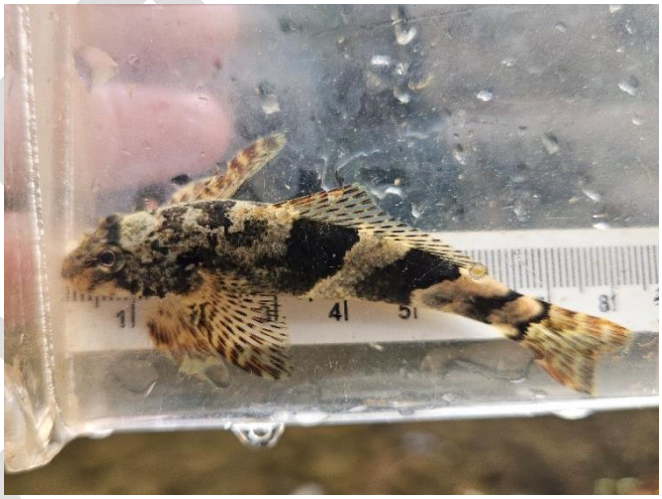
Longfin eel (*Anguilla dieffenbachii*)



Freshwater shrimp (*Paratya curvirostris*) with eggs.

Common bullies (*Gobiomorphus cotidianus*)

Common smelt (*Retropinna retropinna*; top left) and īnanga (*Galaxias maculatus*; bottom)



Torrentfish (*Cheimarrichthys fosteri*)

Elvers (*Anguilla* sp.)

Perch (*Perca fluviatilis*)

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Hochstetter's Frog Survey in the Wairoa River and Cossey Creek, Hunua Ranges (2024 – 2025)

Contract Report No. 7439b

Providing outstanding ecological services to sustain and improve our environments

Wildlands

Hochstetter's Frog Survey in the Wairoa River and Cossey Creek, Hunua Ranges (2024 – 2025)

Contract Report No. 7439b

June 2025

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6/06/2025

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Contents

1.0 Introduction

Watercare Services Limited (Watercare) was granted resource consent to lower the environmental flows required to be supplied from the Cossey and Wairoa dams between July 2021 and January 2022 (DIS60357053). However, the duration of the reduced flow period was then extended under a new consent (DIS60382588), which is due to expire in 2025. To measure and monitor the ecological effects of the lowered flow rates, survey sites were established by Watercare to measure a range of environmental variables along the Wairoa River and Cossey Creek.

Alterations to downstream flow rates have the potential to affect resident aquatic fauna. Hochstetter's frog (*Leiopelma hochstetteri*) is an indigenous, semi aquatic frog species that is widespread throughout the Hunua Ranges, residing near and within streams and tributaries. Hochstetter's frogs are nocturnal, extremely cryptic and vulnerable to predation by the usual suite of mammalian predators in New Zealand (e.g., rodents, mustelids and feral pigs). The threat classification of Hochstetter's frog was recently updated with the species now split into regional populations. The Hunua population is included with the northern coromandel populations and is classified as 'At Risk-Declining' as per Burns *et al.* (2024).

Streams and tributaries throughout both catchments provide valuable potential habitat to Hochstetter's frogs. Surveys have therefore been undertaken in suitable locations to gain information on the presence/absence and distribution of the species. Wildland Consultants Ltd was engaged to undertake surveys for Hochstetter's frogs at monitoring sites in Cossey Creek and Wairoa River since late 2020 (Wildland Consultants Ltd 2021, 2022, 2023, 2024). Hochstetter's frogs have been identified at three impact sites and the two control sites within the Cossey Creek catchment, but have only been found within the control site within the Wairoa River catchment.

Wildland Consultants Ltd was engaged to undertake further surveys in December 2024 and March/April 2025 at the same monitoring locations. This report describes the methods and results of these surveys and a discussion of results to date.

2.0 Wildlife Act Authority

All indigenous frogs are absolutely protected under the Wildlife Act 1953. Therefore, frogs and their habitats cannot be disturbed, handled or removed without an approved Wildlife Act Authority issued by the Department of Conservation. Wildland Consultants is authorised under Wildlife Act Authority 99271-FAU to survey for indigenous frogs.

Amphibian and Reptile Distribution cards (ARDs) are presented in Appendix 2.

3.0 Methods

3.1 Survey Transects

Surveys were carried out along transects in the same locations as in the initial surveys (Table 1) (Wildland Consultants 2021). As per the initial monitoring work, three impact sites and two control sites were surveyed at Cossey Creek (Figure 1, Appendix 1), and four impact sites and one control site were surveyed at Wairoa River Cossey Creek (Figure 2, Appendix 1).

Table 1 – Transect lengths (metres) for surveys undertaken at Wairoa River and Cossey Creek between December 2024 and March/April 2025

Survey Transect	Transect Length December 2024	Transect Length March/April 2025
Wairoa River - A	30	30
Wairoa River - B	30	30
Wairoa River - C	30	30
Wairoa River - D	30	30
Wairoa Tributary - Control	50	50
Cossey Creek - A	50	50
Cossey Creek - B	25	25
Cossey Creek - C	25	25
Cossey Tributary - Control 1	20	20
Cossey Tributary - Control 2	20	20

3.2 Survey Protocol

The methods used to survey for Hochstetter's frogs followed the protocol recommended by Bell (1996).

- Each transect was surveyed by a team of two experienced Wildlands staff and supervised by the project herpetologist.
- Surveys were undertaken during daylight hours (between 9am and 5pm) during suitable weather conditions (i.e., on fine, calm days with little or no rainfall within the 24-48 hours preceding the survey).
- Survey transects were divided in half, with each staff member surveying a different side of the stream.
- If Hochstetter's frogs were detected quickly within a transect, the survey was continued until completion to gain count data to represent simplistic indices of relative density and encounter rate.
- Each site was searched by slowly moving upstream from the start point, carefully examining all available refugia for Hochstetter's frogs (beneath rocks, logs and leaves, and inside crevices and tunnels).
- If replacing an object posed a risk to a Hochstetter's frog, the frog was gently nudged aside using a blunt object (e.g., a leaf or twig). After the object was returned to its position, the frog was gently nudged back under it.
- Both sides of the stream at each site were searched between the water's edge and one metre into the stream bank (if horizontal, or to 60 centimetres high if the stream bank was vertically sloped).
- Hochstetter's frogs were not captured or handled to have morphometric data recorded but had snout-urostyle-length crudely measured by extending a soft measuring tape alongside it to gain an estimate. Each frog was photographed where possible.
- GPS location data was recorded through track logs and waypoints marking the site of each located frog.

Figure 1: Survey sites and Hochstetter's frog observations at Cossey's Creek, Hunua Ranges

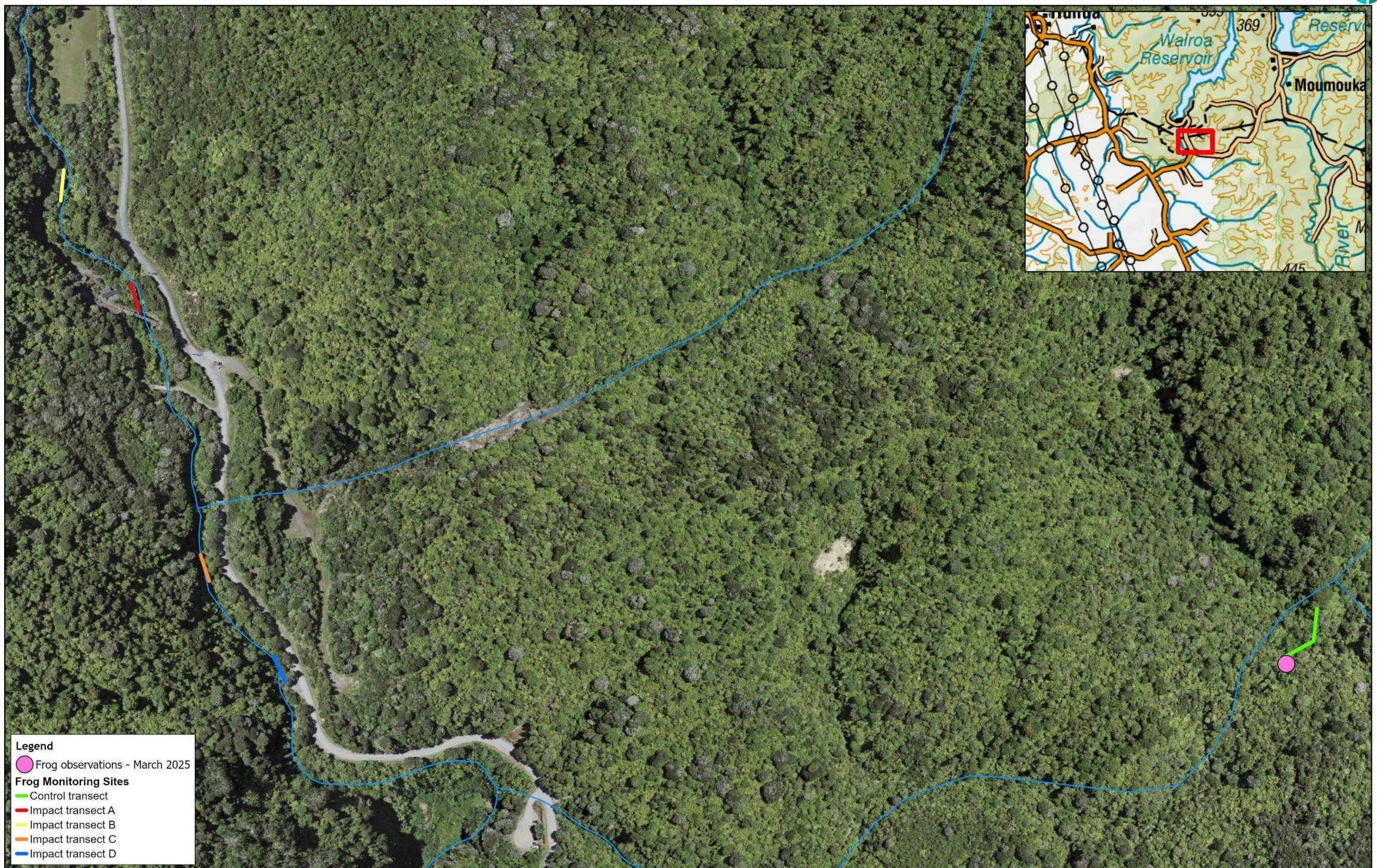

Figure 2: Survey sites and Hochstetter's frog observations at Wairoa River Catchment, Hunua Ranges

3.3 Data collection

The following data was collected at each of the survey transects:

- Date.
- Transect Length.
- Weather.
- Elevation.
- Transect suitability (based on presence and abundance of frog habitat):
  - Unsuitable (no habitat and no canopy cover).
  - Marginal (no habitat and no canopy)
  - Suitable (limited frog habitat present and minimal canopy cover).
  - Optimal (abundance of frog refuges present and full canopy cover).
- Search start/stop time:
  - Total search time.
  - Person search hours.
- Number of refuges searched.
- Stream width at 10-metre intervals along the transect.
- Canopy cover:
  - Open.
  - Partial.
  - Full.
- Habitat composition (%):
  - Bedrock
  - Boulders.
  - Cobbles.
  - Sand.
  - Silt.
  - Clay.
  - Vegetation.
- Transect searchability (based on searchable habitats including rocks and crevices):
  - Suitable (at least one or more suitable Hochstetter's frog refuges present that can be searched).
  - Not suitable (no suitable Hochstetter's frog refuges present).
  - Suitable but unsearchable (Hochstetter's frog refuges present but none of them are searchable – i.e., boulders too large to lift, debris and vegetation that could not be searched as it would require deconstruction which was not acceptable).
- Frogs:
  - Approximate snout-urostyle-length.
  - Approximate age class (Juvenile / Adult).

3.4 Frog hygiene

- Due to the risk of fungal pathogens to indigenous frogs (i.e., chytridiomycosis, Batrachochytrium dendrobatidis), hygiene protocols were followed in accordance with the New Zealand Frog Recovery Group's recommendations.
- Prior to commencing field work each day, all waders and field equipment were sprayed liberally with Sterigene™ to disinfect them. Following disinfection time (one minute), all equipment and boots were rinsed with fresh water. This process was repeated between survey sites and at the end of each field day.[1]

[1] This protocol is also considered sufficient to fulfil the requirements of Kauri Dieback Hygiene protocols for the Hunua Ranges.

- Although it was not intended that staff would catch or handle frogs as part of these surveys, a supply of disposable latex gloves was kept with each staff member. This ensured that in the event that a frog had to be handled a clean glove was available for use.

3.5 Freshwater gold clams

The above frog hygiene protocols are considered sufficient to reduce the risk of spreading gold clams at the site. However, additional procedures were followed including:

- A visual inspection of all equipment was undertaken prior to changing streams or locations and at the end of each day to check for clams.
- Equipment was thoroughly dried and left for a minimum of 48 hours before moving locations (i.e. from Hunua to Waitākere or vice versa).

There were no freshwater gold clams observed within any of the catchments.

4.0 Results

4.1 Wairoa River surveys

4.1.1 Frog Observations

No Hochstetter's frogs were observed within any of the four Wairoa River impact sites (A-D) during either the December 2024 or March 2025 surveys. No frogs were observed within the control site during the December 2024 survey; however, one was observed during the March 2025 survey (Figure 1, Plate 1).

Survey results are presented in Table 2 with detailed results provided in a separate excel spreadsheet as Addendum A.

The mean relative abundance of Hochstetter's frogs within Wairoa Creek Control site was estimated by number of frogs/100 metres. Frog encounter rates were estimated by calculating frog detections per person search hour (Table 3).

4.1.2 Search variables and habitat suitability

Search times varied widely between transects due to different lengths and variable abundance of searchable frog habitats (i.e., rocks) (Table 2). In December 2024, the Wairoa River contained an abundance of good quality habitat (including partial but largely full canopy cover, rocks and boulders, and riparian vegetation) that would be considered 'Suitable' or 'Optimal' for Hochstetter's frogs. The river contained moderate amounts of silt in some areas. This may have contributed towards zero frog detections in all survey transects.

In December 2024, three out of four impact sites at Wairoa River had a full canopy (the fourth had a partial canopy) and on average, habitats comprised 33% bedrock, 34% boulders, 12% cobbles, 1% sand, 13% silt, 3% clay, and 9% riparian vegetation. The control site had a full canopy and comprised 30% bedrock, 12% boulders, 12% cobbles, 37% sand, and 9% riparian vegetation. An average of 131 refuges were searched per site (including the control site).

In March 2025, the Wairoa River level was much higher, likely as a consequence of significant rain in preceeding weeks. As such, there was limited habitat to search and transects were considered as either marginal or suitable during this survey based on the limited searchable habitat.

During the March 2025 survey, most impact sites had partial canopy cover due to tree fall. The habitats on average comprised 35% bedrock, 13% boulders, 26% cobbles, 3% sand, 8% silt and 18% vegetation. The control site comprised 30% bedrock, 15% boulders, 5% cobbles, 35% sand, 3% silt and 18% vegetation. An average of 157.4 refuges were searched per site (including the control site).

Plate 1 – Adult Hochstetter's frog found on control transect. 31 March 2025.

Table 2 – Frog survey data for all transects on the Wairoa River and tributaries (December 2020 to April 2025).

Survey No.	Person Search Time (minutes)					No. of refuges searched					No. of frogs detected					Frog Measurements (Snout-Urostyle Length, mm)				
	Transect A	Transect B	Transect C	Transect D	Control	Transect A	Transect B	Transect C	Transect D	Control	Transect A	Transect B	Transect C	Transect D	Control	Transect A	Transect B	Transect C	Transect D	Control
Survey 1 – December 2020	52	40	40	50	70	100	108	96	155	185	0	0	0	0	1	-	-	-	-	30
Survey 2 – April 2021	37	38	14	43	32	228	146	137	259	331	0	0	0	0	2	-	-	-	-	33/36
Survey 3 – March 2022	12	23	20	34	44	106	122	140	181	344	0	0	0	0	0	-	-	-	-	-
Survey 4 – December 2022	28	14	16	22	46	74	60	102	141	147	0	0	0	0	0	-	-	-	-	-
Survey 5 – March 2023	82	22	105	36	56	828	174	565	231	374	0	0	0	0	0	-	-	-	-	-
Survey 6 – December 2023	30	10	20	14	30	390	87	134	138	144	0	0	0	0	0	-	-	-	-	-
Survey 7 – April 2024	14	12	10	14	40	130	116	78	114	170	0	0	0	0	0	-	-	-	-	-
Survey 8 – December 2024	20	15	10	25	35	828	174	565	321	374	0	0	0	0	0	-	-	-	-	-
Survey 9 – March 2025	48	16	14	40	54	92	131	134	201	91	0	0	0	0	1	-	-	-	-	40

Table 3 – Mean relative abundance and encounter rates of Hochstetter's frogs from all surveys on the Wairoa River and its tributaries (December 2020 to March 2025).

Survey No.	Wairoa River Transects A-D			Wairoa Control Transect		
	Number of frogs found	Mean relative abundance (frogs/100 metre)	Mean Encounter rates (# frogs/person search hour	Number of frogs found	Mean relative abundance (frogs/100 metre)	Mean Encounter rates (# frogs/person search hour
Survey 1 – December 2020	1	0 frogs/100m	0 frogs/hour	1	2 frogs/100m	0.86 frogs/hour
Survey 2 – April 2021	0	0 frogs/100m	0 frogs/hour	2	4 frogs/100m	1.88 frogs/hour
Survey 3 – March 2022	0	0 frogs/100m	0 frogs/hour	0	0 frogs/100m	0 frogs/hour
Survey 4 – December 2022	0	0 frogs/100m	0 frogs/hour	0	0 frogs/100m	0 frogs/hour
Survey 5 – March 2023	0	0 frogs/100m	0 frogs/hour	0	0 frogs/100m	0 frogs/hour
Survey 6 – December 2023	0	0 frogs/100m	0 frogs/hour	0	0 frogs/100m	0 frogs/hour
Survey 7 – April 2024	0	0 frogs/100m	0 frogs/hour	0	0 frogs/100m	0 frogs/hour
Survey 8 – December 2024	0	0 frogs/100m	0 frogs/hour	0	0 frogs/100m	0 frogs/hour
Survey 9 – March 2025	0	0 frogs/100m	0 frogs/hour	1	2 frogs/100m	1.07 frogs/hour

4.2 Cossey Creek Surveys

4.2.1 Frog Observations

During the December 2024 survey, seven frogs were found throughout the Cossey Creek catchment (Table 4, Figure 5 and 6). This included three frogs at Impact Site A, one frog at Impact Site B, one frog at Impact Site C, and one frog at each control site. This included a mixture of adults and juveniles ranging from 11 millimetres to 34 millimetres SUL.

The mean relative abundance of Hochstetter's frogs within Cossey Creek was estimated by number of frogs/100 metres. Frog encounter rates were estimated by calculating frog detections per person search hour (Table 5).

Two frogs were found during the April 2025 survey, one in Impact Site A and the other in Control Site 2.

For both the December 2024 and April 2025 surveys, detailed results are presented in Addendum A.

Amphibian and Reptile Distribution Scheme Cards for all frog detections are presented in Appendix 2.

4.2.2 Search variables and habitat suitability

Search times varied between transects at Cossey Creek, again due to different lengths and the variable abundance of searchable frog habitat (Table 4). Areas of good quality habitat that included partial canopy cover, boulders, rocks, and riparian vegetation was considered to be 'Suitable' for Hochstetter's frogs. Areas where the canopy was partial or full, along with the other features above, were considered 'Optimal' habitat. In December 2024, Cossey's Creek contained 'Optimal' habitat at both control sites, 'Suitable' habitat at two impact sites, and 'Marginal' habitat at one impact site. During April 2025 Control Site 1 was subject to an additional tree-fall and the end of the transect could not be accessed for survey.

In December 2024, on average, habitats within impact sites comprised 21% bedrock, 20% boulders, 37% cobbles, 2% sand, 5% silt, and 15% vegetation. Average habitat composition at the control sites comprised 40% bedrock, 8% cobbles, 30% silt, 16% sand, and 13% vegetation. An average of 130.83 refuges were searched per transect (including the control sites) during the survey.

In April 2025, Cossey's creek impact transects on average comrpised 8% bedrock, 12% boulders, 27% cobbles, 3% sand, 14% silt, and 36% vegetation. Average habitat composition at the control sites comprised 45% bedrock, 20% cobbles, 15% sand, 15% silt, and 5% vegetation. An average of 230.2 refuges were searched per transect (including the control sites) during the survey.

Table 4 – Hochstetter's frog survey data for Cossey Creek impact transects and control transects for surveys to date (December 2020 – April 2025).

Survey No.	Person Search Time (minutes)					No. of refuges searched					No. of frogs detected					Frog Measurements (Snout-Urostyle Length, mm)				
	Transect A	Transect B	Transect C	Control 1	Control 2	Transect A	Transect B	Transect C	Control 1	Control 2	Transect A	Transect B	Transect C	Control 1	Control 2	Transect A	Transect B	Transect C	Control 1	Control 2
Survey 1 – December 2020	130	30	45	21	20	817	204	110	86	122	1	0	0	1	1	30	-	-	44	35
Survey 2 – April 2021	110	64	46	32	62	1418	269	405	106	159	2	1	0	0	2	14,39	25	-	-	20,14
Survey 3 – March 2022	68	56	32	24	46	903	302	423	87	277	0	0	0	0	2	-	-	-	-	29,31
Survey 4 – December 2022	94	50	28	12	72	729	127	118	32	156	0	2	0	1	0	-	44,9	-	45	-
Survey 5 – March 2023	100	70	34	32	42	643	507	290	148	170	2	0	0	1	0	36,24	-	-	NM	-
Survey 6 – December 2023	64	60	50	36	34	918	541	233	82	183	1	2	0	0	1	40	10, 22	-	-	NM
Survey 7 – April 2024	46	40	30	14	60	550	409	220	73	108	0	1	0	0	0	-	21	-	-	-
Survey 8 – December 2024	90	60	80	30	60	337	217	148	44	78	3	1	1	1	1	33,NM,NM	11	35	33	34
Survey 9 – March 2025	33	20	22	11	37	436	224	214	76	174	1	0	0	0	1	42	-	-	-	35

Table 5 – Mean relative abundance and encounter rates of Hochstetter's frogs in Cossey Creek impact transects and the control transects.

Survey No.	Cossey Creek Transects A-C			Cossey Creek Control Transects 1-2		
	Number of frogs found	Mean relative abundance (frogs/100 metre)	Mean Encounter rates (# frogs/person search hour	Number of frogs found	Mean relative abundance (frogs/100 metre)	Mean Encounter rates (# frogs/person search hour
Survey 1 – December 2020	1	0.67 frogs/100m	0.154 frogs/hour	2	5 frogs/100m	1.46 frogs/hour
Survey 2 – April 2021	3	2.67 frogs/100m	0.68 frogs/hour	2	5 frogs/100m	0.97 frogs/hour
Survey 3 – March 2022	0	0 frogs/100m	0 frogs/hour	2	5 frogs/100m	1.30 frogs/hour
Survey 4 – December 2022	2	2.67 frogs/100m	0.80 frogs/hour	1	2.5 frogs/100m	2.5 frogs/hour
Survey 5 – April 2023	2	1.33 frogs/100m	0.40 frogs/hour	1	2.5 frogs/100m	0.94 frogs/hour
Survey 6 – December 2023	3	3.33 frogs/100m	0.98 frogs/hour	1	2.5 frogs/100m	1 frogs/hour
Survey 7 – April 2024	1	1.33 frogs/100m	0.45 frogs/hour	0	0 frogs/100m	0 frogs/hour
Survey 8 – December 2024	5	4.67 frogs/100m	1.67 frogs/hour	2	5 frogs/100m	1.50 frogs/hour
Survey 9 – April 2025	1	0.67 frogs/100m	0.61 frogs/hour	1	2.5 frogs/100m	0.80 frogs/hour

5.0 Conclusion

Watercare Services Ltd has gained resource consent to lower the environmental flows required to be supplied from the Cossey and Wairoa dams to Cossey Creek and the Wairoa River. Downstream flow alterations have been identified as potentially affecting resident aquatic fauna. Hochstetter's frog is a semi-aquatic indigenous frog species that is classified as 'At Risk-Declining' and may be affected by the altered flows. As such, surveys are required to determine if the altered flow rate has impacted the presence and/or abundance of Hochstetter's frog within Cossey Creek and Wairoa River. Flows were reduced in 2020 and were due to be reinstated in January 2022. However, the duration of the reduced flow period was extended requiring additional surveys.

Frog survey methods followed the 'Bell' (1996) protocol and did not involve any catching or handling. The number of refuges inspected for each survey was recorded, together with search time and a range of stream variables including substrate, canopy cover, and stream width. Strict hygiene protocols were followed to minimise the risk of spreading either chytrid disease or kauri dieback on boots and survey equipment.

Frog surveys carried out since December 2020 at the Wairoa River impact transects have not detected any frogs. Frogs were detected during the first two surveys (December 2020 and April 2021) at the control transect. No frogs have been detected in the Wairoa River at either the treatment or control sites since April 2021; however, one was found during the most recent survey in March 2025. It is considered likely that Hochstetter's frogs are not present within the Wairoa impact sites given the lack of detections during surveys to date.

Several frogs were detected in Cossey Creek during initial surveys (2021-2022), including both impact and control sites. However, until December 2024 no frogs had been detected within Impact Site C. Total observations have remained relatively consistent within the Impact Sites to date (excluding April 2022 when no frogs were observed, and December 2024 when a larger number than usual was observed). Frog numbers within the Control Sites have remained consistent over surveys to date with two frogs found in December 2024 (one at each control site) and one frog found in April 2025 at Control Site 2 (noting that Control Site 1 had been subject to additional treefall and the area known to support frogs could not be reached).

No consistent changes in the number of frog detections at control and impact sites are evident at either Cossey Creek or the Wairoa River over time. This may indicate that the lowering of environmental flows has not had an adverse impact on frog populations. However, given the dynamic nature of the system and the very small sample size, such a conclusion would not be considered robust. Any adverse effects of reduced water flows may be quickly masked by the low number of frogs at each transect and highly cryptic nature of this species.

Further surveys are recommended to continue to monitor the health of this frog population, particularly if environmental flows continue to be altered.

Acknowledgments

We thank Emma Baker for her liaison and assistance with site access.

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Appendix 1 Updated photographs of transect sites from the March/April 2025 survey.

WAIROA RIVER

Plate 1 – Wairoa Transect A, at 0m facing upstream. 31 March 2025.

Plate 2 – Wairoa Transect B, at 0m facing upstream. 31 March 2025 .

Plate 3 – Wairoa Transect C, at 0m facing upstream. 31 March 2025.

Plate 4 – Wairoa Transect D, at 0m facing upstream. 31 March 2025.

Plate 5 – Wairoa Control Transect, at 0m facing upstream. 31 March 2025.

COSSEY CREEK

Plate 6 – Cossey Transect A, at 0m facing upstream. April 2025.

Plate 7 – Cossey Transect B, at 0m facing upstream. April 2025.

Plate 8 – Cossey Transect C, at 0m facing upstream. April 2025.

Plate 9 – Cossey Control 1, at 0m facing upstream. April 2025.

Plate 10 – Cossey Control 2, at 0m facing upstream. April 2025.

Appendix 2

Amphibian and Reptile Distribution Scheme (ARDS) Cards

ARDS CARD

NEW ZEALAND AMPHIBIAN/REPTILE DISTRIBUTION SCHEME

Herpetofauna Administrator, RD&I, Department of Conservation, P.O. Box 10420, Wellington.

Card No:1

Observer: B S (Initials) Balsom (Surname)

Date: 23/12/2024

Alt (m):

Locality Name: Hunua Ranges – Cossey Creek

Address: 12 Nixon Street, Grey Lynn, PO Box 46-299, Herne Bay, Auckland 1011

Affiliation: Wildland Consultants Ltd

	Easting	Northing
GPS	1 7 8 5 9 3 9	5 8 9 5 9 8 9

Series	Map No.	Easting	Northing

Area Office: Conservancy: Ecol. District:

Species name	No.	Time	Habitat	Weather
Leiopelma hochstetteri	7	10:00 – 14:00	11, D	2, 2, 1

Voucher specimen(s) No Specify:

Photograph(s) Yes

Extra notes on reverse side No Release site:

Notes: Seven frogs. All were located within stream channel during frog surveys.

Identified by: Blair Balsom
Authority used: Wildland Consultants Ltd, Permit 99271-FAU

Weather

1. Light
2 Fine/Sunny
3 Part Cloudy
4 Overcast
5 Showers
6 Rain
7 Night
8 0-½ Moonlit
9 ½-1 Moonlit

Temperature
1 Hot
2 Warm
3 Moderate
4 Cool
5 Cold

Wind
1 Calm
2 Light breeze
3 Mod breeze
4 Gusty
5 Strong winds

Major Habitat Types

1 Beech Forest
2 Podocarp forest
3 Broadleaf forest
4 Exotic forest
5 Scrub
6 Sub-alpine
7 Alpine
8 Undeveloped tussock land
9 Developed farmland
10 River terrace
11 Fresh water
12 Wet land
13 Coastal
14 Scree
15 Bare rocks
16 Beach
17 Urban
18
19
20

Micro habitats

A Foliage
B Trunk
C Branches
D Under stones
E Under wood
F Open ground
G Crevices
H ground veg
I under flax

ARDS CARD	**NEW ZEALAND AMPHIBIAN/REPTILE DISTRIBUTION SCHEME** Herpetofauna Administrator, RD&I, Department of Conservation, P.O. Box 10420, Wellington.	Card No:2

Observer: H E (Initials) Sollis (Surname)

Date: 31/03/2025

Alt (m): 75m and 44m

Locality Name: Hunua Ranges – Cossey Creek

Address: 12 Nixon Street, Grey Lynn, PO Box 46-299, Herne Bay, Auckland 1011

Affiliation: Wildland Consultants Ltd

	Easting	Northing
GPS	1789237	5890731

Series	Map No.	Easting	Northing

Area Office: Conservancy: Ecol. District:

Species name	No.	Time	Habitat	Weather
Leiopelma hochstetteri	1	15:20 – 16:50	11, D	2, 2, 1

Voucher specimen(s) No Specify:

Photograph(s) Yes

Extra notes on reverse side No Release site:

Notes: One frog. Located within stream channel during frog surveys.

Identified by: Blair Balsom
Authority used: Wildland Consultants Ltd, Permit 99271-FAU

Weather

1 Light
2 Fine/Sunny
3 Part Cloudy
4 Overcast
5 Showers
6 Rain
7 Night
8 0-½ Moonlit
9 ½-1 Moonlit

Temperature

1 Hot
2 Warm
3 Moderate
4 Cool
5 Cold

Wind

1 Calm
2 Light breeze
3 Mod breeze
4 Gusty
5 Strong winds

Major Habitat Types

1 Beech Forest
2 Podocarp forest
3 Broadleaf forest
4 Exotic forest
5 Scrub
6 Sub-alpine
7 Alpine
8 Undeveloped tussock land
9 Developed farmland
10 River terrace
11 Fresh water
12 Wet land
13 Coastal
14 Scree
15 Bare rocks
21 Beach
22 Urban
23
24
25

Micro habitats

A Foliage
B Trunk
C Branches
D Under stones
E Under wood
F Open ground
G Crevices
H ground veg
I under flax

ARDS CARD	**NEW ZEALAND AMPHIBIAN/REPTILE DISTRIBUTION SCHEME** Herpetofauna Administrator, RD&I, Department of Conservation, P.O. Box 10420, Wellington.	Card No:3

Observer: H E (Initials) Sollis (Surname)

Date: 30/04/2025

Alt (m): 75m and 44m

Locality Name: Hunua Ranges – Cossey Creek

Address: 12 Nixon Street,
Grey Lynn
PO Box 46-299,
Herne Bay,
Auckland 1011

Affiliation: Wildland Consultants Ltd

	Easting	Northing
GPS	1 7 8 5 9 3 9	5 8 9 5 9 8 9

Series	Map No.	Easting	Northing

Area Office: Conservancy: Ecol. District:

Species name	No.	Time	Habitat	Weather
Leiopelma hochstetteri	2	15:20 – 16:50	11, D	2, 2, 1

Voucher specimen(s) No Specify:

Photograph(s) Yes

Extra notes on reverse side No Release site:

Notes: Two frogs. All were located within stream channel during frog surveys.

Identified by: Blair Balsom
Authority used: Wildland Consultants Ltd, Permit 99271-FAU

Weather

1 Light
2 Fine/Sunny
3 Part Cloudy
4 Overcast
5 Showers
6 Rain
7 Night
8 0-½ Moonlit
9 ½-1 Moonlit

Temperature

1 Hot
2 Warm
3 Moderate
4 Cool
5 Cold

Wind

1 Calm
2 Light breeze
3 Mod breeze
4 Gusty
5 Strong winds

Major Habitat Types

1 Beech Forest
2 Podocarp forest
3 Broadleaf forest
4 Exotic forest
5 Scrub
6 Sub-alpine
7 Alpine
8 Undeveloped tussock land
9 Developed farmland
10 River terrace
11 Fresh water
12 Wet land
13 Coastal
14 Scree
15 Bare rocks
26 Beach
27 Urban
28
29
30

Micro habitats

A Foliage
B Trunk
C Branches
D Under stones
E Under wood
F Open ground
G Crevices
H ground veg
I under flax

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