

WATERWAYS MONITORING REPORT 2025

Introduction

Monitoring waterways is essential to identify and quantify the factors that affect ecological, cultural, and human health, so they can be improved over time. The Waterways Monitoring Framework (WQMF) was established in 2018 to create a standardised monitoring program for Waiutuutu/Okeover and Ōtākaro/Avon streams (Figure 1). The UC Waterways Plan aims to increase base flow, reduce contamination, and improve habitat for aquatic species. To assess these goals, we collect water quality and quantity measurements quarterly and conduct ecological monitoring annually. These are compared to previous studies conducted on campus since 1979 to evaluate long-term change.

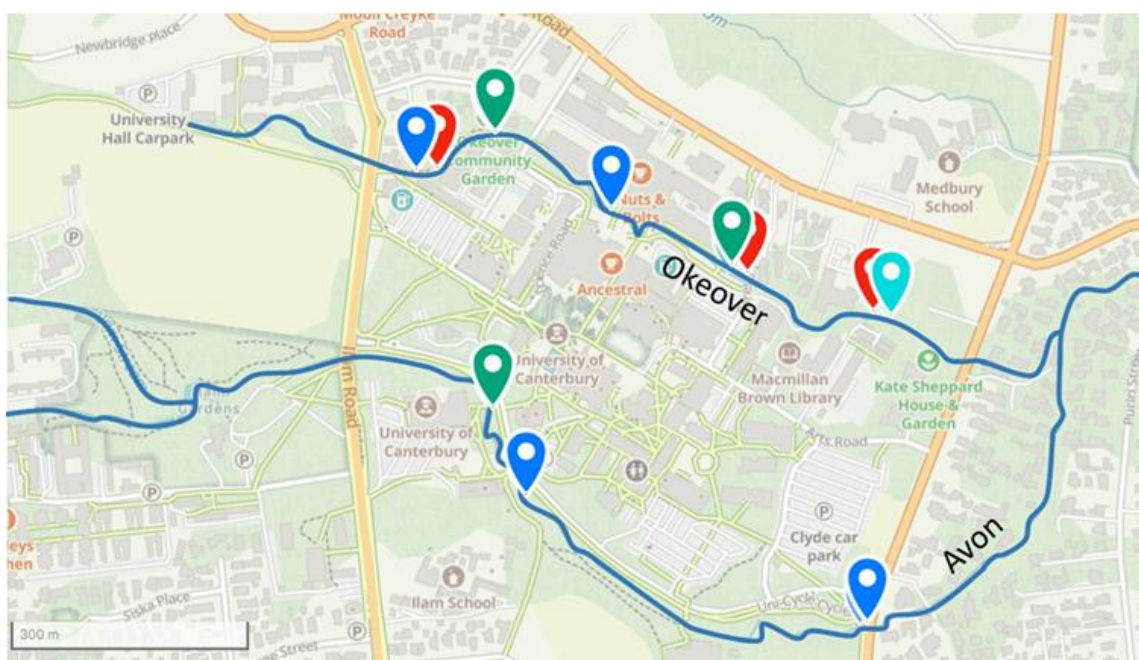


Figure 1: Waterways monitoring sites along the Okeover and Avon streams. Blue pins show the location of water chemistry sampling sites, green indicates ecology (macroinvertebrates), and teal indicates both water chemistry and ecology. Red shows the locations of the stormwater samplers. Basemap: Gaia GPS.

Stream flow

Streamflow measures the volume of water moving through a waterway per second; it is an important component of water quality because it affects turbidity, dissolved oxygen, and in-stream animals. In 2025, flow in the Okeover stream ranged between $0.15 \text{ m}^3/\text{s}$ below Ilam Road and $0.34 \text{ m}^3/\text{s}$ downstream near the greenhouses. Flow in the Okeover is strongly influenced by relatively consistent air conditioning discharges and stormwater inputs. Flow in the Avon is slightly higher, ranging from 0.30 to $0.33 \text{ m}^3/\text{s}$. Flow is similar to previous years.

Temperature

Temperature affects water chemistry, such as dissolved oxygen, and is a key driver of biological activity. Average temperatures remained consistently low throughout the year (14.1°C and 13.9°C in summer and winter, respectively), creating suitable conditions for aquatic plants and animals. Historical records show that temperatures have decreased since 2000 as riparian plantings increased in-stream shade.

Water Clarity and Turbidity

Water clarity reduces when sediment or other particles are suspended in the water column. Lower clarity reduces aquatic plant growth, aquatic animal feeding, and the waterway's visual aesthetic. As part of this monitoring, both total suspended solids and turbidity are measured.

Turbidity in the Okeover was lowest in March and December (mean 0.17 NTU) and slightly elevated during winter and spring (mean 1.20 NTU) when rainfall was higher. The Avon had higher turbidity, ranging from a mean of 3.88 NTU in winter and spring to 8.87 NTU in March and December, which may reflect the extremely high mean NTU values reported at both Avon sites (19.47 and 12.33 NTU) in March. During this March sampling period, bank vegetation removal was occurring upstream, which may have increased sedimentation in the stream and led to unusually high turbidity values.

However, significant infrastructure upgrades occurred along Maidstone and Creyke roads throughout 2025. Subsequently, several silted events were reported in the Waitutuutu stream, with visible deposits of high sediment loads flushed out of stormwater pipes during dewatering procedures carried out under council consent for the infrastructure replacements. Some of these events were noted on 10 and 11 March, 9 and 17 April, 24 June, and 17 and 28 July. While sampling days did not directly coincide with these sedimentation events, it is worth recognising that they could have influenced turbidity and water clarity on other occasions.

Despite this, total suspended solids have remained low, not exceeding 1.3 g/L. This reflects the clear, spring-fed water feeding the Okeover and Avon streams.

Dissolved oxygen

Oxygen is essential for fish, eels, and aquatic insects to breathe and survive. Dissolved oxygen is commonly measured as the saturation of oxygen in the water. The Okeover and Avon had dissolved oxygen levels of 86.6–92.7% and 62.8–90.7%, respectively, over the course of the year. All measurements at the Okeover sites were above 8 mg/L, and most at the Avon sites were also above 8 mg/L. Lower oxygen saturation values, particularly in March in the Avon, may be due to higher turbidity measured during this period, which blocks light and limits photosynthesis in plants. Values reported at Okeover are within the bounds of healthy streams, which typically have around 80% saturation, and oxygen levels are consistent with previous years, though lower oxygen saturation values reported in Avon suggest poorer conditions. Note that oxygen levels are lower during the day, when the stream was sampled, as oxygen is taken up by photosynthesising plants and algae.

Heavy metals

Urban streams are often contaminated with heavy metals that run off from surrounding soils, roofs, roads, and other impermeable surfaces. At high concentrations, heavy metals can be toxic to aquatic species and pose human health risks. We test directly for heavy metals and use proxies for chemical pollution, including conductivity and pH. Conductivity, a measure of dissolved ions in the water, ranged between 155.7–176.7 and 77.0–193.8 in the Avon and Okeover streams, respectively. Both streams have similar pH values, ranging between 6.54–7.28 and 6.33–7.21 in the Avon and Okeover, respectively, though pH has been reported as more alkaline (>7 pH) in previous years. Direct heavy metal sampling indicates that some heavy metal concentrations are elevated seasonally, particularly in spring. However, they do not appear to exceed guideline values required to protect freshwater biodiversity, which is consistent with the 2024 data (Table 1; Point sample). It is worth noting that while dissolved heavy metals in the water column may be at acceptable levels, sediments on the stream bed, which are frequently disturbed, are a significant source of contamination.

Table 1: Mean heavy metal concentrations for 2025 ($\mu\text{g/L}$). Point samples were taken during regular sampling in both Avon and Okeover streams. Stormwater was collected only in Okeover. Guideline values indicate heavy metal concentrations to protect 90% of species.¹

	Point sample - dissolved	Stormwater - filtered	Guideline value (90% protection)
Copper	0.612	0.539	1.8
Lead	0.034	0.160	5.6
Zinc	4.826	43.997	15

Stormwater sampling

Stormwater samplers automatically collect water when the stream rises to a certain level, capturing water at the start of rain events. Surface runoff predominates these samples, though resuspended sediments likely also contribute. Stormwater samples are only collected from the Okeover stream. While copper and lead concentrations were within the guideline values, zinc levels exceeded the suggested value of 15 by approximately three times. In contrast, zinc was below the guideline in 2024, though it was almost 16 times higher than the guideline value of 15 in 2023. Fluctuating zinc levels around the suggested guideline values indicate an area for improvement in understanding the mechanisms driving this variation.

¹Australian and New Zealand Governments. (n.d.). *Toxicant default guideline values for water quality in aquatic ecosystems*. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants>

Ecology

A diverse range of invertebrates inhabit freshwater. Identifying which species are present can indicate longer-term water-quality trends, as some species are more sensitive to poor water quality than others. The sensitivity of invertebrate communities is summarised by the Macroinvertebrate Community Index (MCI). Scores range from <80 (Severe pollution), 80–99 (Moderate), 100–120 (Mild), to >120 (Excellent). MCI scores in the Okeover stream continue to increase slowly. This year, MCI scores indicate moderate pollution. Since 1979, MCI scores have fluctuated between severe and moderate pollution (Figure 2) and have yet to meet the biodiversity target set in the 2019–2025 UC Biodiversity Plan, which is mild pollution or above. The average Okeover MCI score for 2025 is 88.425, while the Avon is slightly more polluted, with a score of 84.286. However, one invertebrate sample in the Okeover stream was collected approximately 110 metres upstream from the standard invertebrate sampling site used in previous years.

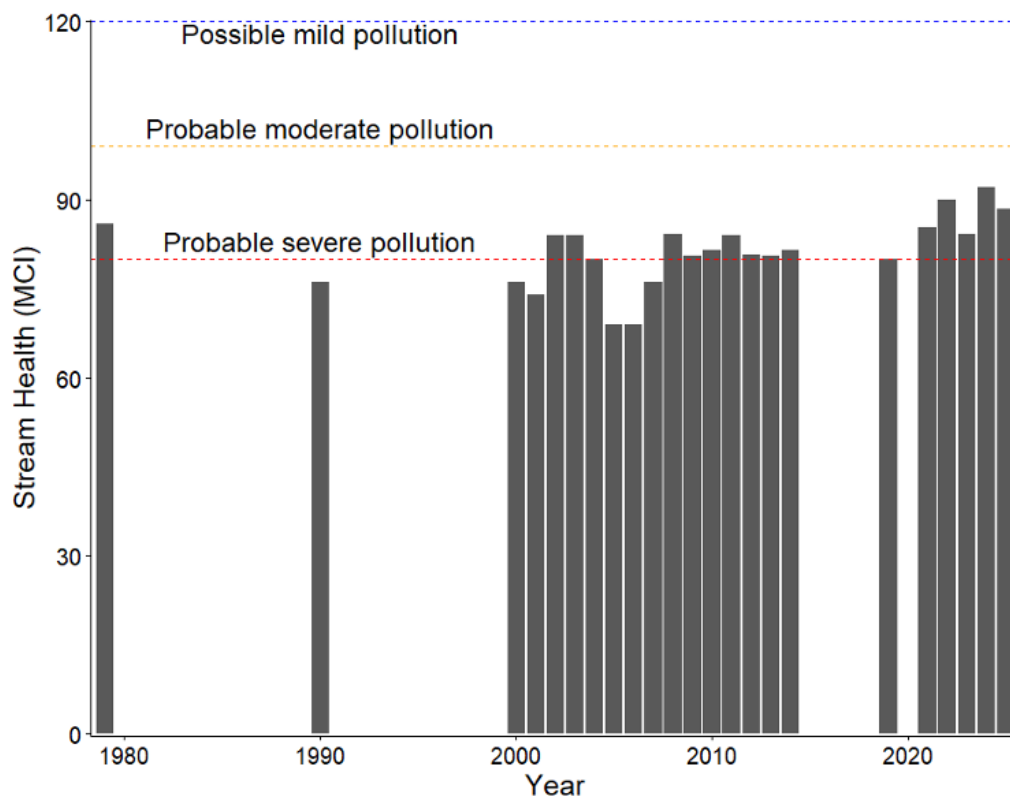


Figure 2: Average MCI scores taken across three sites in Okeover Stream, University of Canterbury, from 1979 to 2025. The red, orange, and blue dashed lines represent threshold values for pollution categories (<90 = severe pollution, ≥90 and <110 = moderate pollution, ≥110 and <130 = mild pollution, pristine conditions are ≥130) as outlined in the National Policy Statement for Freshwater Management (2020). Gaps between bars represent years where data were not available.

Engagement

The streams flowing through campus provide a range of teaching and engagement opportunities for the university and wider community. Ilam Primary School collaborated with university students and academic staff, along with the Christchurch City Council's Community Waterways Advisor, to support primary school students in an invertebrate and water-quality investigation in the Hareroa Stream. The sustainability office also supported Ilam Primary with a Hīnaki inquiry led by Environment Canterbury's Mahinga Kai Facilitator, Makariri Rupene, and two litter removal events were carried out in the Hareroa Stream. Furthermore, a community engagement evening was held to bring the community together with a short korero and shared kai, with the aim of inaugurating an upper catchment care group. This was supported by, and in conjunction with, Christchurch Waterways Partnership (CCC), Avon-Ōtākaro Network (AvON), Te Tuna Tāone, and EnviroHub with the Stormwater Superhero Trailer. Continuing from previous years, two undergraduate courses, BIOL112 (biology) and GEOG201 (geography), also use the collection of annual macroinvertebrate and stream-flow data to provide practical field opportunities. Additionally, this data provides a valuable addition to the monitoring provided as part of this project.

Recommendations for campus waterways management

One of the key persistent stressors affecting the waterways on the UC campus is deposited fine sediment. As noted above, this sediment smothers the stream bed, degrading aquatic habitats and hindering feeding for aquatic animals. Additionally, activities in the stream, such as removing bank vegetation, or high rainfall events cause the sediment to become suspended in the water column, as observed earlier in 2025. We recommend a regular regime of sediment removal and the continuation of riparian planting along the stream to stabilise banks and reduce sedimentation.

Summary and next steps for the waterways monitoring program

While physical conditions such as temperature, dissolved oxygen, and water clarity generally indicate a healthy urban stream, periodic fluctuations in turbidity and dissolved oxygen may still occur due to urban activity around streams. Furthermore, aquatic life within the Okeover and Avon streams remains poor. Ongoing monitoring will provide a clearer indication of water-quality trends and identify areas where improvements can be made. While current monitoring provides a good indication of physical and some ecological (macroinvertebrate) parameters, we offer the following suggestions to continue building this program:

- Extending the stormwater monitoring to include the Avon.
- Testing for E. coli, nitrogen, and phosphorus.
- Increasing engagement and outreach across schools, community groups, and the university campus.
- In previous years, environmental DNA (eDNA) samples have been collected as an effective method to detect the presence of valued native fish, even when only a few individuals are present in the stream. Periodic eDNA sampling in the future could be beneficial to understand any seasonal patterns or changes over time in the presence of these valued species.