

# Pond water quality at Tahuna Torea Nature Reserve

By Shaun Lee 22 September 2025

## Summary

This study monitors water quality before and after a Koi carp removal project at Tahuna Torea Nature Reserve in 2025. Too few fish were removed to see meaningful effects, but the analysis provides useful baseline data on pond water quality in the stormwater pond. Water quality was manually measured for Dissolved Oxygen, pH, Temperature and Nitrate. An AquaWatch real time sensor was deployed to monitor Conductivity, Dissolved Oxygen, pH, Rain, Temperature and Turbidity. Removing accumulated silt is identified as a solution to increasing biodiversity in the pond.

## The pond



*Image GeoMaps mapping service ©Auckland Council 2025*

The pond is man made and recorded as a public Stormwater Treatment Facility.

## Koi carp

Grass carp (*Ctenopharyngodon idella*) are herbivorous fish introduced to the Tahuna Torea Nature Reserve for aquatic weed control<sup>1</sup>. It is suspected that these grass carp died during the 2020 drought, when the pond reached record low water levels. In contrast, koi carp (*Cyprinus carpio*) are likely being regularly released into the pond by pet owners.

Koi carp can significantly increase water turbidity<sup>2</sup> due to their benthic foraging behaviour. As they root through the sediment in search of food, they disturb the substrate and resuspend fine particles into the water column, reducing water clarity.

To address this, local residents and rangers, in collaboration with Auckland Council and a Bow Hunting Club, organised an event at 3pm on the 29<sup>th</sup> of March 2025 to suppress the Koi carp population. Fishing is not allowed in the pond but Council may have done pest fish suppression in the pond in the past. It had been a dry summer, and the pond level was noticeably low, making large fish easier to spot. 33 fish were counted on the 10<sup>th</sup> of November 2024. Eight fish were removed by the Bow Hunting Club. The largest fish was 57cm long. On the 31<sup>st</sup> of March seven large Koi carp were counted alive in the pond, 12 fish were counted on the 3<sup>rd</sup> of April.

## Other vertebrates living in the pond

**Birds:** The pond supports a resident population of waterfowl, predominantly Mallards (*Anas platyrhynchos*), with occasional records of pūkeko (*Porphyrio melanotus*). Foraging by little shag (*Microcarbo melanoleucos*) and pied shag (*Phalacrocorax varius*) was observed on multiple occasions.

**Fish:** Brown bullhead catfish (*Ameiurus nebulosus*) are regularly encountered in the pond, sometimes occurring in schools of juveniles<sup>3</sup>. These fish are occasionally targeted by illegal harvest. Large numbers of mosquito fish (*Gambusia affinis*) are conspicuous on the water surface at night. Eel (*Anguilla spp.*) sightings were rare, suggesting low abundance.

## Manual water quality testing

Water clarity was measured at two sites before and after the event using a Wai Care kit borrowed from Auckland Council. Turbidity was assessed with a water clarity tube, in

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<sup>1</sup> Barfoot, C. (1999). Tahuna Torea: Tip site to nature reserve. Auckland: Auckland City Council.

<sup>2</sup> Parkos, J. J., Santucci Jr, V. J., & Wahl, D. H. (2003). Effects of common carp (*Cyprinus carpio*) on multiple trophic levels in shallow mesocosms. Canadian Journal of Fisheries and Aquatic Sciences, 60(2), 182-192.

<sup>3</sup> <https://inaturalist.nz/observations/191797742>

which a black disc is moved through the water sample in the tube to determine the distance at which it disappears and reappears. Measurements were taken in the nearest shade. Each measurement was repeated three times by the author, and the average depth (cm) was recorded as the clarity value.

| Site | Day    | Time     | Conditions   | Disappear / appear average |
|------|--------|----------|--|----------------------------|
| A    | 27 Mar | 5:50 pm  | Fair weather all day and in the preceding week. Sunny, windy | 4cm                        |
| B    | 27 Mar | 6:20 pm  | Sunny, calm  | 5.5 cm                     |
| A    | 28 Mar | 10:00 am | Sunny, light breeze. Shower in the morning and rain at noon. | 3.5 cm                     |
| B    | 28 Mar | 10:10 am | Sunny, light breeze  | 6 cm                       |
| A    | 28 Mar | 2 pm     | Sunny, windy   | 3.5 cm                     |
| B    | 28 Mar | 3 pm     | Sunny, light breeze  | 7 cm                       |
| C    | 28 Mar | 2:30 pm  | Sunny, windy.  | 6 cm                       |
| A    | 28 Mar | 6 pm     | Sunny, windy   | 3.5 cm                     |
| B    | 28 Mar | 6:10 pm  | Sunny, windy   | 6 cm                       |
| A    | 29 Mar | 10:00 am | Sunny calm   | 4 cm                       |
| B    | 29 Mar | 10:10 am | Sunny, calm  | 6 cm                       |
|      | 29 Mar | 3 pm     | Koi carp removal event                                       |                            |
| A    | 29 Mar | 6 pm     | Overcast, calm, light shower                                 | 4 cm                       |
| B    | 29 Mar | 6:10 pm  | Overcast, calm, light shower                                 | 7 cm                       |
| A    | 30 Mar | 6 pm     | Sunny, calm  | 4 cm                       |
| B    | 30 Mar | 6:10 pm  | Sunny, calm  | 6 cm                       |
| A    | 31 Mar | 6 pm     | Overcast, calm   | 4 cm                       |
| B    | 31 Mar | 6:10 pm  | Overcast, calm   | 6 cm                       |
| A    | 1 Apr  | 6 pm     | Mostly overcast, calm  | 3.5 cm                     |
| B    | 1 Apr  | 6:10 pm  | Mostly overcast, calm  | 6 cm                       |
| A    | 2 Apr  | 6 pm     | Mostly overcast, calm  | 4 cm                       |
| B    | 2 Apr  | 6:10 pm  | Mostly overcast, calm  | 6 cm                       |
| A    | 3 Apr  | 6 pm     | Overcast, very windy. Rain today                             | 3.5 cm                     |
| B    | 3 Apr  | 6:10 pm  | Overcast, very windy. Rain today                             | 6 cm                       |



Site A: Adjacent to pond sign -36.872591, 174.882080



Site B: Back of pond by bird boxes -36.872184, 174.883268



Site C. Weir track. -36.872783 174.883713

### Other readings 28 March 2025

Dissolved oxygen was measured at three sites. The manual method involves extracting surface water into a vial, where contact with air can lead to artificially high readings (often above 9 mg/L). pH, temperature, and nitrate were measured at Site B only.

**Site A. 2pm.** Dissolved oxygen: 11+ mg/L (ppm)

**Site B. 3 pm.** Dissolved oxygen: 11+ mg/L (ppm)

Ph: 7, Temperature: 21.3, Nitrate: 0

**Site C. 2:30 pm.** Dissolved oxygen: 11+ mg/L (ppm)

## AquaWatch Waka

An AquaWatch waka was borrowed from Auckland Council and deployed for 18 days (29<sup>th</sup> of March - 16 April 2025). Conductivity, Dissolved Oxygen, pH, Temperature and Turbidity were recorded every hour. Regional rainfall data was also reported on via the AquaWatch platform

At the time of deployment, the pond water level was very low. Rainfall on the 4<sup>th</sup> of April had a significant effect across multiple measures.



*Waka in monitoring location -36.872133 174.882786*

Site  
Auckland RC CSC 5 : A-100140

Date Range: 29 Mar 2025 - 16 Apr 2025



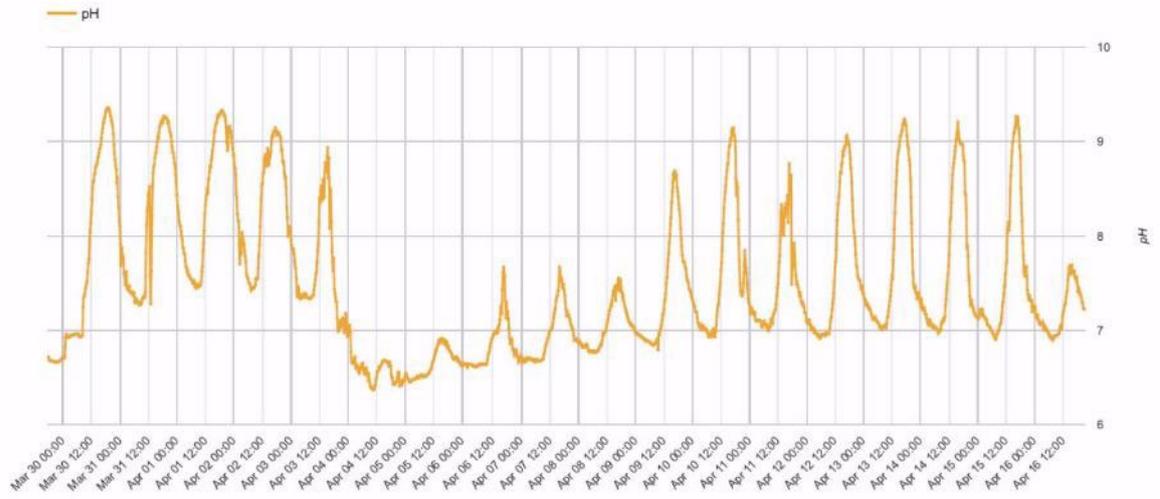
Site  
Auckland RC CSC 5 : A-100140

Date Range: 29 Mar 2025 - 16 Apr 2025



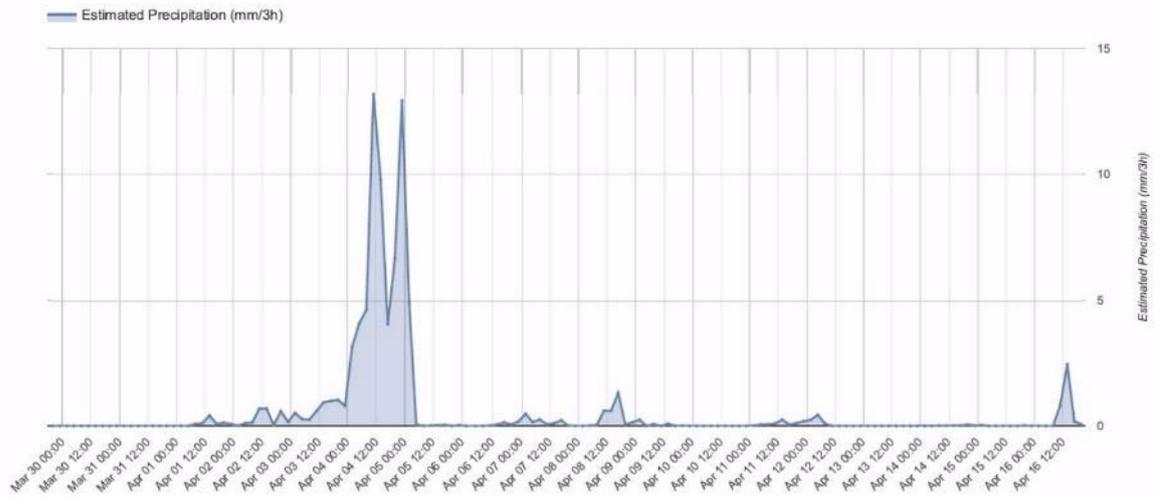
Date Range: 29 Mar 2025 - 16 Apr 2025

Site:  
Auckland RC CSC 5 : A-100140



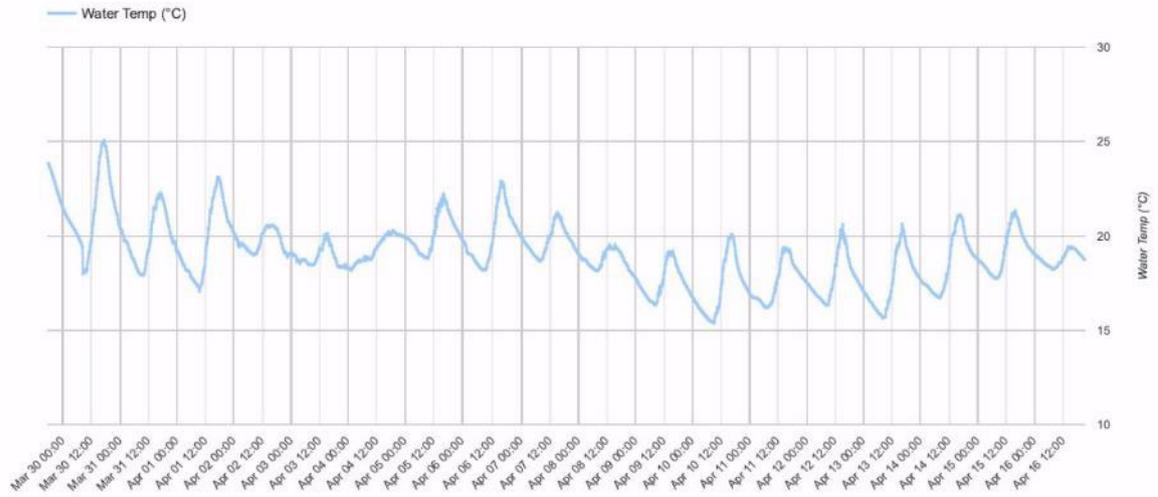
Date Range: 29 Mar 2025 - 16 Apr 2025

Site:  
Auckland RC CSC 5 : A-100140



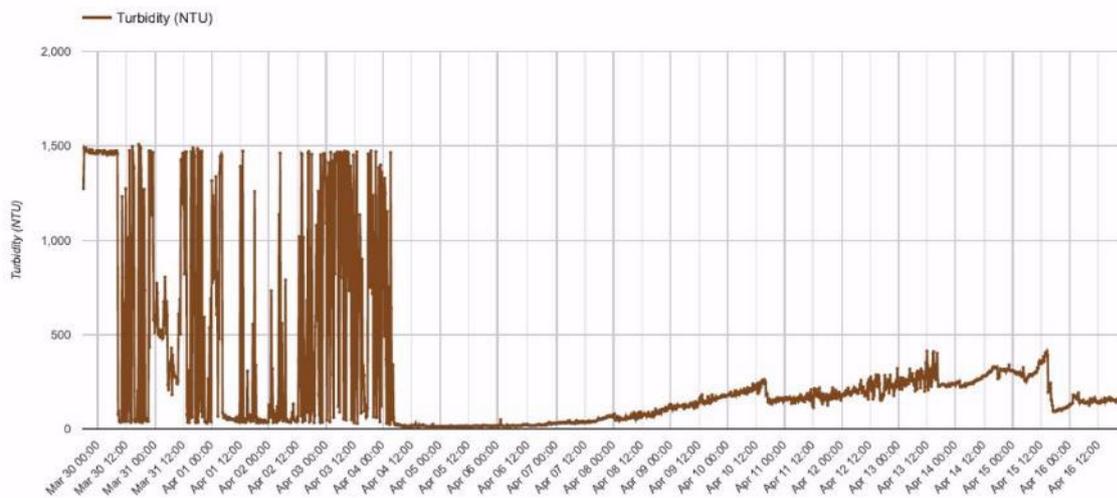
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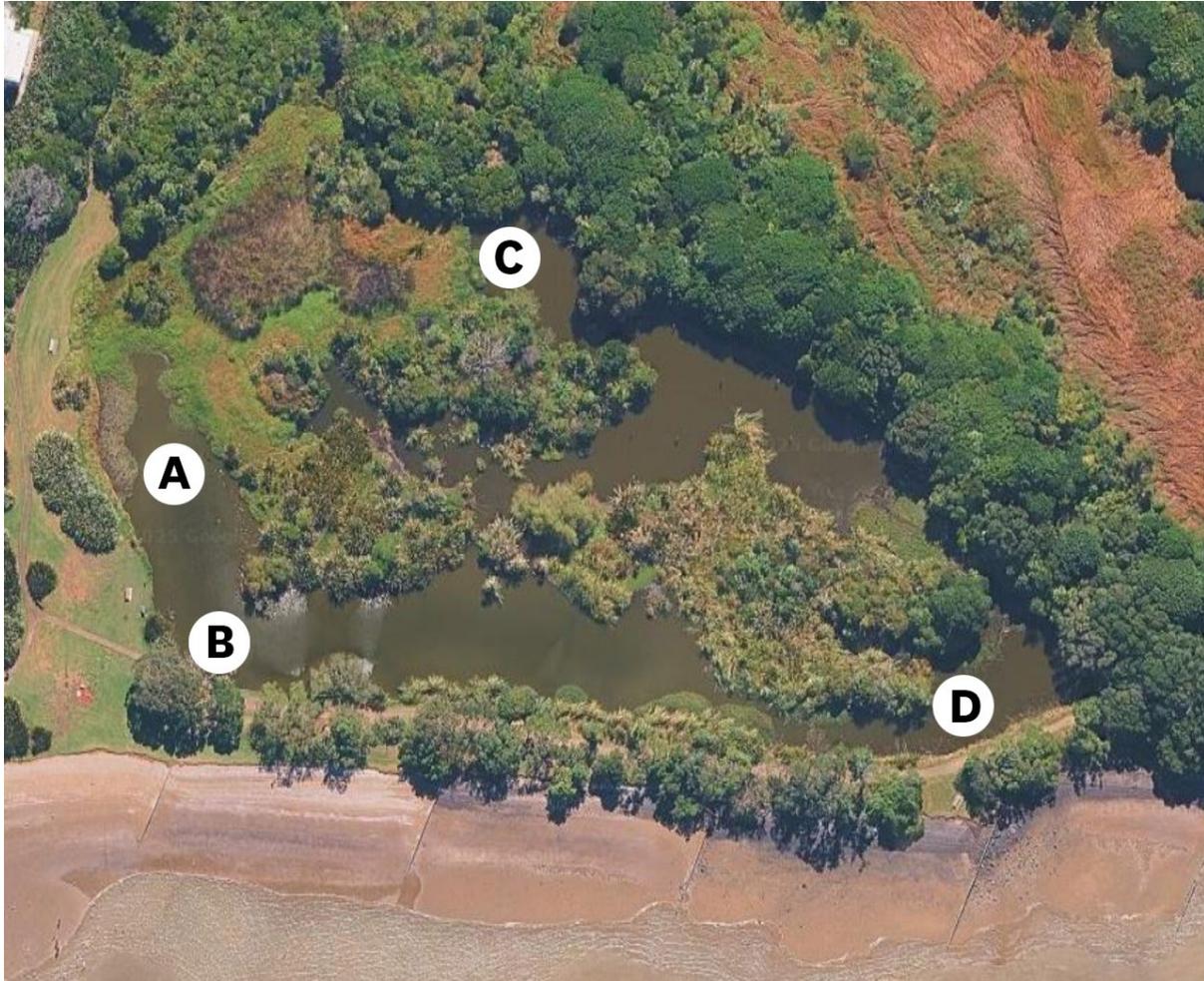


Initial high swings in turbidity suggest the waka was touching the floor of the pond.

The data shows signs of eutrophication in the pond with low Dissolved Oxygen, high pH swings, and likely high algal/macrophyte biomass.

## Soft sediment observations

Soft sediment depth was recorded opportunistically during the first half of 2025. These observations have been plotted on the map below. It is important to note that water depth in the pond varies both temporally and spatially.



| Location       | Water depth    | Soft sediment depth |
|----------------|----------------|---------------------|
| A              | 40 cm          | 30 cm               |
| B              | 50 cm          | 50 cm               |
| C              | 30 cm          | 15 cm               |
| D              | 50 cm          | 50 cm               |
| <b>Average</b> | <b>42.5 cm</b> | <b>36.25 cm</b>     |

Sediment depths were estimated qualitatively, based on the extent to which observers sank into the substrate when entering the pond.



*Site D. Photo by Amanda Choy. 14 March 2025.*



*The area of the pond measured in Google Earth Pro.*

A polygon was drawn around the outside of the visible pond edge using Google Earth Pro. The 108-point shape includes some areas with macrophyte coverage in the latest aerial image but will underestimate the area of the pond due to overhanging foliage. The perimeter of the pond was calculated at 0.87 km, the area was 0.47 ha.

The volume of sediment in the pond is estimated to be  $\sim 1,704 \text{ m}^3$  about 2,000 tonnes of sediment, this is roughly 150 truckloads.

Silt accumulation is a recognised problem in Auckland's 650+ stormwater ponds. It reduces pond function, requires periodic removal, and generates between 1,900 and

4,000 tonnes of sediment each year (with a council target of 10,000 tonnes)<sup>4</sup>. Auckland Council manages this through regular desilting, landfill disposal, and increasingly through trials and strategies for beneficial reuse (e.g. landscaping, soil amendment).

Based on the Portland Road project, removing 2,000 tonnes of silt would likely cost in the range of \$100,000–\$250,000, with the cost lower if beneficial reuse is possible and higher if landfill disposal is required.

## Sea level rise

The New Zealand Government funded a tool to predict the vertical land movement of our coastlines<sup>5</sup>. Auckland is likely to face ~30 cm of sea-level rise by 2050 under a “middle-of-the-road” emissions scenario. Using the tool Tahuna Torea Nature Reserve is modelled to be sinking at 2 mm per year adding an extra 7 cm of water level. The pond is already in the highest risk class for coastal inundation<sup>6</sup>.

The pond is likely to be regularly impacted by storm surge in the second half of this century (around the 2070s–2080s), with occasional flooding starting in the 2040s–2050s. Under higher-emissions scenarios (e.g., SSP5-8.5), these thresholds are reached earlier — occasional flooding in the 2030s–2040s and regular impacts advancing into the 2050s–2060s.

The Draft Shoreline Adaptation Plan for the Tāmaki Estuary categorises the area as limited intervention.

## Discussion

The AquaWatch platform generated more data across more metrics over a longer period with less volunteer effort.

Turbidity / water clarity was consistently poor. Clarity decreased and became more variable with less settled weather. The rain likely washed fine sediments into the pond and wind helped mix-up bottom sediments.

**Koi carp suppression alone is unlikely to improve water quality because the large amounts of soft sediment on the pond floor are easily resuspended by wind and rainfall-driven circulation, even without fish.**

The pond is unlikely to provide habitat for native fish like Inanga or Banded kōkopu which are sensitive to turbidity and low oxygen. Native bullies may exist in the pond but its unlikely due to the aforementioned conditions. Shortfin eels are very tolerant of poor

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<sup>4</sup> <https://knowledgeauckland.org.nz/media/nsafqs2r/considerations-beneficial-use-of-sediments-from-stormwater-ponds-across-auckland-landcare-research-dec-2023.pdf>

<sup>5</sup> <https://searise.nz/maps/>

<sup>6</sup> [https://hdp-au-prod-app-ak-haveyoursay-files.s3.ap-southeast-2.amazonaws.com/3117/3079/1933/b959e6cf70ebd18b44d9c12a3fd453aa\\_Draft\\_Adaptation\\_Strategie\\_s\\_Tamaki\\_Estuary.pdf](https://hdp-au-prod-app-ak-haveyoursay-files.s3.ap-southeast-2.amazonaws.com/3117/3079/1933/b959e6cf70ebd18b44d9c12a3fd453aa_Draft_Adaptation_Strategie_s_Tamaki_Estuary.pdf)

water quality and low oxygen. They could survive here, though growth may be slow in turbid, food-limited water. It's likely they are competing with Catfish for food.

Investing in restoration of the pond would provide only short-term benefits, as the pond is likely to be regularly breached by storm surges later this century. However, removing the accumulated sediment would still deliver long-term benefits by preventing it from washing into the ocean.

## Acknowledgements

Thank you to Amanda Choy for helping with the manual water quality tests. Auckland Council for supplying the water quality testing equipment. AquaWatch for their expertise and support.