

# **Draft Lake Rotoroa Restoration Plan**

## **Vision**

Restore Lake Rotoroa's ecological health to a state that is safe for swimming, thriving with indigenous biodiversity, and valued by the community.

## **Problem Statement**

Lake Rotoroa's ecological health is impaired in three major areas: a.) trophic condition (nutrient enrichment), b.) pathogen bacteria, and c.) invasive ecology and loss of biodiversity. To restore the health and mana of the lake, each of these three areas of impairment must be addressed. Nutrient enrichment has resulted in a loss of colour and clarity and frequent toxic algae blooms in the lake that close the lake to all contact recreation. The primary source of nutrient enrichment in the lake is piped stormwater from the surrounding catchment. Lake nutrient internal loads (recycling of legacy loads from the sediment) are also believed to be significant, especially for nitrogen. Pathogen bacteria make the lake, at times, unsafe for swimming and contact recreation. Measured faecal coliform bacteria levels often exceed national guidelines for swimming, particularly in certain parts of the lake. The primary source of pathogen bacteria contamination in the lake is known to be waterfowl (direct and shoreline deposition). Invasive species, both flora and fauna, have compromised the ecological health of the lake over many decades. Simultaneous to the dominance of invasive species, the lake has experienced a loss of native biodiversity. The collapse of native lake macrophyte beds in the 1990s, and the transition to a phytoplankton (floating algae) dominated system has had a negative impact on native flora and fauna in the lake. Lake biodiversity would benefit from lake water quality improvements; specifically reductions in phytoplankton levels.

## **Multipronged Integrated Approach**

There is no single "silver bullet" that will resolve the challenges described above. Rather, we recommend a multi-pronged and integrated approach focused on progress rather than perfection. We recommend that such an approach is implemented within an adaptive management framework, whereby ongoing monitoring, analysis, and stakeholder feedback inform future action and/or change in strategy.

Outline below is a proposed restoration plan, with prioritised actions, based on our current knowledge of the lake's ecological and water quality health and known mitigation options.

## **Restoration Strategy**

### **1. Improve Trophic Condition**

#### **Objective:**

Reduce lake algae levels, including the occurrence of toxic algae blooms, and improve lake colour and clarity by reducing nutrient enrichment, from both external and internal loads.

## Key Actions:

### *Source Controls:*

- **Nature-based catchment solutions:**
  - Enhance stormwater water controls in the catchment through the construction of, for example, rain gardens, bioswales, and wetlands.
- **Stormwater end-of-pipe filters:**
  - Install end-of-pipe filters, e.g. biological or adsorptive, on the largest stormwater inlets to the lake.
- **Stormwater infrastructure upgrades:**
  - Retrofit and maintain stormwater catchpit inserts at key locations to trap rubbish, sediments and hydrocarbons.
- **Catchment education:**
  - Community and catchment education events and programmes aimed at improving residential practices with respect to lake water quality impacts.

### *In-Lake Mitigation:*

- **Planting in lake margin and surrounds (wetland extension):**
    - Native plant restoration to improve local runoff filtration and in-lake sequestering.
    - Establish a community-based wetland care group with support from National Wetland Trust and Waikato Regional Council
  - **Floating wetlands:**
    - At least 5% of lake surface area, targeting major stormwater inlets (e.g. north end).
  - **Chemical dosing:**
    - Annual dosing of ecology friendly chemicals to bind phosphorus from the water column.
    - And/or eco-friendly algaecide (e.g. Lake Guard Oxy)
  - **Ultrasonic treatment of floating algae (cyanobacteria)**
    - E.g. LG Sonic
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## 2. Reduce Pathogen Bacteria

### Objective:

Reduce faeces-sourced pathogen bacteria to make the lake safer for contact recreation.

### Key Actions:

- **Designate a bird-free targeted future swimming zone:**
    - Install waterfowl (ducks and geese) deterrents
    - Enhance planting to lake edge (except for beach).
  - **Educate community on lake health including duck health**
    - Install lakeside signage prohibiting duck feeding in swimming zone
    - Develop education and communication strategies to promote health of both ducks and lake
    - Promote lake water quality aspirations.
  - **Student research project:**
    - Focused on defining spatial correlations between waterfowl, E. coli levels, and people (Dr. Juli Gaviraghi Mussoi).
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## 3. Improve Biodiversity and Reduce Invasive Species Abundance

### Objective:

Improve lake ecological balance by reducing invasive species populations and enhancing native species populations, both flora and fauna.

### Key Actions:

- **Targeted invasive fish removal:**
    - Targeted removal, especially bullhead catfish, using annual contracted fyke-netting, with monitoring of species and biomass removed.
  - **Submerged macrophyte planting:**
    - Establish native aquatic macrophytes on the lake bed, alongside reduced algal biomass and improved water clarity.
  - **Community fishing days:**
    - Run family-friendly fishing events to build awareness and contribute to invasive fish reduction (recognising these are primarily educational rather than a primary control method).
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## 4. Improve Monitoring, Adopt Adaptive Management, and Promote Collaboration

### Objective:

Ensure robust data collection, engage stakeholders, follow adaptive management, and integrate maatauranga Maaori (indigenous knowledge).

### Key Actions:

- **Ongoing monitoring:**
  - Maintain current monthly monitoring programme (lake water quality)
  - Add stormwater inflow monitoring
  - Add enhanced pathogen bacteria monitoring (synoptic and spatial)
  - Coordinate with Waikato Regional Council.
- **Lake water quality modelling:**
  - Develop and maintain a predictive model for nutrient and contaminant inflows, internal dynamics, flushing, and ecological outcomes
  - Use model to establish current lake nutrient budget and to guide mitigation strategies and design.
- **Cultural monitoring & partnership:**
  - Co-design monitoring and restoration actions with mana whenua to achieve the aspirations of Te Ture Whaimana.
- **Community engagement:**
  - Regular community education and advocacy events
  - Regular opportunities for community feedback and engagement.
- **Strategy review:**
  - Review and adapt interventions every 2–3 years, based on latest monitoring, ecological, and community feedback.

***This strategy leverages technical, ecological, and community actions for a holistic improvement to ecological health and water quality in Lake Rotoroa, with regular review and active collaboration.***