Restoration **A**cts for the **W**aikato **R**iver

(**RAWR**)

Group 8:

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UAPP411: Regional Watershed Management

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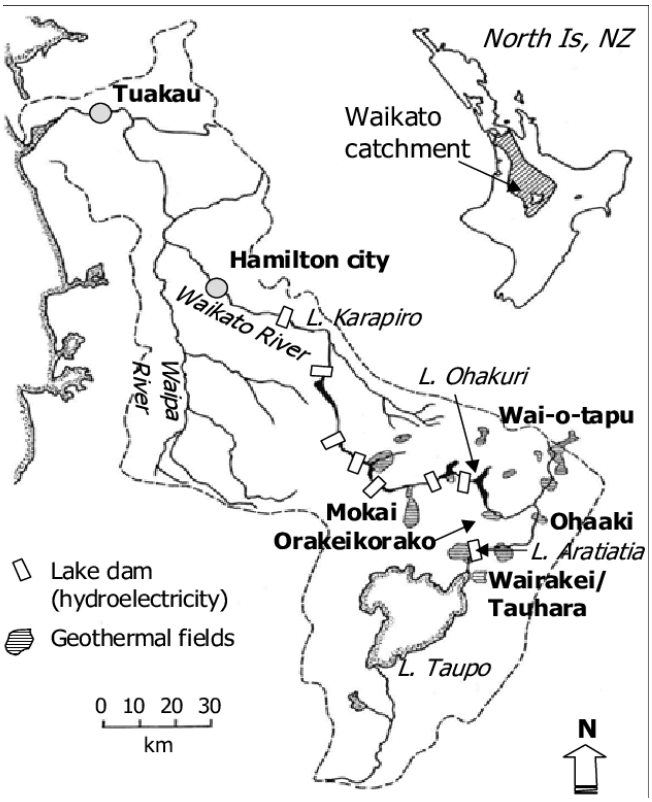
Mission Statement

RAWR's goal is to target the increased concentrations of mercury, arsenic, and boron around geothermal sources of the Waikato River on the North Island of New Zealand. We also look to decrease the high levels of *E. Coli* downstream of Hamilton city and promote awareness of how the hydroelectric dams are impacting animals and having downstream effects by 2040.

Background and History:

The watershed's history starts with a volcanic eruption over 20,000 years ago which created the river. The Waikato River region has been populated for over seven hundred years starting with the indigenous group called the Maori people. The river has spiritual significance to the Maori, as they used the river to baptize, cure illness, cleanse the dead, and to spiritually cleanse themselves. The region also offered fertile land and resources, making it habitable for their population. Some food sources from the river include eel, plants, and fish.



In 1858, the Chief Pootatau Te Wherowhero became the overseer of all of the Waikato territories. He protected all of the territories from colonization and purchasing, keeping it for the Maori people. Eventually a European settlement, Hamilton, was established in 1864 which

took land from its indigenous people. After this, wars started between the European settlers and the Maori people, resulting in large amounts of Maori land being confiscated (but later, some was returned). The European settlers used this land for dairy farming, and created small towns surrounding the farms. Eventually, the Waikato river was used for transportation and became a major hub of economic activity.

Towards the 20th century, most of the land surrounding the river and its tributaries was used for farming, with many developments and geological changes occurring within this time period. In 1987, Sir Robert Mahuta claimed that the land of the Waikato region should be returned to the Waikato people. Eventually a treaty was signed in order to regulate the area, provided visions and strategies to return the land to its rightful owners, and to protect the land and all Maori people and New Zelanders. This land is still heavily populated and used, with a Gross Domestic Product of $29,200,000,000 in 2021. The Waikato river has also become a center of hydroelectric power for New Zealand with hydroelectric dams and other properties. Some main features of this watershed/river include: Te Puaha o Waikato (the mouth of the river), Huka Falls, and the Taupiri Mountain. Overall, this watershed is the center of economic growth, cultural history, spiritual grounding, and renewable power sources, making it a key watershed for New Zealand and its people.

Policies and Mandates:

Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010:

- Purpose: restore and protect the health of the Waikato River
- Gave Waikato River Authority full governance over the Waikato River
- Provides $210 million to WRA to cleanup the river and restore it over the next 30 years
- Addresses redress for certain assets, the regulation of customary activities, and the management of the Waikato River

Waikato Regional Policy Statement

- This document represents the generalized policies and objectives for environmental management of the Waikato region
- Outlines water quality, biodiversity protection, cultural considerations, and quantity management

Waikato River Authority (WRA):

- Advises and prepares the strategy for restoration
- consist of 10 members appointed by the Waikato River Clean-Up Trust

Revise older policies and mandates to align with the WRA's goals

Governance and Structure:

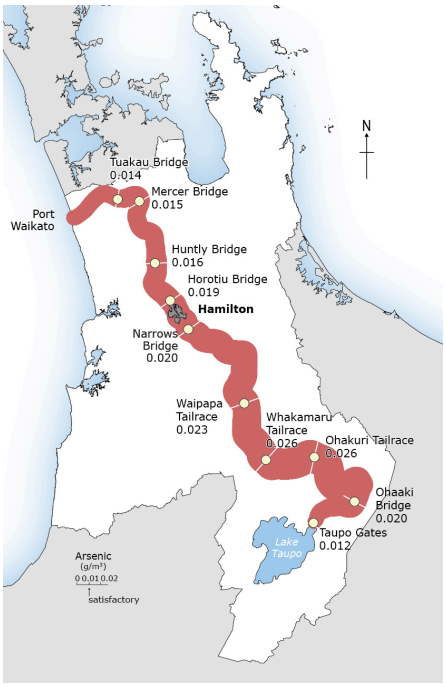
The government structure of the Waikato region is run by several groups including stakeholders, government agencies, local authorities and community representatives, as well as iwi (Maori Tribes). The WRA plays a central role in the government of this region through funding of restoration projects, and overseeing current policies and strategies. Stakeholders are involved in public consultations, advisory groups, and forums related to making decisions about the river. Various government agencies and legislation participates in managing the Waikato river by

creating and enforcing policies, some of which listed above. The Maori tribes also have a significant role in the governance of this region. Culture is highly respected and the land is protected and preserved in ways that remain true to the iwi. Overall, there are a lot of people collaborating to manage and govern this area making a lot of voices heard and understood.

Problems:

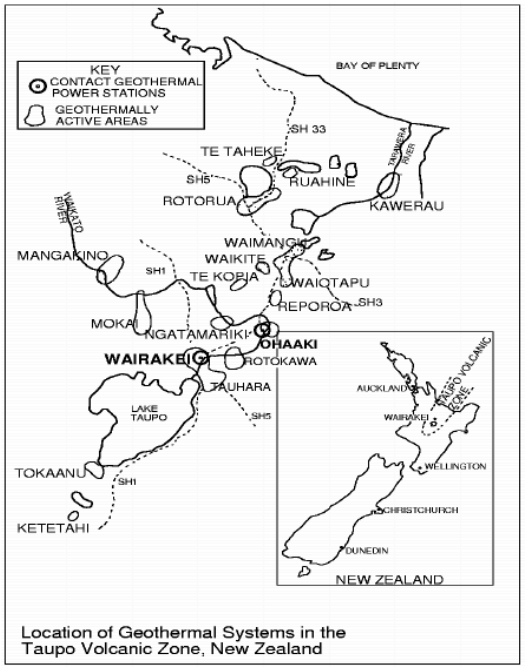
Problem	**Description**	**Causes**
High concentrations of pollutants.	There are high levels of mercury, arsenic, and boron in the Waikato River, which is hazardous to humans and animals.	Geothermal power stations near the Waikato River release untreated wastewater back into the environment.
High concentrations of *E. Coli.*	There are increased concentrations of *E. Coli* in the Waikato river downstream of the city of Hamilton. There are overall higher concentrations of *E. Coli* in the Waikato river due to local farm animals.	The densely populated city of Hamilton releases wastewater into the Waikato river, causing the *E. Coli* concentrations downstream to increase. Local farms are located in close proximity to the Waikato river. Stormwater runoff causes the animal waste products to be drained into the river, increasing the overall levels of *E. Coli*.
Hydroelectric dam interference.	Dams are interfering with wildlife and causing downstream effects. This results in an unbalance in existing ecosystems.	Hydroelectric dam interference changes water temperature as water moves downstream.

Problem 1: Increased concentrations of mercury, arsenic, and boron.



Increased levels of mercury, arsenic, and boron have adverse health effects on the people and animals that use the river for food and water. A major problem is the fact that Hg can build up its concentration through the food chain and the consumption of most fish becomes a hazard for humans. For the most part, arsenic is filtered out and the water is safe to drink farther downstream from geothermal power stations, but the other toxins are worrisome.

Goal 1: To decrease concentrations of mercury, arsenic, and boron.



Location of Geothermal Systems in the Taupo Volcanic Zone, New Zealand

The major cause of arsenic, boron, and mercury in the Waikato River stem from the wastewater released by the nearby geothermal power stations (Wairakei and Ohaaki). ..... A way to decrease the concentration of these pollutants would be for these power stations to treat their wastewater before returning it back into the environment. Another way to decrease the concentrations of mercury, arsenic, and boron is to reduce sediment production upstream, since sediment is a sink for toxins. One way to reduce sediment production in water is to reduce the amount of sediment entering the watershed. This can be done by using no till farming methods upstream.

Problem 2: Increased Levels of *E. Coli*

The increased levels of *E. Coli* comes from the city of Hamilton. The city is densely populated, which causes it to produce large amounts of wastewater. The high levels of *E. Coli* in the river also stem from the Waipa river and the increased animals living around it. The local farms are in close proximity to the Waikato river, meaning the animals that live on these farms are producing waste products near the river. Stormwater runoff will infiltrate the local farmlands and run into the Waikato river, causing the animal waste products to contaminate the river.

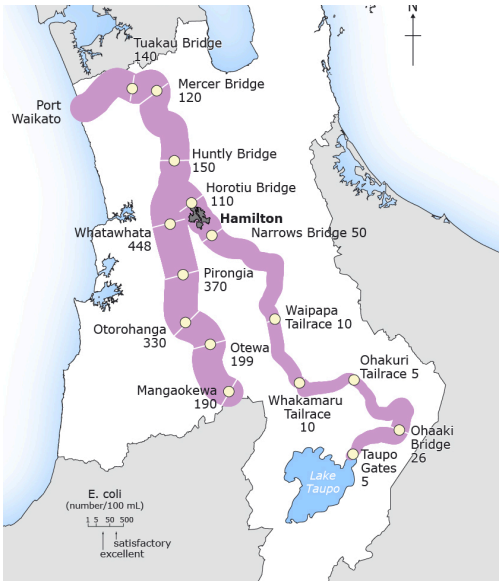


Figure shows the increased levels of bacteria in the Waipa and Waikato rivers. The thickness of the purple line correlates with the levels of bacterial concentration. The figure demonstrates that there are increased bacterial levels downstream of the city of Hamilton, and around the Waipa river.

Goal 2: Decrease the levels of *E. Coli* throughout the river

One way to decrease the *E. Coli* population in the river downstream of Hamilton would be to increase the effectiveness of the local wastewater treatment plants. By doing so, the wastewater would be cleaner before going back into the river, which would lead to overall decreased levels of *E. Coli* downstream of Hamilton. Establishing stormwater runoff systems around the Waipa river would help to avoid pollutants, such as animal waste products, from entering the river during periods of rain. Having these stormwater runoff systems developed around the local farmland would decrease the amount of *E. Coli* entering the river due to the local farm animals.

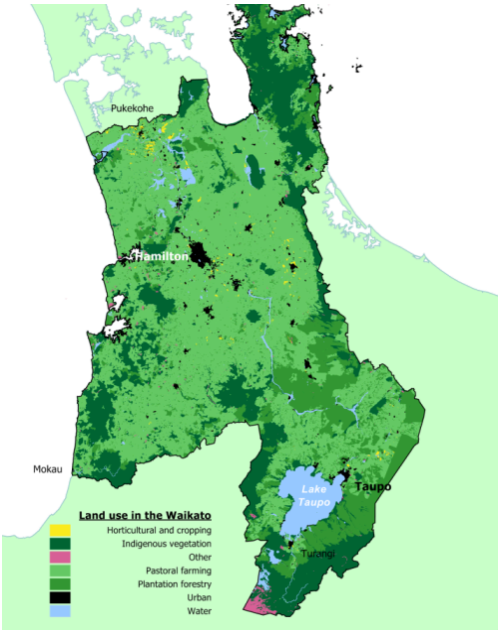
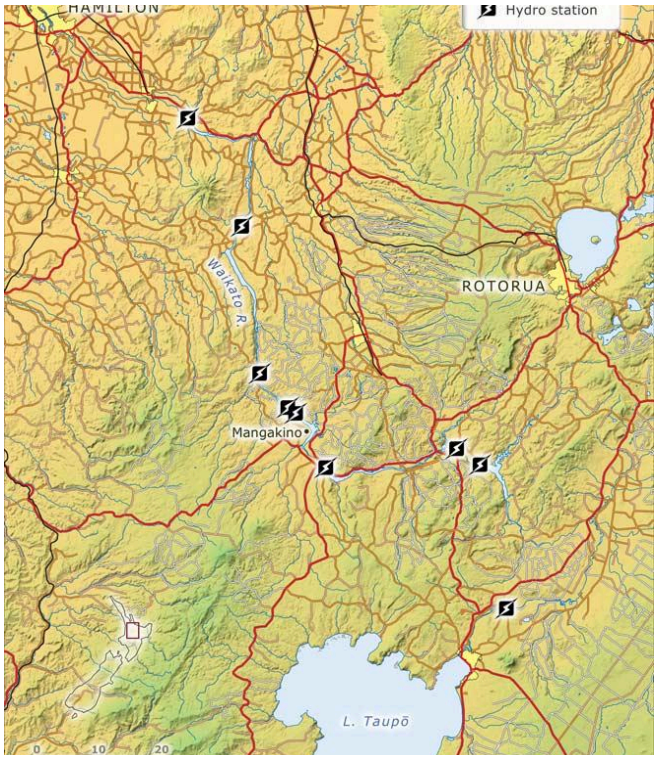


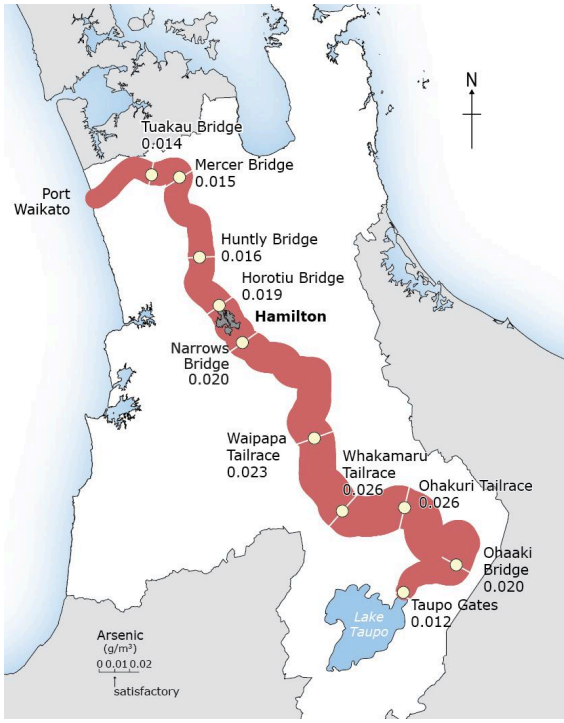
Figure shows the land use map of the Waikato River Catchment. The majority of the land is covered by pastoral farming.

Problem 3: Hydroelectric Dam Interference



Dams interfere with animals, causing downstream effects which in turn creates issues in water temperature as the water moves downstream from the dams. As a result, existing ecosystems are harmed and unbalance can be seen. Dams also contribute to a disruption of nutrient cycles. As things, such as debris and food, get caught in reservoirs, aquatic life has trouble getting their food sources. Along with these issues, dams can also cause a disruption of fish migration resulting in big changes in habitat.

Goal 3: Find Alternatives to Current Dams



There are several alternatives to dams including hydropower. Run of river hydropower and micro hydro power are both great options for generating electricity and diverting water flow through turbines. This reduces a lot of the environmental impacts of dams as well as minimizing the destruction of the river in general. Other options are solar power, wind power, and tidal energy techniques. All of these options have less impact on our ecosystems and cause less sudden change and damage. Lastly, biomass energy is a way to take organic matter and turn it into energy, which can be renewable and more sustainable than the current hydroelectric dams.

Recommendations:

To combat issues involving increased concentrations of mercury, arsenic, and boron we suggests:

- Power stations treating their wastewater before returning it back into the environment
- Reducing sediment production upstream, since sediment is a sink for toxins
- Reducing sediment production in water
- Reducing the amount of sediment entering the watershed
- Ending till farming methods upstream

To combat the issues involving high levels of *E. Coli* downstream of Hamilton we suggest:

- Increasing the effectiveness of the wastewater treatment plant
- Establishing the local farms a farther distance from the river
- Developing storm water runoff systems to avoid pollutants, such as animal waste products, from entering the river during periods of rain

To combat the issues involving dams interfering with animals and having downstream effects we suggest:

- River hydropower and micro hydro power options for generating electricity and diverting water flow through turbines
- Solar power, wind power, and tidal energy techniques
- Biomass energy to take organic matter and turn it into energy

Conclusions:

The Waikato River is a very versatile and resourceful catchment that needs to be improved upon and protected. The issues with the dams, E. coli, arsenic, boron, and mercury need to be addressed and solved quickly and efficiently. Efforts can be made to fix these said problems by looking for alternative solutions to dams, increasing the effectiveness of the river's surrounding wastewater treatment plants, and requiring the nearby power stations to filter their wastewater before bringing it back to the ecosystem that is this catchment. A few policies and mandates are in place to protect the Waikato River, but more need to be enacted by the RAWR action plan. If these plans and recommendations are followed, the Waikato River will be in better shape by 2040.

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