Northland Regional Council
Recreational Swimming Programme
Safeswim Summer Review
2024/2025

Northland
REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

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1.0 Background

1.1 Recreational Swimming Water Quality Programme

Northland's Recreational Swimming Water Quality Programme (RSWQP) has been undertaken at popular swimming sites since 2009. It is a collaborative effort led by the Northland Regional Council in partnership with Ngā Tai Ora – Te Whatu Ora, and the Far North, Whangārei, and Kaipara District Councils.

The programme follows the Microbiological Water Quality Guidelines (MfE, 2003) provide categories of health risk of recreational swimming based on the relationship between faecal indicator bacteria and pathogens.

Category	Freshwater sites (E. coli)	Open Coastal Sites (Enterococci)	Enclosed Coastal Sites (Enterococci)
Surveillance	≤260/100mL	≤140/100mL	≤140/100mL
Alert	260-550/100mL	140-280/100mL	140 - 280/100mL
Action	>550/100mL	>280/100mL	>280/100mL

Table 1. National guideline categories for recreational swimming sites and associated responses.

Sampling typically occurred weekly at all recreational sites from December to March, with results available approximately 48 hours later. However, this delay often resulted in outdated information, as water conditions are clearly subject to change over such timeframes.

1.2 Safeswim

Recognising the limitations of the traditional RSWQP sampling approach, Auckland Council developed the Safeswim programme in 2017. Safeswim ensures water users can make informed decisions on when and where to swim based on current information. Safeswim achieves this by combining current environmental data (e.g. rainfall) with predictive models allowing real-time microbial water quality predictions to be made at monitored swimming sites. The results are underpinned by regular sampling, along with routine model review and

refinement. Other additional information is also available such as lifeguard status, tides, weather, physical hazards and facilities.

Northland Regional Council (NRC) made the switch to Safeswim and predictive modelling in December 2022 after a successful trial period. Since using Safeswim, NRC has continued to regularly sample and add more sites to Safeswim. There are currently 54 coastal sites, and 19 freshwater sites displayed on Safeswim (See Figure 1) with more in future development.

Figure 1. Northland's recreational swimming sites on Safeswim.

When water quality at a swimming site is predicted to meet the national guidelines for safe swimming, a green water droplet (indicating a low risk of illness from swimming) is displayed. When water quality is predicted to exceed the national guidelines, a red water droplet is displayed advising unsuitable swimming conditions (See figure 2). When there is a wastewater overflow, a black droplet is displayed advising public not to swim or contact water.

There are also functions to override predicted water quality when there are events which a model can't predict, e.g. sewer spills and extreme weather. For instance, during heavy rain events such as Cyclone Gabrielle Safeswim was used to communicate the risks of swimming during/post these events.

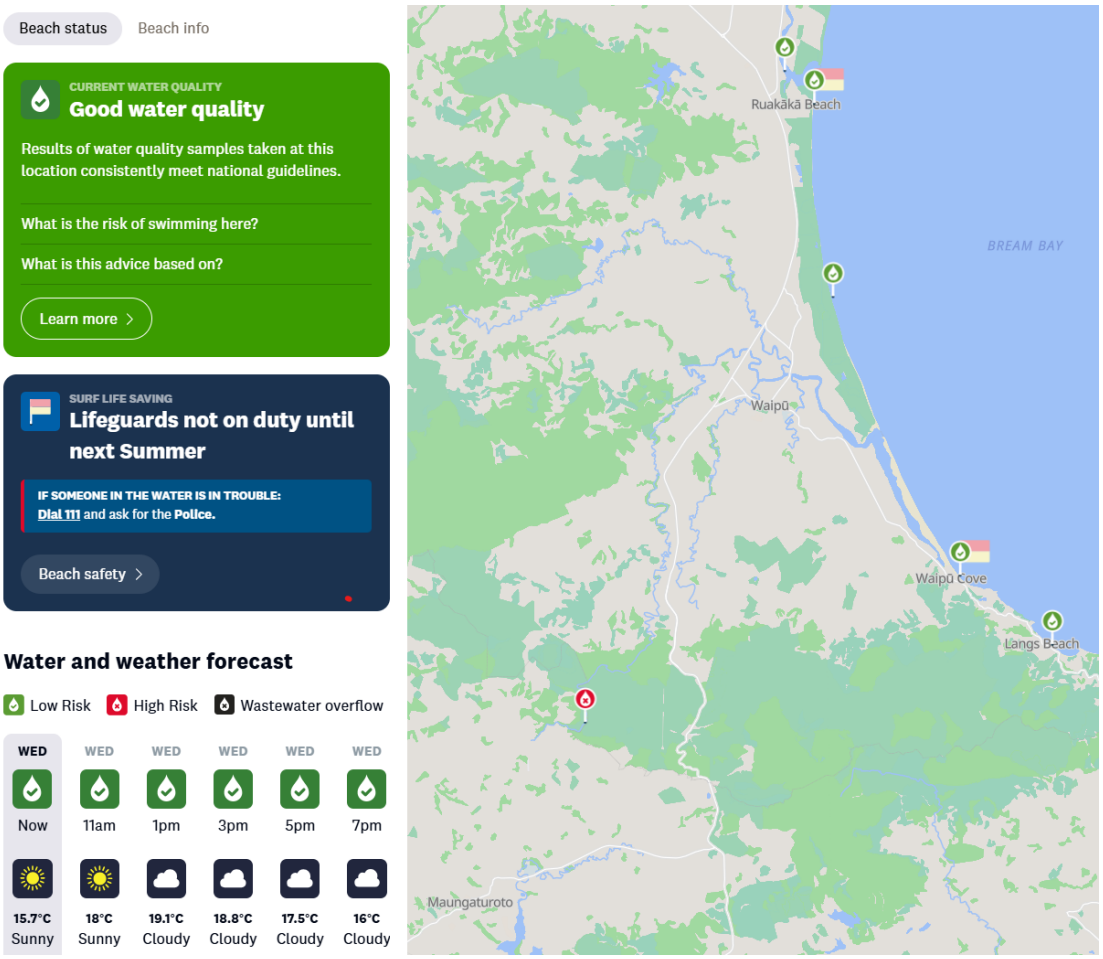

Figure 2: Real-time water quality predictions at three of Northland's coastal swimming sites on Safeswim.

Whilst providing the public with a greater understanding of real-time water quality at their favourite swimming sites, Safeswim has also allowed Northland Regional Council to better manage its resources, spread sampling over the year. Ultimately, Safeswim has proven to be a very successful and useful tool for informing the public of recreational swimming health risks and is currently recognised by the World Health Organisation as best practice.

1.3 Model Development

Safeswim makes use of a few modelling approaches to predict water quality: Black box models, Criteria models, and permanent status 'models' (Green/Red).

To build predictive models for each of Northland Regional Council's monitored recreational swimming sites, historic data was analysed to determine the best model available to predict water quality. Data had to meet certain criteria for each modelling approach; models were subsequently approved by an expert health panel before going live on Safeswim.

A Black box model is a regression-based model that is built based on a strong correlation between rainfall and microbial contamination events. This model establishes a relationship between input variables (e.g., rainfall) and an output variable (i.e., faecal indicator bacteria concentration), based on relatively simple linear statistical techniques. This model requires large datasets to be constructed effectively (Puhoi Stour, 2020).

Criteria models are based on a set of criteria that are developed using expert judgement. The development of a criteria model is based on historical sample results, but the use of professional judgement allows subjectivity to be included in the model framework. Criteria models have similar data requirements and limitations to Black box models. However, Criteria models only predict risk level pertaining to national guideline compliance/failure and not concentrations of faecal indicator bacteria, unlike in Black box models (Puhoi Stour, 2020).

Overall, each predictive model used on Safeswim is underpinned by ongoing sampling, ensuring that model accuracy is maintained or improved over time. To do this, model predictions and sample results are compared to a literature-based accuracy performance standard of 80% (i.e., model prediction agrees with sample results at least 80% of the time).

Several sites in Northland that have been allocated a Permanent green status. These sites have had very few guideline exceedances over years of monitoring, meaning that they are highly likely to be safe for recreational water users regardless of weather conditions. Conversely, a small number of Northland's monitored swimming sites have consistently displayed poor water quality, with no strong relationships with weather and were given a permanent red status on Safeswim. Ongoing sampling and source tracking testing is undertaken regularly at these sites in hope to show water quality improvements and establish a better model.

1.4 Sampling

Sampling continues to be undertaken weekly within the recreational swimming season (i.e., December to March) for freshwater sites and a monthly for coastal sites. Throughout the 2024-25 recreational swimming season, Northland Regional Council collected:

- 223 freshwater samples, with 35 'action' level samples – exceeding guidelines.
- 149 coastal samples, with 10 samples at 'action' level.
- 6 samples were analysed for microbial source tracking (MST) to identify the cause of contamination on some of the 'action' samples.

Sampling over the 2024-25 season included sites not currently displayed on Safeswim, with additional samples collected for future model development. All sample results recorded over this season can be accessed on the Land Air Water Aotearoa (LAWA) website: http://www.lawa.org.nz/explore-data/swimming/. Where available, water quality predictions displayed on LAWA reflect Safeswim model predictions.

2.0 Results

Consistent with the national guidelines, Safeswim reporting statistics are constrained to periods of peak use (i.e., between 6 am to 9 pm over the summer period). At each site, the percentage of these hours that are compliant with national guideline values is the primary measure of swimmability on Safeswim. Ahuroa at Piroa Falls and Tauranga Stream both have low swimmability percent. They are continued to be sampled monthly year-round to hopefully see an improvement and change in models.

2.1 Coastal

A total of 59 coastal sites were displayed on Safeswim over the 2024-25 recreational swimming season. Sites were sampled quarterly (Permanent green/Black box model sites) or monthly (Criteria model sites) depending on data requirements. Over this season, the average swimmability recorded on Safeswim was 97.6% across all of Northland's coastal swimming sites.

Table 2. Safeswim coastal sites and their predicted swimmability over the 2023-24 recreational swimming season.

Site Name	Model	Percent swimmable
Baylys Beach	Permanent Green Site	100.00%
Cable Bay	Permanent Green Site	100.00%
Glinks Gully Beach	Permanent Green Site	100.00%
Maitai Bay	Permanent Green Site	100.00%
Mangawhai Heads (Open coast)	Permanent Green Site	100.00%
Matapouri Bay (Middle beach)	Permanent Green Site	100.00%
Matauri Bay	Permanent Green Site	100.00%
McLeod Bay	Blackbox Model	100.00%
Oakura Bay (North end)	Permanent Green Site	100.00%
Ocean Beach (Mid beach)	Permanent Green Site	100.00%
Ohawini Bay	Blackbox Model	100.00%
Omamari Beach	Permanent Green Site	100.00%
Omapere	Permanent Green Site	100.00%
One Tree Point	Permanent Green Site	100.00%
Opononi (Hokianga Harbour)	Permanent Green Site	100.00%
Pahi Jetty	Permanent Green Site	100.00%
Pataua South	Blackbox Model	100.00%
Ruakaka Beach	Permanent Green Site	100.00%
Russell at Mid North Moorings	Permanent Green Site	100.00%
Sandy Bay	Permanent Green Site	100.00%
Tamaterau Bay	Permanent Green Site	100.00%
Taupo Bay	Permanent Green Site	100.00%
Teal Bay	Blackbox Model	100.00%
Tinopai at Below Shops	Permanent Green Site	100.00%
Uretiti Beach at Tip Road	Permanent Green Site	100.00%
Waipu Cove	Permanent Green Site	100.00%
Woolleys Bay at Mid Beach	Permanent Green Site	100.00%
Langs Beach (Mid Beach)	Blackbox Model	99.29%
Paihia (Seaview Road)	Blackbox Model	98.89%
Paihia (Te Haumi)	Blackbox Model	98.89%
Paihia (Waitangi Bridge)	Blackbox Model	98.89%
Onerahi (Opposite playground)	Blackbox Model	98.37%
Tinopai at Below Puapua Creek	Criteria Model	98.00%

Site Name	Model	Percent swimmable
Ahipara Beach	Blackbox Model	97.87%
Ruakaka River at Princess Street	Blackbox Model	97.78%
Whananaki at East Beach	Blackbox Model	97.78%
Coopers Beach	Blackbox Model	97.59%
Hokianga Harbour at Horeke Wharf	Blackbox Model	97.23%
Taurikura Bay	Criteria Model	97.19%
Rawene Wharf	Blackbox Model	97.12%
Church Bay	Blackbox Model	96.24%
Otamure Bay	Blackbox Model	96.23%
Matapouri Bay	Blackbox Model	95.67%
Matapouri Bay Estuary (Southern bridge)	Blackbox Model	95.39%
Urquharts Bay	Criteria Model	95.20%
Taipa Estuary	Blackbox Model	95.12%
Pacific Bay	Blackbox Model	94.83%
Little Cable Bay	Blackbox Model	94.26%
Ngunguru Estuary	Blackbox Model	93.33%
Tokerau Beach	Criteria Model	93.27%
Whatuwhiwhi	Criteria Model	93.27%
Rangiputa	Criteria Model	93.05%
Houhora Harbour	Criteria Model	92.91%
Wellington Bay	Blackbox Model	92.76%
Kowharewa Bay	Blackbox Model	92.62%
Mangawhai Heads (Motor camp)	Blackbox Model	91.42%
Ngunguru River (Motor Camp)	Blackbox Model	89.43%
Tauranga Bay Estuary	Permanent Red	0%

2.2 Freshwater

A total of 19 freshwater swimming sites were sampled weekly and displayed on Safeswim over the 2024-25 recreational swimming season. The average swimmability recorded on Safeswim this season was 90.7% across all of Northland's freshwater swimming sites (see Table 3).

Table 3. Safeswim freshwater sites and their predicted swimmability over the 2024-25 recreational swimming season.

Site Name	Model	Swim Percent
Lake Ngatu (South end)	Permanent Green Site	100.00%
Lake Taharoa (Pump house)	Permanent Green Site	100.00%
Lake Waro	Blackbox Model	100.00%
Victoria River at DOC crossing	Blackbox Model	99.41%
Lake Manuwai	Blackbox Model	97.87%
Waipoua (Swimming hole)	Blackbox Model	95.64%
Waitangi River at Wakelins	Blackbox Model	95.57%
Mangakahia Swimming hole	Blackbox Model	95.18%
Waipapa River at Waihou Valley	Blackbox Model	94.38%
Kaihu River	Blackbox Model	94.26%
Waitangi River at Lily Pond	Blackbox Model	94.16%
Waipapa Stream at Charlies Rock	Blackbox Model	93.79%
Lake Rotopokaka (Lake entrance)	Criteria Model	93.05%
Raumanga River at Falls	Blackbox Model	90.54%
Tirohanga River	Blackbox Model	89.36%
Hatea River at Whangarei Falls	Blackbox Model	80.71%
Kerikeri River at Rainbow Falls	Blackbox Model	78.01%
Kerikeri at Stone store	Blackbox Model	67.59%
Ahuroa River at Piroa Falls	Blackbox Model	2.91%

2.3 Microbial Source Tracking

Select sample results in the 'action' national guidance category were further analysed with Microbial Source Tracking using PCR (i.e., analysing DNA to identify microbial contamination sources). PCR analysis was undertaken for ruminant (e.g. cattle, sheep), avian (e.g. wildfowl) and two human markers (HR183 and HumM2).

The common source of contamination in our sites tested was avian, followed by ruminant. The source of contamination at Kerikeri at Stone Store and Kaihu at Swimming hole was dominated by avian. These and results of previous years testing are used to inform water quality and compliance monitoring NRC undertakes.

Site Name	Escherichia coli/ Enterococci	PCR Avian GFD (Water)	PCR Human Bacteroidales (Water)	PCR Human HumM2 (Water)	PCR Ruminant (Water)
Kerikeri at Stone Store	7300	**7200**	<900	<900	<900
Kaihu at Swimming Hole	1300	**5700**	<180	<180	540
Raumanga at Raumanga Valley Park	2100	890	880	<180	**3600**
Waipapa at Charlies Rock	**4100**	<900	<900	<900	**3700**
Victoria at DOC Reserve Crossing	1100	460	<180	<180	<180
Ruakaka Estuary at Princess Road	530	**810**	<180	<180	<180

Table 4. PCR results for 2024/25 season, dominant source highlighted in bold font.

3.0 Future Model Developments

A minimum of four samples are currently collected each year at monitored recreational swimming sites with Black box and Permanent green models. Monthly sampling is currently undertaken at sites with Criteria models and Permanent red models, with the aim to develop these into Black box models in the future. Six additional sites are being sampled weekly (by Ngāti Kuri) with the aim of establishing on Safeswim for the 25/26 season. These sites will be bringing representation to the far north area, with Houhora currently Safeswim's most northern site. Two further coastal sites, Tauranga Bay Beach and Bland Bay, are also being sampled monthly and will be live on Safeswim when data requirements have been met.

4.0 Summary

NRC has now used Safeswim to communicate results for three successful summer seasons. Regular sampling underpins all of our models and allows NRC to validate model accuracy. There have been several model upgrades. A full review, comparing all our models with all data from sampling occasions will be done this Winter. A report will be published showing these findings in the coming months.

The eight additional sites throughout Northland not yet displayed on Safeswim are being continually sampled. Six of these sites are being tested weekly, and two monthly, with the aim to establish a model for Safeswim for the next season.

5.0 References

Puhoi Stour Ltd (2020). Northland Safeswim Trial (2019/2020 summer). Prepared for Northland Regional Council.

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