

SAFESWIM AT A CROSSROADS: NEXT STEPS FOR NEW ZEALAND'S WORLD LEADING PROGRAMME

A. Schollum & M. Neale (Puhoi Stour Ltd), H. Foreman & N. Brown (Auckland Council, Healthy Waters)

ABSTRACT

In July 2021, the Safeswim programme was cited as an exemplar of global best practice by the World Health Organisation in its updated guidance on recreational water quality monitoring and communication.

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- introducing predictive water quality modelling and targeted sampling to the programme alongside longitudinal monitoring,
- integrating data from continuous monitors on the wastewater network,
- enabling water network managers, public health experts, and surf life saving professionals to raise hazard alerts manually, and
- presenting this information to the public in real time through a dedicated website.

After five years' of evolution, Safeswim now provides a fully integrated system for water quality and beach safety monitoring, management, and communication from Cape Reinga to Port Waikato. In addition, from late 2022 Surf Life Saving New Zealand adopted Safeswim as the preferred platform for public safety communication at all lifeguarded beaches around New Zealand.

This paper provides an overview of the Safeswim system, explains the framework that underpins its approach to water quality assessment and communication, describes the predictive models and system architecture that underpin the system, and presents the results of independent investigations, including by Audit NZ, into the accuracy of Safeswim's predictive models.

The limitations of recreational water quality monitoring programmes based on weekly monitoring were illustrated across New Zealand this summer with beaches being 'closed' based on 'out of date' monitoring results that no longer represented actual conditions. Conversely, in the United Kingdom people routinely swim unawares in water contaminated by overflows from wastewater networks.

As New Zealand's institutional arrangements for water management evolve, Safeswim's accurate, transparent, user-focused, and world-leading approach provides an alternative to current programmes based solely on weekly monitoring, which is not capable of telling swimmers what they want to know – where is it safe to swim now?

KEYWORDS

Water quality, technology, engagement, operations, industry capability

Guidelines for safe recreational water environments

VOLUME 1
COASTAL AND FRESH WATERS



WORLD HEALTH ORGANIZATION
GENEVA

2003

Auckland Council 2016

Sample collected at beaches



Culture based lab analysis (~24 hr)



Results emailed to Council



Analyst enters results on website



Very few beach users read website



Central

Recreational Area	Date	Status
Blockhouse Bay	Thursday 30 March	Safe
Cox's Bay	Long-term health warning	Unsafe
Herne Bay	Thursday 30 March	Safe
Home Bay	Thursday 30 March	Safe
Judges Bay	Friday 31 March	Safe
Kohimarama Beach	Thursday 30 March	Safe
Meola Reef	Long-term health warning	Unsafe
Mission Bay	Thursday 30 March	Safe
Okahu Bay	Monday 03 April	Safe
Point Chevalier Beach	Thursday 30 March	Safe

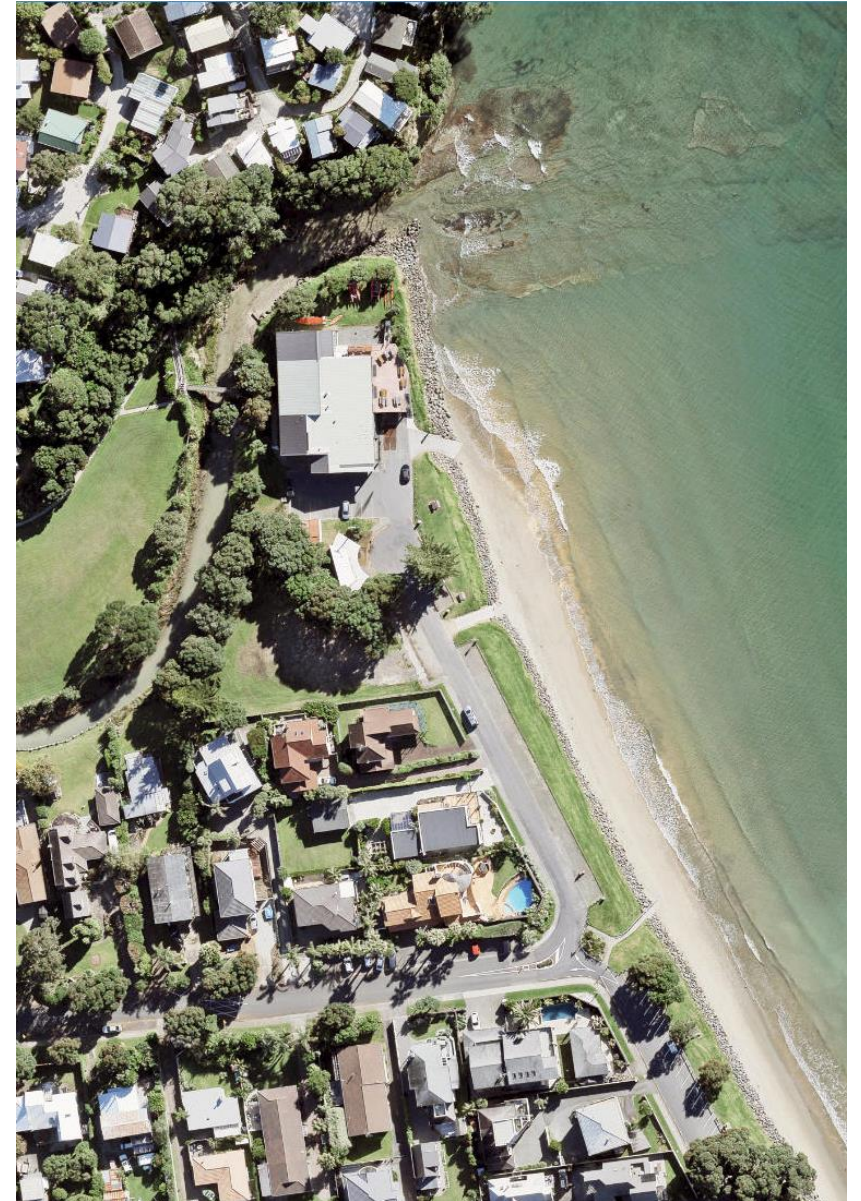
Three key problems in Auckland

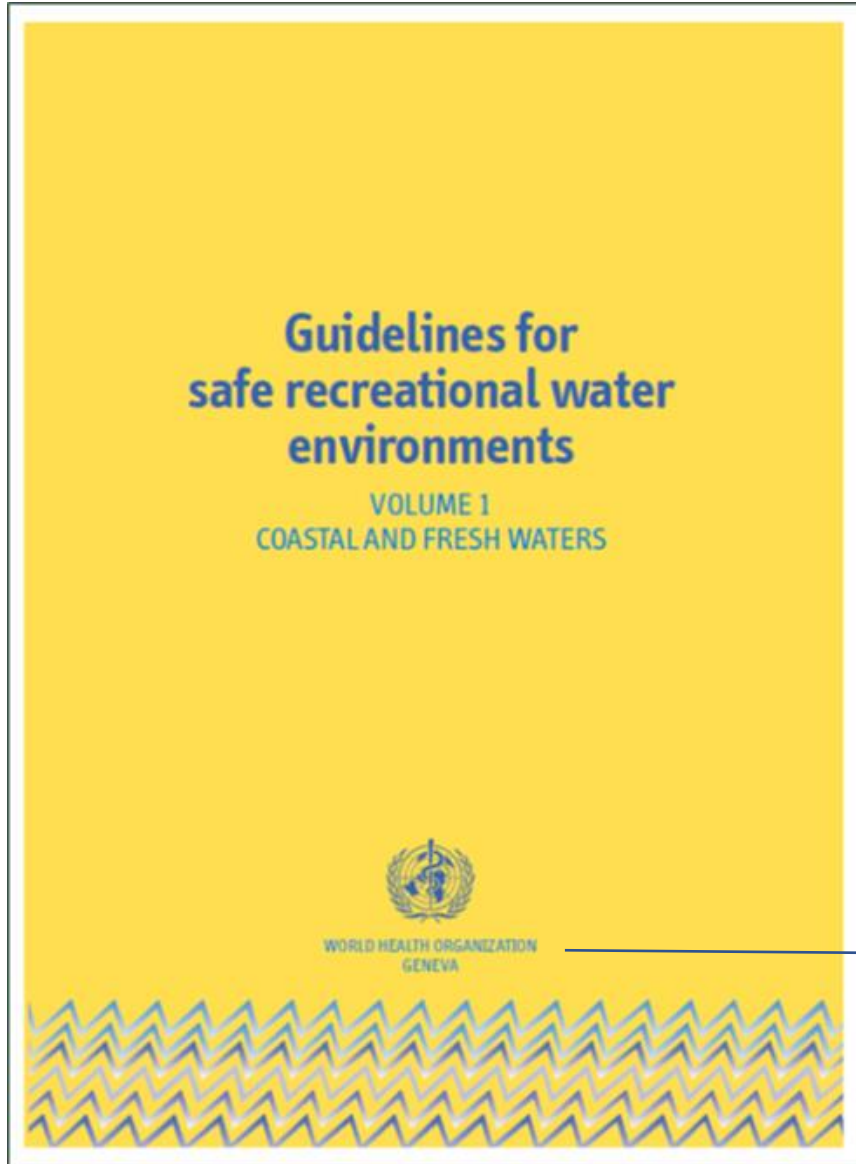
- Assessing risk
 - Biased sampling method, and weekly monitoring missed >70% of contamination events
 - 24 to 48 hr laboratory turnaround time – out of date!
- Communicating risk
 - Results – ‘safe’ ‘not safe’ – posted weekly to static website
 - Water quality messaging crisis driven and often ‘after the fact’
- Water quality only
 - Beach safety is affected by more than water quality

	6 March	8 March		15 March
Beach	Safeswim	Model Forecast	Sample Results	Safeswim
Pt Chev	<10	1881 (383-6400)	277 (74-1396)	<10
Herne Bay	<10	1267 (255-3380)	328 (20-644)	<10
Home Bay	10	773 (234-2472)	554 (74-2755)	<10
St Mary's Bay	<10	481 (345-650)	545 (10-3076)	<10
Okahu Bay	<10	467 (126-1049)	2783 (63-15531)	<10
Mission Bay	<10	386 (23-1675)	1179 (512-3609)	<10
Kohimarama	<10	692 (18-2154)	1964 (457-5794)	10
St Heliers	<10	92 (5-960)	504 (52-1918)	<10

False sense of security – Red Beach

- Old Safeswim
 - 330 samples (1995 and 2017)
 - 1 guideline exceedance (4th January 2012)
- New Safeswim
 - 8th Nov 2017 (6mm rain)
 - 4 of 9 beach samples exceeded guideline
 - Stream sample 17,239
 - 18th January 2018 (12mm rain)
 - 7 of 9 beach samples exceeded guideline
 - Stream sample 5,475





2021

Example 4.1. The Safeswim predictive model for Auckland, New Zealand

In 2017, Auckland City launched the Safeswim website and mobile application as a joint initiative between the Auckland Council, Watercare (the city water and wastewater utility), Surf Lifesaving Northern Region and the Auckland Regional Public Health Service. This initiative was partly funded by a targeted council rates increase for water quality improvement.

Safeswim encourages users to “jump online before you jump in”, directing users to the nearest of more than 100 classified beaches in the region. The system allows users to decide when and where they swim by indicating safety using a red and green coding system. A small number of beaches are permanently closed or unclassified.

Safeswim uses a predictive model built using real-time rainfall and tide data, together with a historical time series of water quality testing results for intestinal enterococci and E. coli. The model provides real-time estimates of the likelihood of an exceedance and classifies beaches as red when the risk of illness by ingestion exceeds 5%.

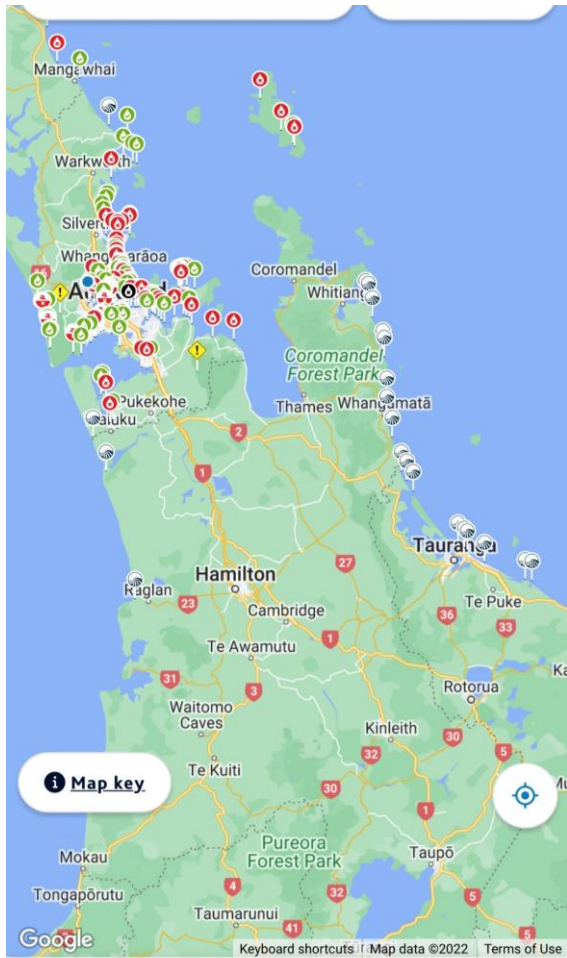
All Safeswim’s water quality models are overseen by an independent panel of public health experts, which meets quarterly to evaluate performance and provide direction. An independent audit of Safeswim completed by Audit New Zealand in 2020 found that a random sample of Safeswim’s water quality predictions was 89% accurate.

Generally, water quality, especially on the north shore, is good for 95–97% of days. However, exceedances are more common in areas of the city with CSOs where rainfall of more than 15 mm occurs in a 24-hour period, particularly after extended dry periods. In areas with permanently closed beaches, exceedance can occur in dry weather or with as little as 3–4 mm of rain.

The system is a marked improvement over the previous system, which had a 48-hour delay between sample collection and public reporting of results. Transparent public reporting has also increased public awareness and scrutiny about the causes of water pollution, and willingness to pay via targeted council rates for improvement. This has increased the capacity of local authorities to address the primary sources of pollution.

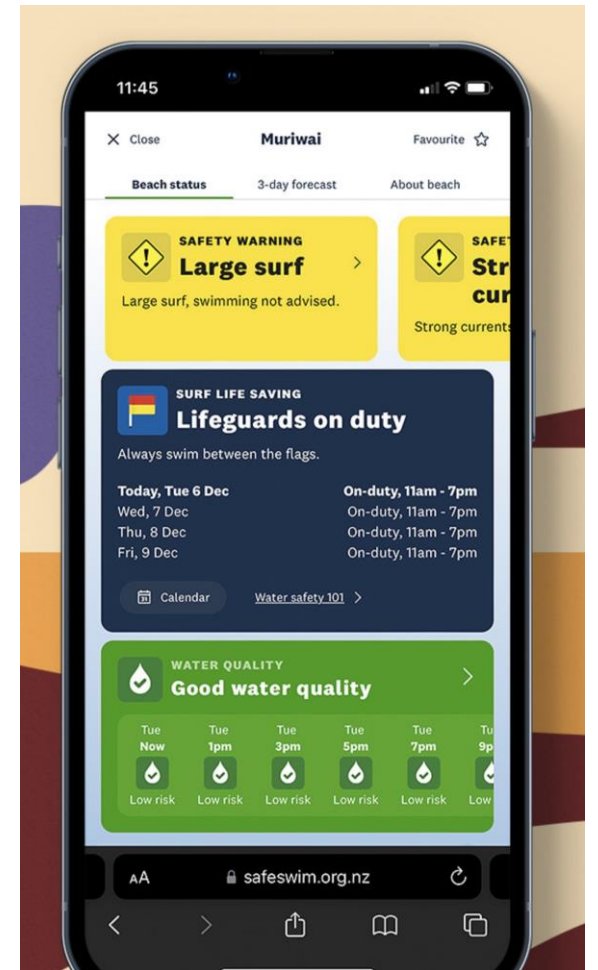
A range of improvement projects are under way, including a large central sewer interceptor (designed in preparation for future growth and impacts of climate change) that will divert overflows away from the harbour to the main wastewater treatment plant. The interceptor is due for completion in 2028. In the meantime, water quality is continually being improved through detection of damaged pipes, and misconnections of sewer and stormwater; restoration of natural treatment in streams and wetlands; and sewer and pump station upgrades. These are all combined with streetscape improvement, where possible.

Source: <https://www.safeswim.org.nz/>



Water quality predicted to meet guidelines low risk of illness	Water quality predicted to exceed guidelines high risk of illness	Wastewater overflow detected nearby very high risk of illness	Data temporarily unavailable
Water quality consistently poor, swimming not advised	Water safety information only (real-time water quality not available)	Hazard alert	Take note of local information (e.g. beach closures)
Beach is currently patrolled by surf lifeguards	Lifeguards are not on duty	Dangerous Conditions No swimming	

safeswim.org.nz



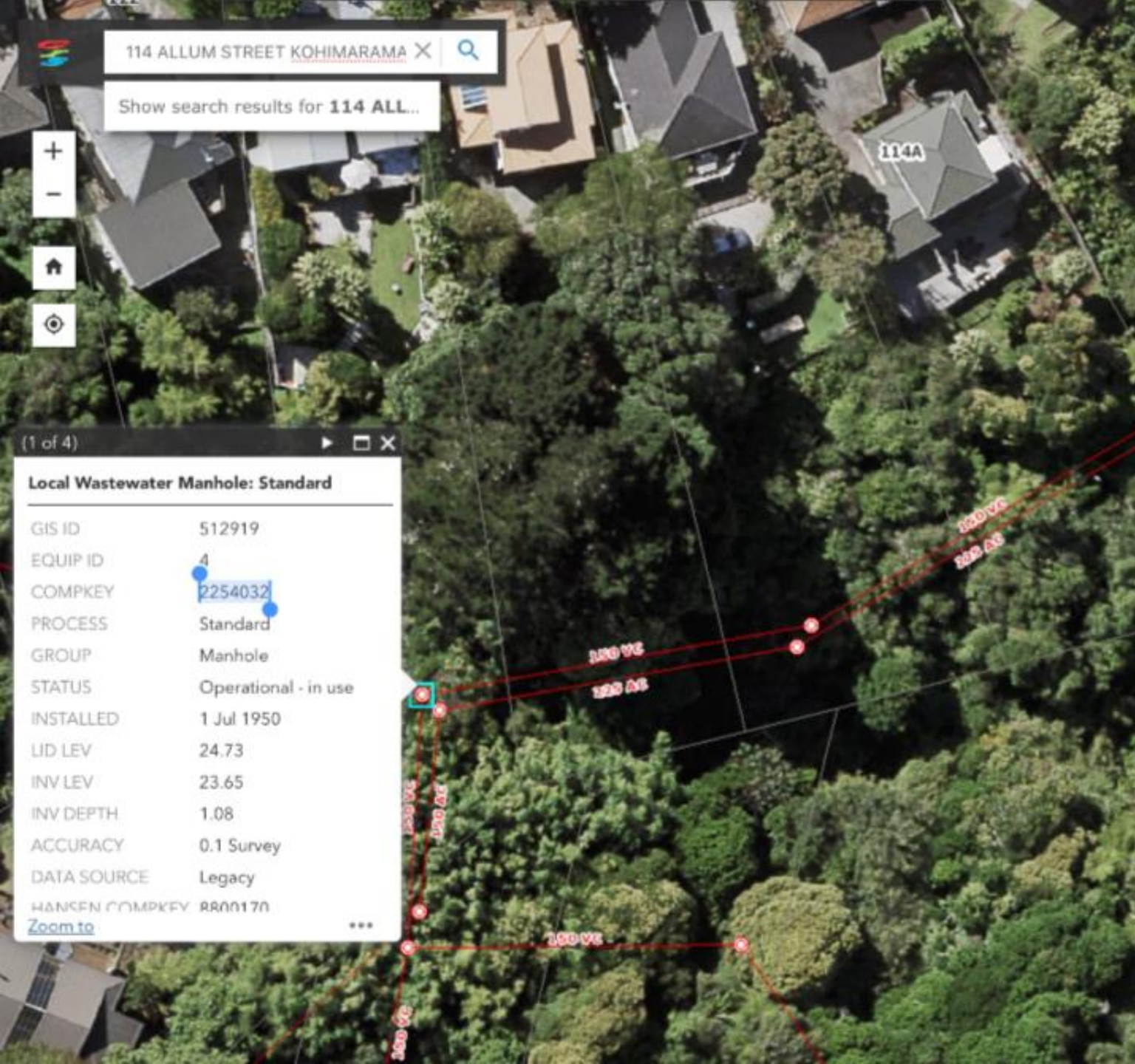


Public health warning
A sewage spill has occurred in this area. Please do not enter.



The water contamination advisory code is 001 2003 00
Auckland Council

DANGER KEEP OUT



114 ALLUM STREET KOHIMARAMA X

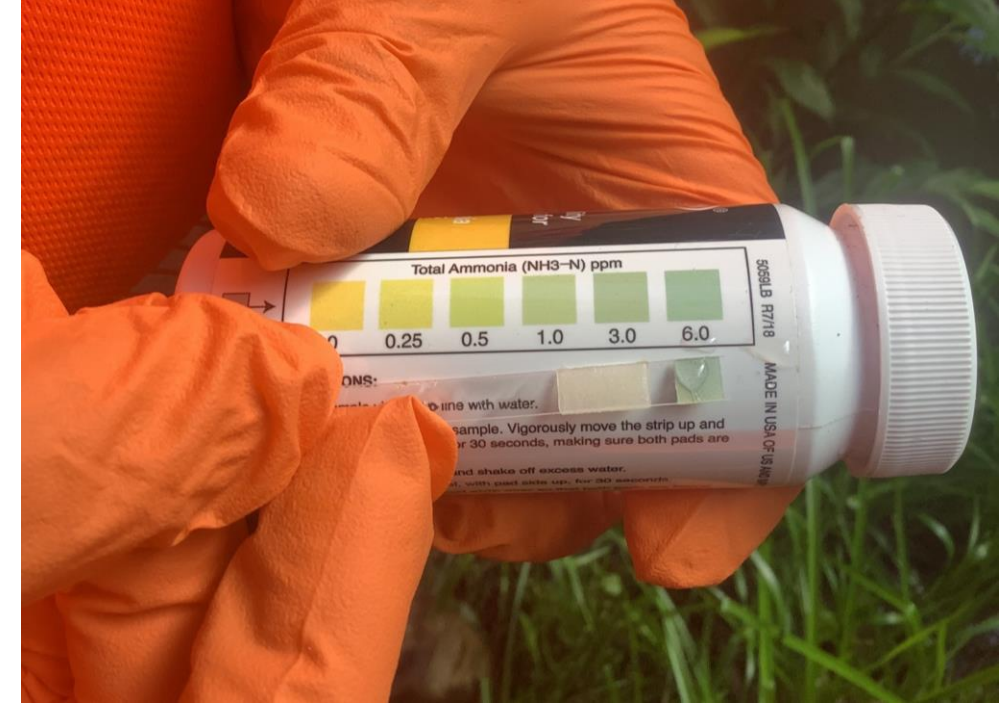
Show search results for 114 ALL...

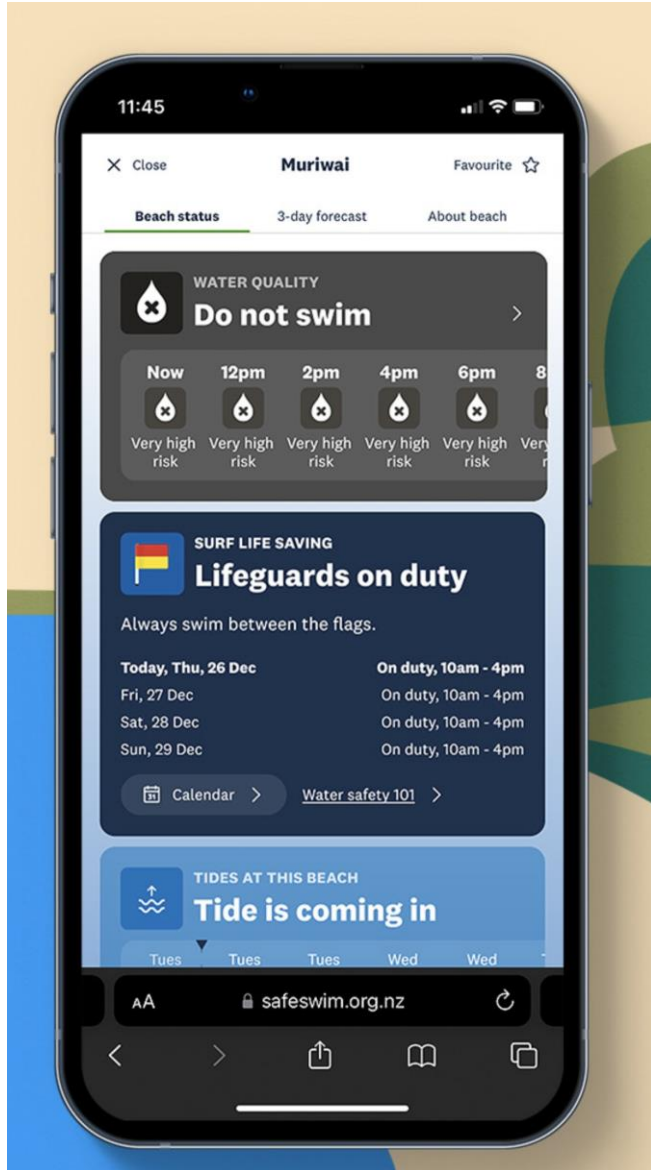
(1 of 4)

Local Wastewater Manhole: Standard

GIS ID	512919
EQUIP ID	4
COMPKEY	2254032
PROCESS	Standard
GROUP	Manhole
STATUS	Operational - in use
INSTALLED	1 Jul 1950
LID LEV	24.73
INV LEV	23.65
INV DEPTH	1.08
ACCURACY	0.1 Survey
DATA SOURCE	Legacy
HANSEN COMPKEY	RR00170

[Zoom to](#)





11:45

Close Muriwai Favourite

Beach status 3-day forecast About beach

WATER QUALITY
Do not swim

Now	12pm	2pm	4pm	6pm	8pm
Very high risk	Very high risk	Very high risk	Very high risk	Very high risk	Very high risk

SURF LIFE SAVING
Lifeguards on duty

Always swim between the flags.

Today, Thu, 26 Dec	On duty, 10am - 4pm
Fri, 27 Dec	On duty, 10am - 4pm
Sat, 28 Dec	On duty, 10am - 4pm
Sun, 29 Dec	On duty, 10am - 4pm

Calendar Water safety 101

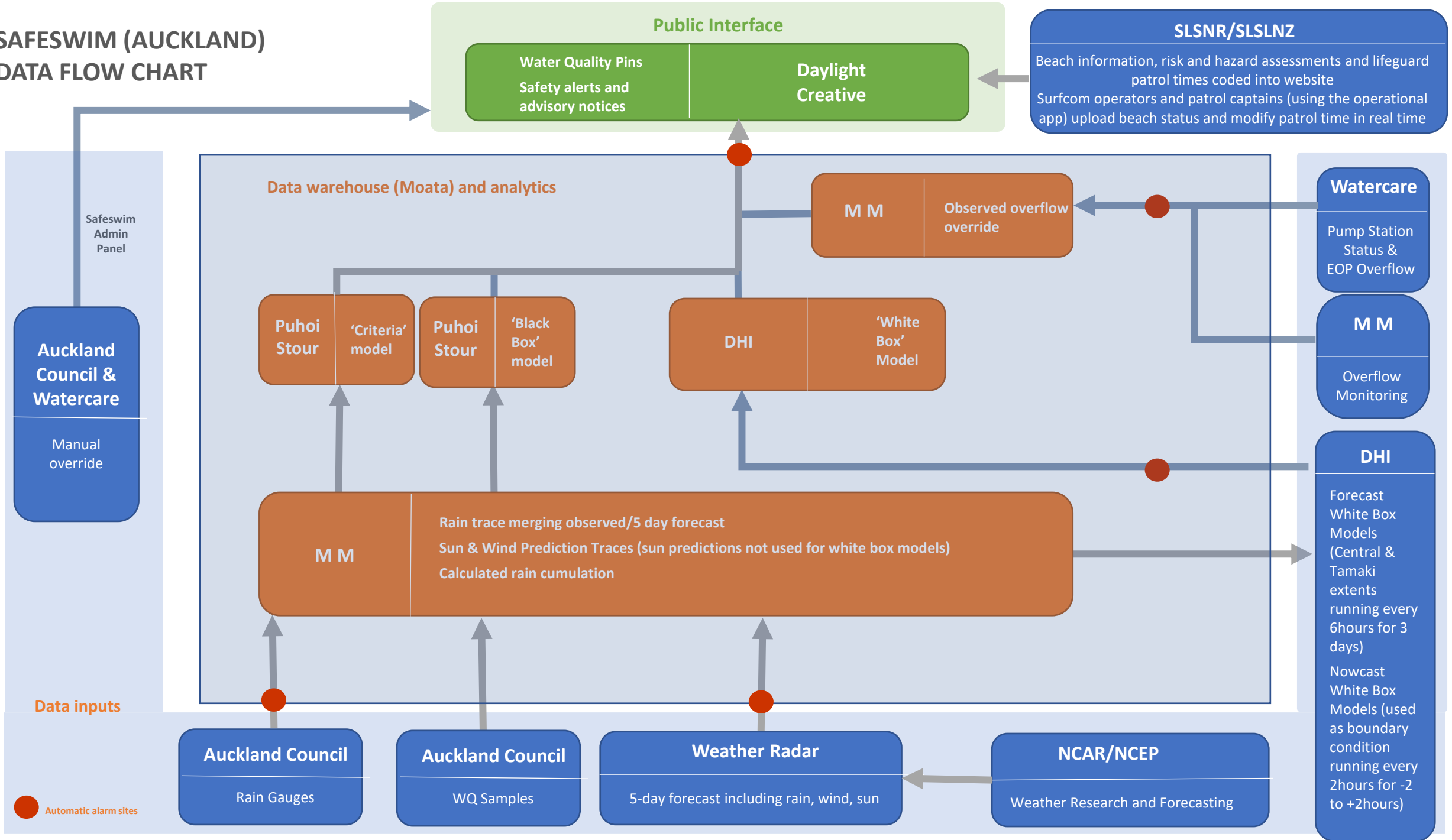
TIDES AT THIS BEACH
Tide is coming in

Tues Tues Tues Wed Wed

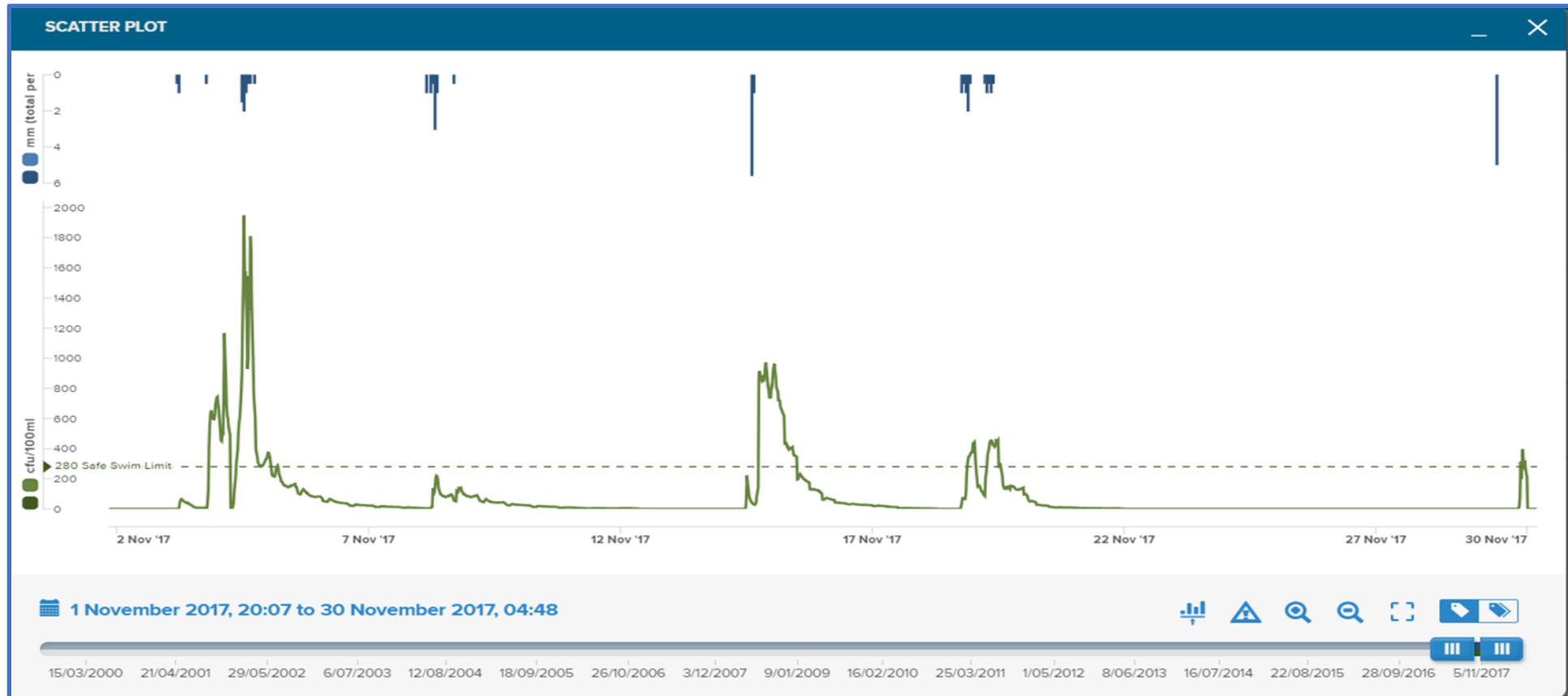
safeswim.org.nz

Navigation icons: back, forward, share, bookmark, tabs

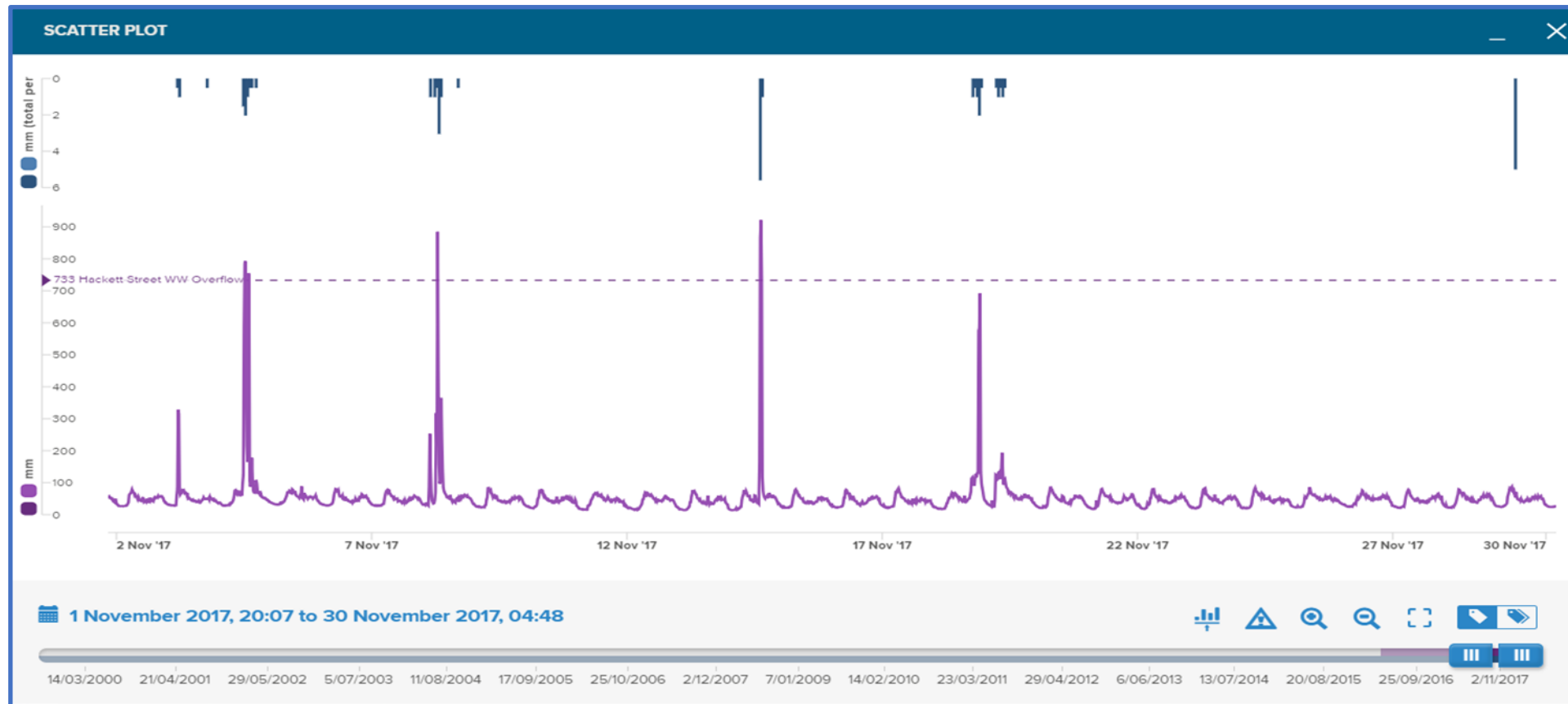
SAFESWIM (AUCKLAND) DATA FLOW CHART



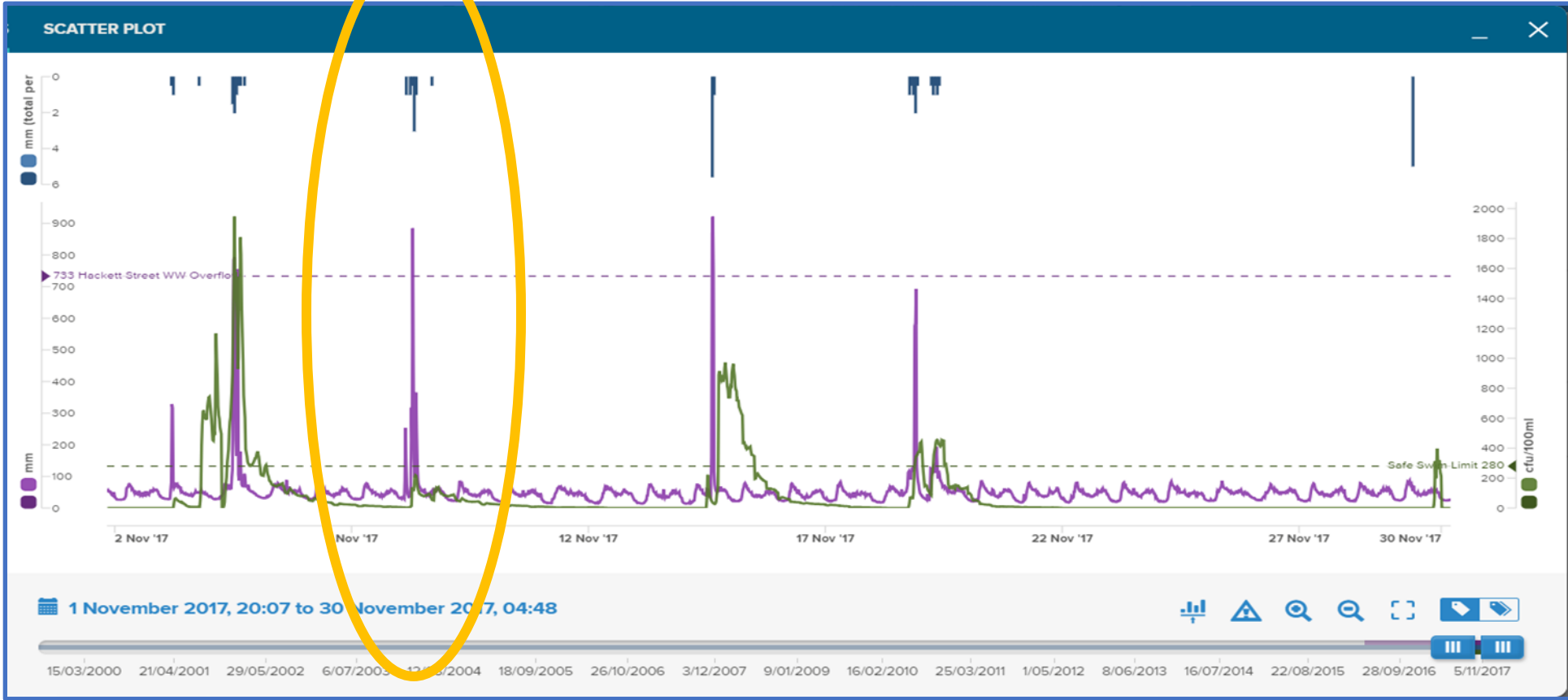
Rainfall + water quality prediction



Rainfall + observed overflows (from wastewater sensor)



The value of real time data

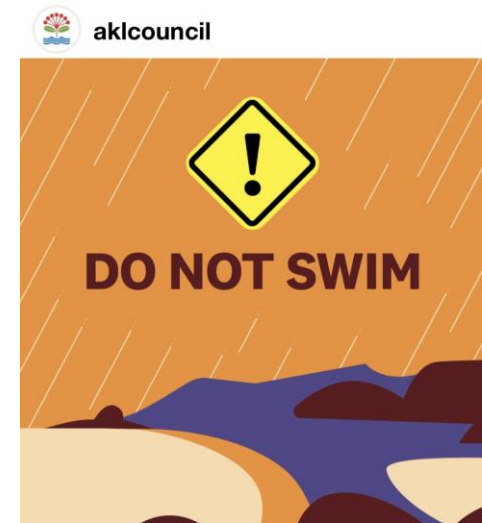
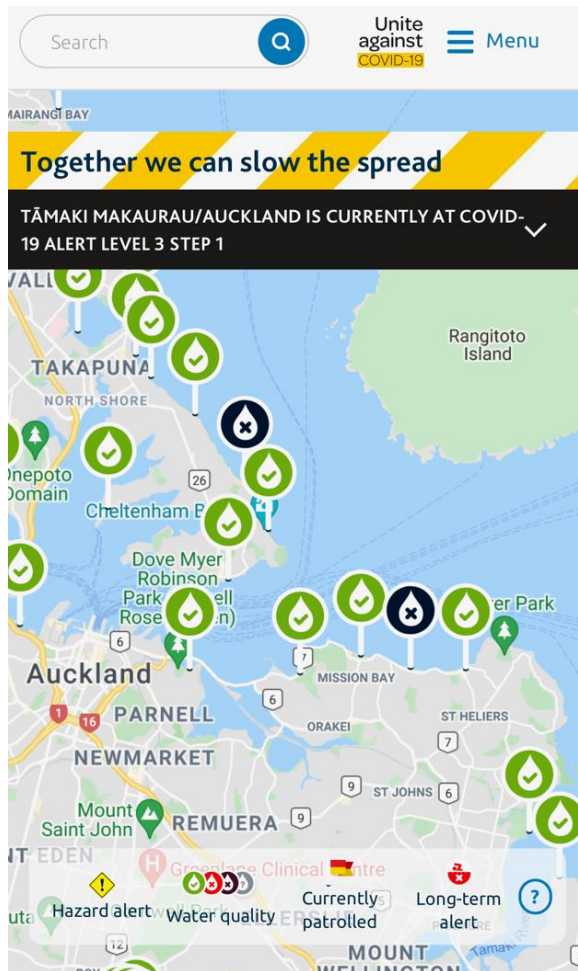


System performance

2018 comparative assessment (Mission Bay)

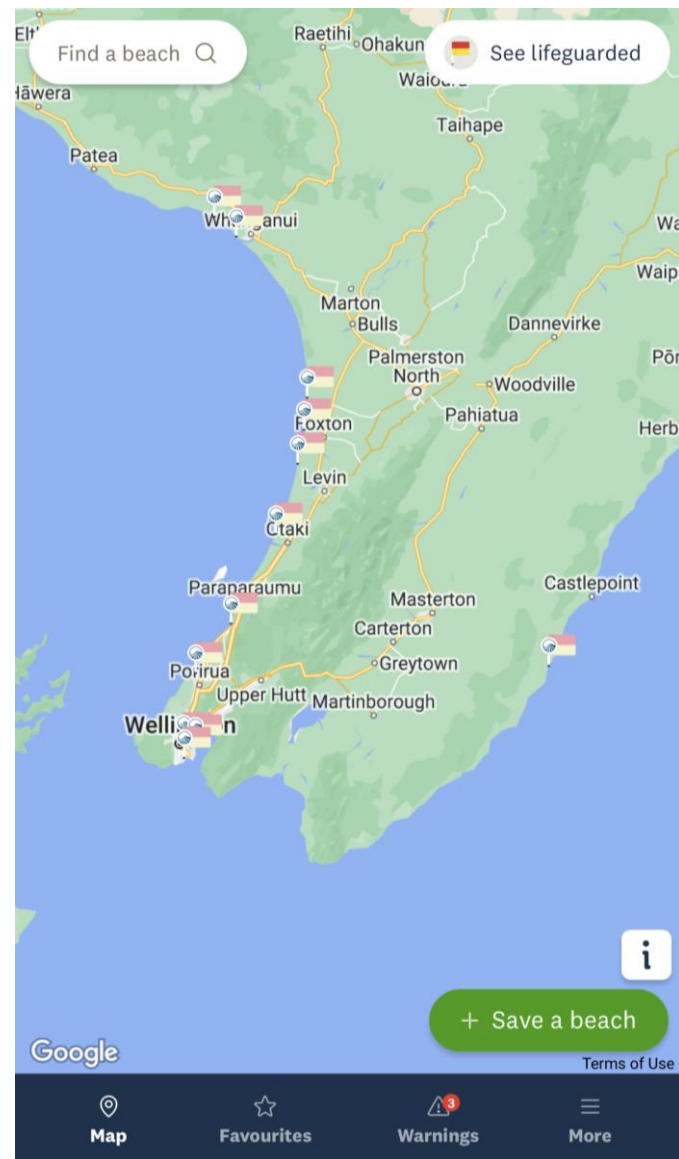
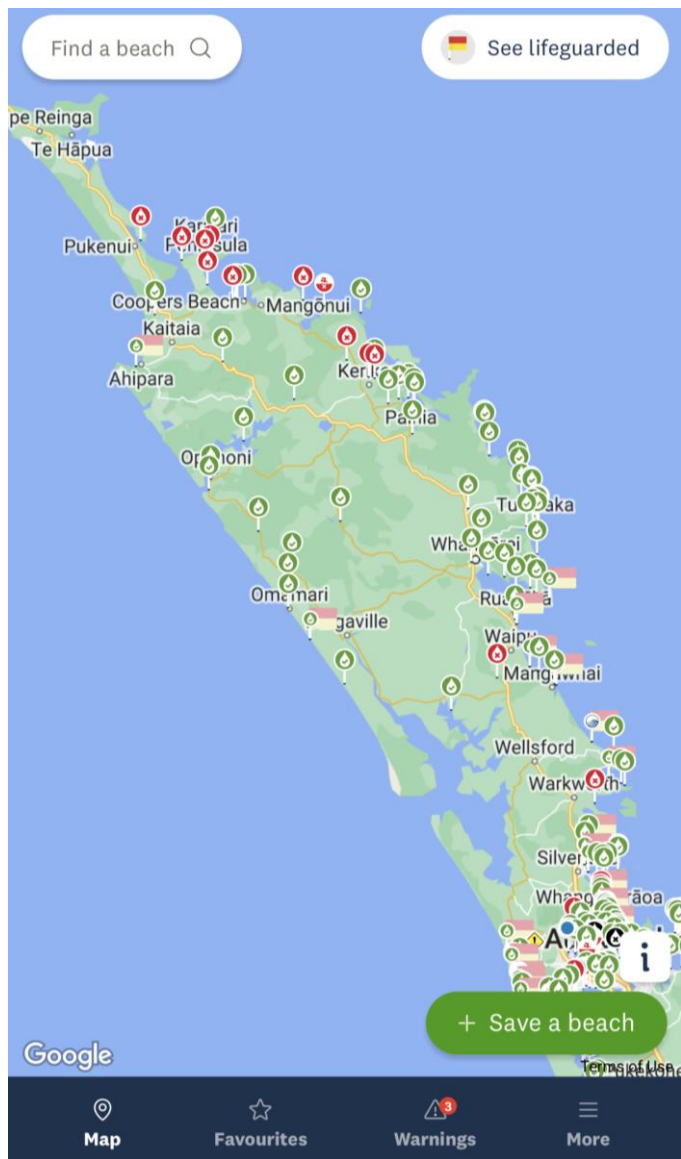
Measure	Safeswim model	Monitoring model	Inactive model	USGS Performance Criteria
Accurate	15 of 17 = 88%	9 of 17 = 53%	12 of 17 = 71%	80%
Accurate or precautionary	16 of 17 = 94%	15 of 17 = 76%	12 of 17 = 71%	
False negatives (i.e. high risk)	1 of 17 = 6%	4 of 17 = 24%	5 of 17 = 30%	
Guideline exceedances detected	4 of 5 = 80%	1 of 5 = 20%	0 of 5 = 0%	50%

2021, 2022, 2023 Audit NZ = 89% accurate system-wide



aklcouncil ⚠️ DO NOT SWIM ⚠️
 Damage to water networks and pumpstations is causing widespread wastewater overflows.

Flood waters have washed contaminants and debris into the water and, in some locations, slips may make beach access hazardous. Exercise caution and do not swim until conditions have returned to 'green' on Safeswim.



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