



SCIENCE & INNOVATION ACTIVITY

1 Water Quantity and Quality

1.1 Activity Overview

Water is an important resource that provides for the cultural, environmental and economic needs of our Region. The Science and Innovation Team serves the Water Quality and Quantity activity of Horizons' Annual Plan through a range of science monitoring and research programmes that track changes in the water resource and inform decision-making around water management.

The team's Water Quality and Quantity activity during 2017-18 is focussed on improving our knowledge and understanding of the Region's water resource. This information is important for ensuring Horizons is meeting its obligations under the revised **National Policy Statement for Freshwater Management 2014** (NPS-FM), informing decision-making and **State of Environment** (SoE) reporting, and supporting implementation of the One Plan with a particular focus on allocation and nutrient management. As set out in the Science and Innovation Operational Plan, work for 2017-18 includes:

- Ensuring regional and national monitoring and reporting requirements – such as the national regulations for measurement of water takes, the revised NPS-FM and One Plan – are met;
- Continuing our catchment characterisation work programme, with a focus on water quality and age tracers in the Rangitikei River catchment;
- Monitoring 80 popular swim spots around the Region;
- Working with the relevant agencies to improve communication about public water supplies and improve our knowledge and understanding of drinking water security in the Region; and
- Supporting our Freshwater and Partnerships teams to ensure freshwater initiatives are informed by science and targeted to address water quality issues.

The Water Quality and Quantity Activity is measured against three performance measures that require the Science and Innovation Team to report to Council on progress five times per year. As stated in the Annual Plan 2017-18, reporting includes both formal reporting and Council workshops.

Measures include:

Measure	Reporting Period					YTD Actual	Target
	1st	2nd	3rd	4th	5th		
Undertake research and monitoring to:							
Track changes in the health of the Region’s water resource * ¹	✓	✓	✓	✓	✓	100%	100%
Inform policy and non-regulatory programme development * ¹	✓	✓	✓	✓	✓	100%	100%
Assess policy implementation effectiveness * ¹	✓	✓	✓	✓	✓	100%	100%

*¹ Annual Plan (AP)/Long-term Plan (LTP) targets

1.2 Activity Highlights

This report covers the reporting period from 1 March to 30 April 2018. A summary of progress made against the targets for the year is in the table at the end of this section.

Water Allocation

Context

The Science and Innovation Team provides technical advice to support Horizons' consents and compliance teams, and also oversees the management and reporting of water allocation to ensure that Horizons is meeting the requirements of the National Regulations on Water Measurement and Reporting and the requirements under the One Plan. This also provides meaningful data for future freshwater accounting as required by the NPS-FM. Actual water use information is used for assessing compliance and to support resource management decision-making.

Activity

Water Metering

- 1.2.1 The summer irrigation season has ended with the Water Metering project team making more progress than expected with regard to routine inspections, and maintenance of the field network due to the addition of a temporary full-time technician, with the right skills and enthusiasm, for the season. All seasonal/farming related telemetered water take sites have been inspected, leaving just the industrial sites to be visited during winter.
- 1.2.2 Increasing the coverage of inspections has allowed faulty sites to be identified and issues addressed. The team have also replaced a number of telemetry units that have come to the end of their useful life with new, more reliable gear. This will help ensure the integrity and quality of the data in future seasons.

- 1.2.3 Further work to be completed during the coming months includes work on managing the automated data streams from TLAs, data management and system upgrades to allow IRIS workflow to be implemented, and potential automation of the water meter data processing and archiving. There are also a number of new telemetry installations to be completed, mainly for takes sized between 5 and 10 l/s, and these will be prioritised for the start of the 2018-19 season.
- 1.2.4 National water metering regulations require all water takes that are greater than 5 l/s to have water meters installed. Records show that, to date, 88% of water takes greater than 20 l/s are telemetered, 70% of takes 10-20 l/s are telemetered, and 27% of takes 5-10 l/s are telemetered. The majority of non-telemetered takes have meters installed, as required by the water metering regulations. The exact numbers will be able to be reported when the data update process is complete.

Water Allocation

- 1.2.5 Levels of surface water allocation remain stable with no significant new applications to take water received. Several large water permits, including Shannon and Taumaranui municipal water supplies, are currently on hold awaiting provision of further information.
- 1.2.6 In the Upper Manawatu, allocation is within the overall cumulative limits set in the One Plan however, at a subzone level five remain over-allocated presently. Several water users have undertaken to physically move their abstraction intakes from over-allocated sub-zones to sub-zones where there is water available. This includes two users from the Raparapawai catchment, and one in the Tamaki Water Management Zone. It is acknowledged that changes to infrastructure come at a cost, but these changes will help ensure water use is managed within the limits set. The proposed changes will, when implemented, result in only one of the subzones being over-allocated.

Water Age

Context

Horizons regularly collects and analyses surface water and groundwater age tracers throughout the region. This information helps us better characterise the Region's water resource by informing us of how water is connected and moves through a catchment, improving our understanding of how water can best be managed to address water quality and quantity issues.

Activity

- 1.2.7 As rainfall infiltrates through the ground, it can take years, decades, or even centuries before it is seen again as surface water, generally referred to as groundwater 'transit-time' or 'lag-time'. As it moves through the ground, water can also undergo hydrogeochemical processes, which may have a strong impact on water quality as it moves along a flow path. By testing water chemistry and age we can establish useful information about where groundwater is recharged (i.e. via rainfall or surface water); how long it takes to move along a flow path (water age and lag-time); and hydrogeochemical changes that may occur during transport (e.g. mineralisation or denitrification).

- 1.2.8 An early focus for the science and innovation team was the Ōhau River and Waikawa Stream catchments, adjacent catchments located within the Horowhenua Groundwater Management Zone (GMZ). These Surface Water Management Zones (WMZ) were selected due to their proximity to one another, and because they have quite distinct water quality but similar land use. The Waikawa WMZ is identified in Horizons' One Plan as a target catchment for nutrient management, whereas the Ōhau WMZ is not. The relatively small size of these catchments has enabled us to carry out an intensive monitoring programme across relatively small catchments, with known land-use and reasonably well-constrained flow pathways.
- 1.2.9 Tracers were collected from surface water and groundwater during 2015 and 2016 with data analysis being carried out by GNS. A draft report, synthesising the groundwater age, chemistry, gas and isotope tracers collected over this time, has now been received by Horizons. It is important to note that the application of age tracers in this way is new and novel science; as such, our understanding of how this information can be applied is rapidly evolving.
- 1.2.10 Preliminary findings suggest that recharge of the groundwater system is predominantly rainfall-driven. Loss of surface water from rivers and streams to the groundwater system is known in certain areas of Ohau River and the Waikawa Stream, particularly in the vicinity of State Highway 1 where significant loss of flow can occur during summer.
- 1.2.11 High concentrations of radon in surface water indicates that groundwater is discharging to the lower reaches of the Ohau River and Waikawa Stream just upstream from where they intercept and flow across the Quaternary sands. It is inferred that the permeability of these sands is too low to allow groundwater discharge to the sea and as a result, groundwater flow is upwelling and discharging into the surface waterways.
- 1.2.12 High groundwater nitrate concentrations in the Ohau and Waikawa catchments were identified as the result of groundwater recharge by local rain which carries land surface derived nitrate into the groundwater system. Nitrate concentrations in the groundwater of the Ohau catchment are lower than in the southern Waikawa catchment, despite similarities in land use. The tracer signatures indicate partial groundwater recharge from the river in the Ohau catchment, implying that the lower nitrate concentrations in the Ohau catchment are likely to be a result of dilution by river water.
- 1.2.13 Groundwater moves more quickly through gravels in the Ohau catchment and water is relatively young as it nears the discharge area of the gravel system and returns into the river. Groundwater is older in the less-transmissive gravels of the Manukau catchment where it discharges into the Manukau Stream at the interception between the Quaternary gravel and sand near the coast.
- 1.2.14 Groundwater in the Ohau and Waikawa catchments is generally oxidised and therefore not expected to be associated with complete denitrification. The estimated rates of oxygen reduction for these gravel aquifers suggest water requires decades in the groundwater system to reach anoxic conditions favourable for denitrification to occur.

- 1.2.15 The longer groundwater transit time through the Manakau catchment may allow for greater denitrification potential in the gravels, before the water returns into the stream, than in the Ohau catchment. This does however, rely on biogeochemical processes occurring during transit, and further investigation into these processes is required.
- 1.2.16 Building our knowledge of groundwater and surface water dynamics in catchments such as the Ōhau and Waikawa assists with improving our understanding of drivers of water quality and ecosystem health. This study has been carried out in concert with (almost three years of) intensive water quality and periphyton monitoring. The next phase of this work programme will focus on preliminary analysis of these data and assess a wider range of catchment information to continue to build our understanding.
- 1.2.17 A similar work stream is now underway in the Rangitikei catchment, with staff collecting both surface water and groundwater tracers over February to April 2018. Our aim is to apply our new knowledge of age tracers and isotopes to understand more about the groundwater dynamics, source, and hydrochemical processes at work in the Rangitikei catchment.

2018 National Pesticide Survey

Context

The **Institute of Environmental Science and Research** (ESR) co-ordinate a four-yearly National Pesticides Survey of groundwater, in partnership with regional councils. The next survey is scheduled for late 2018.

Activity

- 1.2.18 There have been seven national surveys of pesticide contamination in groundwater, taking place every four years since 1990. The next survey is planned for late 2018, with sampling in the Horizons Region scheduled for September 2018.
- 1.2.19 The aims of the survey are to provide a national overview of pesticides in New Zealand's groundwater systems, to provide regional level information that will be appropriate for council's state of the environment reporting, to investigate temporal variation in pesticide concentrations between surveys, and to identify environmental factors associated with pesticide contamination of groundwater.
- 1.2.20 As part of the 2018 survey, ESR is offering to expand the suite of analysed pesticides to include glyphosate (present in household products such as *Round-up*) and its metabolites, as well as a selection of emerging contaminants (steroid hormones, paracetamol, ibuprofen, caffeine, nicotine, diclofenac, antibiotics, that may be found in human effluent and steroid hormones that can be found in animal effluent, as shown in **Error! Reference source not found.**).

Table 1 List of Emerging Contaminants in Water (NSAID = non-steroidal anti-inflammatory drug) that may be analysed as part of the 2018 National Pesticide survey.

Compound	Reporting Limits (ng/L)#	Compound Type
Paracetamol / Acetaminophen	10-100	Analgesic
Carbamazepine	10-100	treatment of epilepsy and neuropathic pain, schizophrenia, bipolar disorder
Clarithromycin	10-100	Antibiotic
Diclofenac	10-100	NSAID
Ibuprofen	10-100	NSAID
Caffeine	10-100	Tracer of human effluent
Cotinine	10-100	Tracer of human effluent
Nicotine	10-100	Tracer of human effluent
Sucralose	10-100	Tracer of human effluent
DEET	10-100	Topical insect repellent
Benzophenone 3 (BP3)	10-100	Sunscreen active ingredient
Benzophenone 2(BP2)	10-100	Sunscreen active ingredient
Bisphenol A (BPA)	10-100	Plasticiser
Triclosan	10-100	anti-microbial
Estriol (E3)	10-100	Steroid hormone (pregnant women)
Estrone (E1)	10-100	Steroid hormone (dairy and swine effluent)
Ethinylestradiol (EE2)	10-100	Steroid hormone (contraceptive)
βEstradiol (βE2)	10-100	Steroid hormone (all women, dairy and swine effluent)

- 1.2.21 Presently, little is known about the fate and transport of emerging contaminants, which can naturally-occurring or manmade (anthropogenic) chemicals can be resilient to degradation, accumulate in different environmental areas, and have toxic effects on living organisms. The main sources of emerging contaminants in the urban environment are wastewater, stormwater, landfill leachate, industrial and marine activities. In agricultural or rural environments the presence of emerging contaminants could be associated with the use of animal antibiotics, steroids and septic wastewater discharges.
- 1.2.22 With the recent discovery of per- and polyfluoroalkyl substances (PFAS) in soil and water in the vicinity of fire-fighting test sites in New Zealand, including Ohakea, public interest in the presence of emerging contaminants is on the rise. The opportunity to test for these compounds as part of the national survey is a proactive and cost-effective way for Horizons to collate an initial dataset and identifying whether these compounds are present in groundwater in the Horizons Region.

- 1.2.23 Sampling sites will include a number of sites surveyed in previous years for a range of pesticides and herbicides, but will also include additional sites targeted to areas where emerging contaminants might be found.

Estuary Habitat Mapping

Context

Estuaries are important coastal receiving environments. They are often referred to as the “Canary in the coal mine” of a catchment, as they receive the collective nutrient and sediment loads from all upstream locations. Monitoring estuary is therefore a highly valuable to understand cumulative processes in the catchments. If intact, estuaries are of high ecological (e.g. as breeding places for fishes and birds) and recreational value.

Increased nutrient and sediment loads however, can cause eutrophication and oxygen depletion, which may lead to anoxic nutrient cycling with sulphur release and a decline in biodiversity and amenity values. Horizons Regional Council started estuary habitat mapping in 2016 with a vulnerability assessment of all the Region’s estuaries for eutrophication and sedimentation. Based on these results, of this a habitat monitoring plan was designed, which includes both broad and fine-scale habitat mapping for several estuaries in the region.

Activity

- 1.2.24 The second year of fine-scale habitat monitoring with Wriggle Coastal Management in the Manawatū estuary was completed during summer 2017-18. This included sedimentation rate monitoring data, sediment and water quality data, as well as benthic macroinvertebrate assessment. This year’s survey included data collection only. While brief comparison indicates the potential for accumulating mud in the estuary, data from at least a third year of monitoring is necessary to confirm this observation. All data will be analysed during the next financial year (2018-19) after the third year of fine-scale monitoring has been completed. This will form the baseline information about estuary health. Based on these results further monitoring recommendations can be made.
- 1.2.25 Sedimentation monitoring plates were installed in the Whangaehu estuary and a report summarising the locations of the plates and first observations was completed in April 2018. Four sediment rate-monitoring plates were installed at three representative sites along the lower estuary. These will be used to establish a sediment-monitoring baseline over 5 years for the Whangaehu estuary. This will include measuring the sediment deposition over the buried concrete plates, sediment grain size analysis and sediment oxygenation. An initial assessment of these parameters during the installation showed high amounts of soft to very soft muds covering 62% of the intertidal area with measured mud content at the sedimentation plates ranging from 75-98%, which places the Whangaehu estuary at “high risk” (scale from very low to high) for sedimentation. Monitoring results for sediment oxygenation supported this finding with the oxygenated sediment layer being only 1-2mm deep at two sites (an oxygenation layer of <0.5cm leads to a high-risk rating).

1.2.26 Management actions to minimise fine sediment inputs into the estuary were recommended by Wriggle. These actions aim to prevent further impact on the estuary and these have been shared with our Land team to inform the SLUI programme and other land management initiatives. We are collectively exploring the possibility of including the estuary sedimentation monitoring with the current SedNet modelling for to derive potential SLUI outcomes. Other management options for the Whangaehu estuary will also be explored.

1.2.27 Further estuary habitat monitoring at the Rangitikei, Ohau and Waikawa estuaries were conducted by Wriggle Coastal Monitoring. The respective reports are expected by the end of June 2018.

1.3 Activity Progress Report

Project	Key Deliverables	Progress to Date
Water Allocation and Groundwater Monitoring	Surface Water Allocation	Work continues on IRIS database to enable reporting, as originally scoped.
	Groundwater Quantity, Quality and Seawater Intrusion	Monitoring was delivered as scheduled.
	National Monitoring Programmes	Monitoring was delivered as scheduled.
	Water Metering and National Regulations	Work continues towards meeting obligations and Horizons CI team continues to advance the development of the reporting tool to meet MfE's requirements.
Water Quality and Discharge Monitoring	- Monthly SoE and Discharge monitoring undertaken - Automated QC software is running on the data - Lab tender is completed - Hilltop software training for new staff	- A work programme is underway to validate and integrate different sources of water quality archive data. - Training of staff in applications such as Hilltop, GIS and 'R' is underway to improve capability across the organisation. - The tender process for the lab contract is complete. - Monthly monitoring was completed as scheduled.
	Sediment monitoring data processed and on the archive	Monitoring and processing is ongoing.
	Continuous physico-chemical monitoring (such as temperature and dissolved oxygen) data processed and on the archive	Monitoring and processing is ongoing.
	External (contract) monitoring completed as per contracts	Monitoring is ongoing as required.
Biological Monitoring	Monthly periphyton monitoring	Monthly monitoring was completed as scheduled.
	Annual macroinvertebrate monitoring	- Sample collection has been completed for the 2017-18 season. - State and trend reporting for 2016-17 is complete.
	Didymo monitoring undertaken in all quarters except winter	Didymo monitoring for February completed. Monitoring for May underway and largely completed.

Project	Key Deliverables	Progress to Date
	- Fish monitoring programme, including brown mudfish monitoring, undertaken - Sites of Significance Aquatic (SOS-A) SoE monitoring undertaken	SoE fish monitoring has begun and is approximately half way through the programme at the time of writing.
	- Macroinvertebrates Drivers Report - Periphyton Drivers report	- Macroinvertebrates drivers report – data has been provided to DairyNZ and analysis of the data is underway. - Periphyton drivers report – data analysis is largely complete and reporting by NIWA is underway with a draft report expected in the next few weeks. A workshop between Horizons and NIWA is planned for June.
Lake Monitoring	- Quarterly lakes sampling undertaken - Lake Submerged Plant Indicators (SPI) monitoring undertaken - Lake bathymetry monitoring undertaken	- Lake SPI has been completed for 2017-18 and reporting is now underway. - Bathymetric mapping for 2017-18 has been completed for Lake Waipu.
	Monthly monitoring of coastal and estuary sites	Monthly monitoring of the coastal and estuary monitoring sites was delivered as scheduled.
	Broad-scale mapping in the Whanganui and fine-scale mapping in the Manawatū undertaken and reported	Mapping of the Ōhau, Waikawa, Manawatū, Rangitikei and Whangaehu estuaries has been completed.
Innovative Science and Research	Nutrient diffusing substrate monitoring	Unfortunately due to regular heavy rainfall resetting instream conditions, this investigation was abandoned this year and will be revisited in 2018-19.
	- Preferential uptake of ammonia for periphyton growth project is funded and initiated - Work undertaken and report produced	A medium Envirolink advice grant for this work has been approved. A report is due by 30 June 2018.
	Undertake an investigation into the ecological effects of cyanobacteria on macroinvertebrates monitoring	Weather conditions have prevented this work being completed this year and this programme will be revisited in 2018-19.
	Monitoring at reference sites to inform the development of the Stream Ecological Valuation (SEV) calculator	Weather conditions have prevented this work being completed this year and this programme will be revisited in 2018-19.
	Monitoring of the Turitea Stream restoration project ongoing	Weather conditions have prevented this work being completed so far this year.
Resource Accounting	Flow relationships, mean annual low flows (MALFs) and minimum flows	This work programme is carried out by the Catchment Data Team and is progressing.
	Water use accounting and reporting	WaterMatters continues to operate and plans for further development are in place.
	Contaminant accounting – development of summary reports for target catchments	A catchment summary document for the Upper Manawatū is on hold pending the results of the water quality state and trends work currently underway.
	Stormwater	The stocktake and gap analysis report is now being finalised.

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2 Land

2.1 Activity Overview

The Land Management Activity covers Horizons' main land-based initiatives, with a particular focus on **Sustainable Land Use Initiative (SLUI)**, and is reported to Horizons' Catchment Operations Committee. Our Land and Fluvial Research and Monitoring programmes assist these programmes by informing prioritisation and monitoring the effectiveness of the work programmes.

Fluvial monitoring and research during 2017-18 is focused on advancing the collection and analysis of fluvial survey data, with a focus on processing the existing data for the Oroua River and advancing a survey of the Manawatū River. These surveys provide crucial information about the storage and transport of sediment to inform the upcoming evaluation of Horizons' policy and plan framework for the management of sediment in our Region.

A new research programme investigating sediment transport and its effects on water quality and flood schemes is underway. During the next two years, this programme will be delivered through partnerships with Landcare Research and Massey University, and will focus on the following key outputs:

- Supporting the review of the Sustainable Land Use Initiative (SLUI) programme;
- Continuing a National Science Challenge project investigating the transport of sediment and its effects within the Manawatū and Whanganui catchments; and
- A collaborative work programme with Landcare Research and Massey University to further investigate sedimentation rates in the Oroua River, including analysis of changes in sediment deposition over a decade from 2006 and sediment source tracking using fingerprinting techniques and geochemical analysis.

The Land Management Activity is measured against three performance measures that require the Science and Innovation Team to report to Council on progress five times per year. As stated in the Annual Plan 2017-18, reporting includes both formal reporting and Council workshops. Measures include:

Performance Measure	Reporting Period					YTD Actual	Target
	1st	2nd	3rd	4th	5th		
Undertake research and monitoring to:							
Track changes in the health of the Region’s land and fluvial resources* ¹	✓	✓	✓	✓	✓	100%	100%
Inform policy and non-regulatory programme development* ¹	✓	✓	✓	✓	✓	100%	100%
Assess policy and implementation effectiveness* ¹	✓	✓	✓	✓	✓	100%	100%

*¹ AP/LTP targets.

2.2 Activity Highlights

This report covers the reporting period from 1 March to 30 April 2018. A summary of progress made against the targets for the year is in the table at the end of this section.

Our Land 2018

Context

New Zealand's Environmental Reporting Series is co-produced by Stats NZ and the Ministry for the Environment. In April, Our land 2018 was released; the first land report in the environmental reporting series. The report highlights the importance of both soil and biodiversity in our ecosystems and environment, collates and presents information on the current state and changes over time, and identifies present gaps in the datasets and knowledge.

The following are some key messages from the report and how these relate to the Horizons Region.

Activity

- 2.2.1 Nationally, indigenous land cover has decreased over time between 1996 and 2012 (tussock grassland, shrubland and forests). The proportion of land cover lost is small however the loss still has an impact on biodiversity. In the Horizons region, indigenous forest has declined by <1 per cent, indigenous shrubland by 3 per cent and tussock grassland <1 per cent. It is important to note that the most recent land cover database was developed 2012 and the report recognizes a need for an updated land cover database layer to ensure reporting is accurate.
- 2.2.2 Eighty three per cent of indigenous land dwelling vertebrates are threatened or at risk of extinction and seven bird species, three gecko species and one species of wētā are in decline in terms of conservation status. However the status of 20 bird species is improving.
- 2.2.3 New Zealand has widespread natural erosion, however according to the modelling in this report, 44 per cent of soil that enters rivers nationally comes from pasture which equates to 84 million tonnes annually. Natural disasters and events such as the earthquakes in Canterbury and Marlborough as well as storm events across the country have also had an impact on landforms, caused loss of soil and have implications for how land is managed. More intense rainfall events can be expected in the future due to climate change, and this is also the case for areas of the Horizons Region.
- 2.2.4 Soil quality is monitored by regional councils across a range of land uses and for a range of parameters such as macroporosity, and bulk density (indicators of compaction), soil carbon and nitrogen (indicators of organic matter in soil), acidity and phosphorus which can affect productivity and nutrient loads to waterways. Most parameters fit within their target ranges nationally however, 33 per cent of sites had phosphorus levels that were higher than the target range. Excess phosphorus is not used by pasture/crops and can be lost to waterways. Macroporosity results from 44 percent of sites indicated the soil was compacted, affecting productivity, growth and soil

biodiversity as well as increasing greenhouse gas emissions. These figures were even greater when considering intensive land use alone.

- 2.2.4 Soil quality monitoring is variable across the country. This report notes that existing soil quality data tends to focus on more intensive land use types, such as dairy farming and horticulture. Further, some regional councils have more comprehensive datasets, while others do not have soil quality monitoring programmes at all. Presently, we do not have a representative monitoring network that provides nationally consistent information on the health of soils. This is a significant gap in New Zealand's soil data.
- 2.2.5 Horizons Regional Council began soil quality monitoring in 2015 after previously conducting visual soil assessments. The current focus of the programme is on building the number of monitoring sites to provide baseline information. These sites will then be revisited every five years so we can begin to track changes over time.
- 2.2.6 The report highlighted a common theme of gaps in the data that was used in the analysis. Many aspects of land information are collected at the regional scale to varying degrees depending on the pressures and focus of each council, for example soil quality monitoring, land use and soil mapping and type. Soil information is important when using applications such as Overseer, understanding sources of nutrients and improving farm management practices. Accuracy of these soil maps is key in a country with such variable landscape features. There is national coverage of the Fundamental Soil Layer developed by Manaaki Whenua Landcare Research (MWLR), however these maps are now considered outdated and less reliable than S-map, a programme also developed by MWLR that aims to produce a nationally consistent, quantitative spatial soil database. There is no national coverage of S-Map however and Horizons currently has S-Map coverage for 20 per cent of the region. There is also currently no national representative dataset for land use information, a limitation that is often encountered by many teams in Horizons.
- 2.2.6 Land management is often seen as a rural challenge however, it is important to recognise that urban environments can also impact the health of soils and biodiversity. Landfills, industrial waste discharges and human wastewater disposal can also impact the health of our land if they are not well managed. Figure 1 highlights some of the pressures on our land and how our own activities can impact the environment.

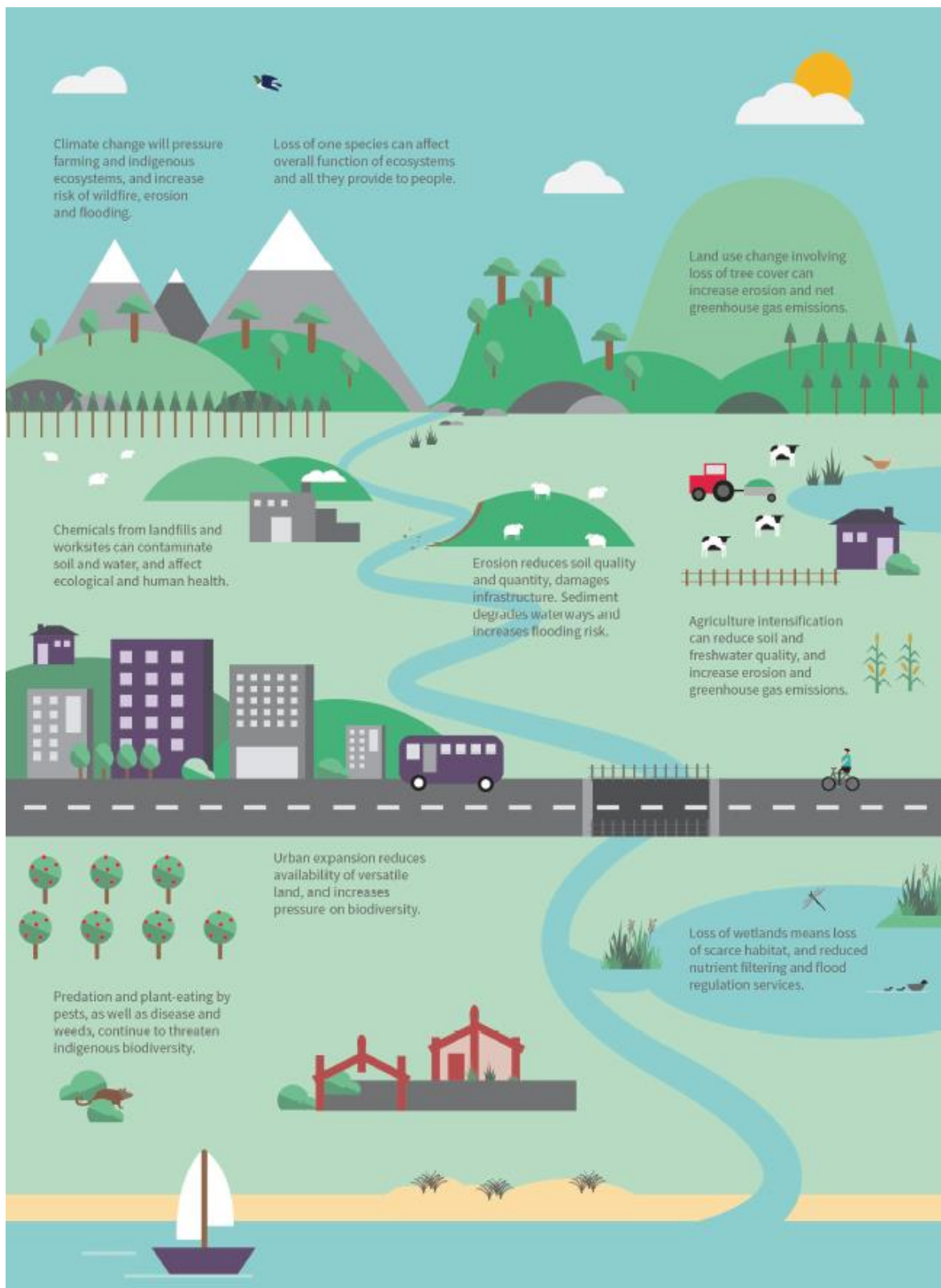


Figure 1 Infographic from Our Land 2018 demonstrating how land activities, both urban and rural, interact with the environment.

Gravel Use Monitoring

Context

Quarterly processing of gravel use records helps us monitor the amount of gravel being utilised and ensure that targeted rates for gravel use (gravel levies) are appropriately calculated.

Activity

2.2.7 Gravel use records collected at the end of the third quarter of the 2017-18 financial year (Figure 3) show that the reported gravel extraction volume was higher than for the same quarter in previous years.

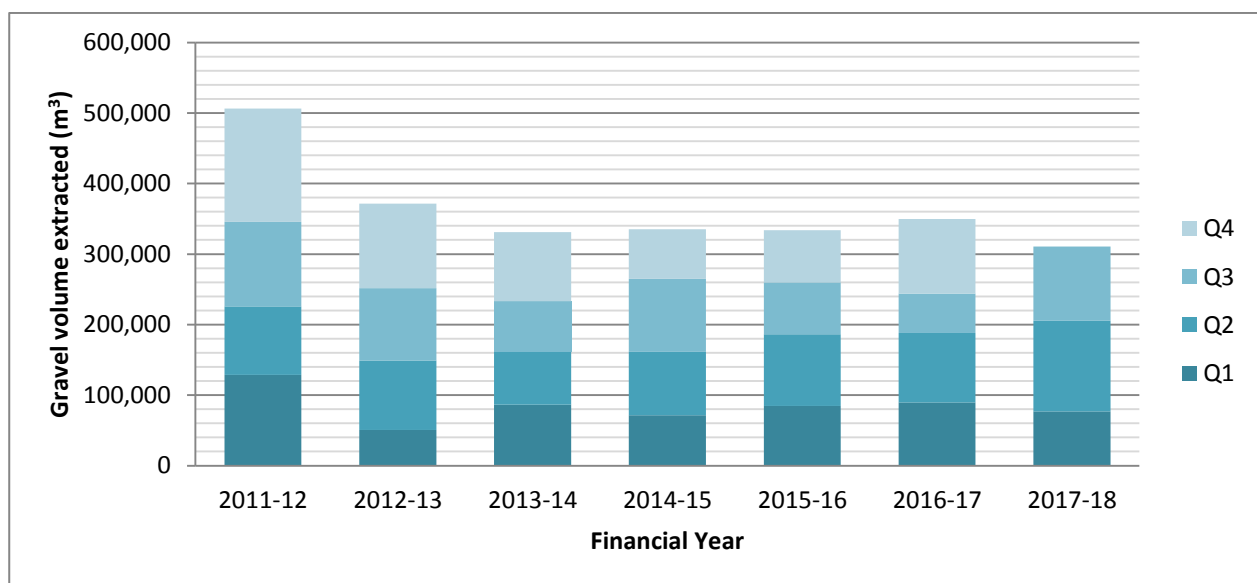


Figure 3 Plot showing amount of gravel taken through consented takes in each quarter during the last six years, including the third quarter of 2017-18 financial year. Q1 = July to September, Q2 = October to December, Q3 = January to March, Q4 = April to June. Please note that the gravel taken for Q3 2017-2018 is currently an estimate.

2.3 Activity Progress Report

Project	Key Deliverables	Progress to Date
Fluvial monitoring and research to inform gravel management	▪ Cross-section field surveys and information to inform gravel management and river management (Rangitikei River) ▪ Gravel use management	▪ Field surveying of the Manawatū River from Ashhurst to Opiki and Opiki to the sea has been planned and scheduled for 2018. ▪ The Ashhurst to Opiki portion of the survey has been completed under budget and the remaining staff time will be spent advancing surveying of the Ohau River. ▪ The Opiki to the sea portion is due for completion by the end of May 2018. ▪ Gravel extraction data continues to be collected and collated on a quarterly basis.
SLUI support	▪ Contribution to determining effects of SLUI on water quality outcomes for the SLUI review	▪ A science work programme in partnership with Horizons' Land Team is underway to inform the SLUI review project, with work contracted to Landcare Research. ▪ The final report for Part 1: Sediment and water clarity has been completed. ▪ A draft report for Part 2: Nitrogen, phosphorus and <i>E. coli</i> has been provided. ▪ A land/fluvial workshop was held for presentations and discussion on the contracted work in May 2018.
Our Land and Water National Science Challenge – Cascade of Sediment project	▪ Provision of information and in-kind support	▪ Whanganui catchment data has been supplied and this work programme is underway.
Sediment Source Tracking in the Oroua River catchment	▪ Sediment source investigation and report	▪ Sample collection and lab processing is complete. ▪ A draft report is due in June 2018 with preliminary findings presented by Simon Vale at the land/fluvial workshop in May 2018.
Oroua LiDAR Research Project	▪ Provision of data ▪ Report on LiDAR analysis and utility of LiDAR	▪ A draft report has been provided and a presentation given at the Land/Fluvial workshop in May 2018.
The Suitability of Tephra to treat Municipal Wastewater	▪ Research update from Massey ▪ Conclusion of study (June 2018)	▪ The project is ongoing until June 2018.

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3 Biosecurity and Biodiversity Monitoring & Research

3.1 Activity Overview

Biosecurity and biodiversity management are core functions of Horizons that add significantly to the environmental, economic, social and cultural prosperity of the Region, by enhancing the quality of indigenous ecosystems and reducing the impacts of pest plants and animals. This group of activities includes Horizons' species-led pest plant and pest animal control (Biosecurity function) and the protection of bush and wetlands through site-led approaches, including support of community biodiversity programmes (Biodiversity function).

The Biodiversity Monitoring and Research programme assists these functions by informing prioritisation of biodiversity sites, measuring the effectiveness of biodiversity work programmes and undertaking research to inform pest management under the Regional Pest Management Strategy and Regional Pest Management Plan. The biodiversity and biosecurity monitoring and research activity also maintains functional links to biodiversity and biosecurity research-related activity occurring under the Land, Water Quality and Water Quantity programmes.

The work programme for 2017-18 includes:

- Peer review of the efficacy of our wetlands and forest fragments monitoring programmes;
- Support for the implementation of the Regional Pest Management Plan; and
- Completing a stock-take and prioritisation of the Region's significant lakes.

Biodiversity and Biosecurity activity for scientific monitoring and research is measured against three performance measures that require the Science and Innovation Team to report to Council on progress five times per year. As stated in the Annual Plan 2017-18, reporting includes both formal reporting and Council workshops. Measures include:

Performance Measure	Reporting Period					YTD Actual	Target
	1st	2nd	3rd	4th	5th		
Undertake research and monitoring to:							
Track changes in the health of the Region’s living heritage* ¹	✓	✓	✓	✓	✓	100%	100%
Inform policy, habitat protection and biosecurity programme development* ¹	✓	✓	✓	✓	✓	100%	100%
Assess policy implementation effectiveness * ¹	✓	✓	✓	✓	✓	100%	100%

*¹ AP/LTP targets

3.2 Activity Highlights

This report covers the reporting period from 1 March to 30 April 2018. A summary of progress made against the targets for the year is in the table at the end of this section.

Macroinvertebrate State and Trends

Context

Aquatic macroinvertebrate monitoring is undertaken annually in the Horizons Region. Macroinvertebrate communities are widely used as indicators of stream ecosystem health because they include a wide range of species, each with relatively well-known sensitivity or tolerance to stream conditions. The most common stream health indices are taxa richness, percentage of EPT taxa and the Macroinvertebrate Community Index (MCI).

Activity

- 3.2.1 State of the environment monitoring for macroinvertebrates in the region commenced in 1999 and has been undertaken on an annual basis at a range of sites over the period 1999 – 2017. During the 2017-18 financial year Stark Environmental Ltd were contracted to undertake a trend assessment of Horizons' macroinvertebrate data.
- 3.2.2 A draft report (currently being reviewed) has been produced with the results of the trend assessment and includes a description of the state of water quality from the monitoring undertaken in early 2017. State of water quality in the report is represented by the macroinvertebrate class index (MCI) which can be broken into four water quality classes as shown in Table 2.

Table 2 Water quality classes utilising the MCI Score.

Quality class	Stark (1998) descriptions	Stark & Maxted (2007a)	Wright-Stowe & Winterbourn (2003)
Excellent	Clean water	> 119	125–200
Good	Doubtful quality or possible mild pollution	100–119	105–115
Fair	Probable moderate pollution	80–99	85–95
Poor	Probable severe pollution	< 80	< 75

- 3.2.3 Of the 88 sites monitored in 2017, 20 (23%) were classed as excellent, 38 (43%) were classed as good, 22 (25%) were classed as fair and 8 (9%) were classed as poor. The spatial distribution of these results is represented graphically in Figure 2 and Figure 3. In general sites in good or excellent condition tend to be located in the upper parts of the catchments.
- 3.2.4 The sites identified as being in poor condition are:
- Mangatera Stream at Timber Bay (Site 13)
 - Hautapu River at Papakai Road (Site 50)
 - Hautapu River upstream Rangitikei confluence (Site 51)
 - Arawhata Stream at Hokio Beach Road (Site 71)
 - Hokio Stream at Lake outlet weir (Site 72)
 - Manganaonao Stream at Kuku Beach Road (Site 80)

- Owahanga at Branscombe Bridge (Site 87)

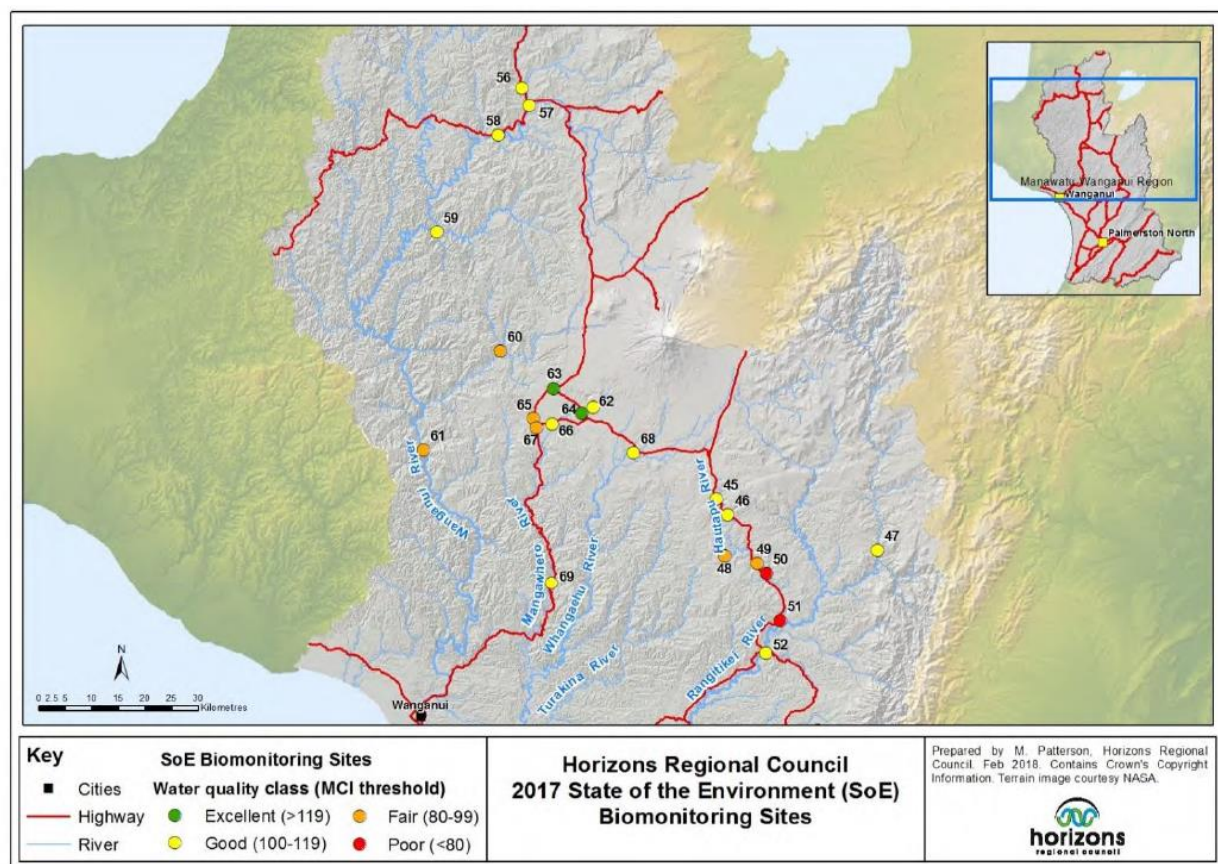


Figure 2 River quality classes based on the MCI for SoE monitoring sites in the northern part of the Manawatu – Wanganui Region sampled in 2016-17. Sites classed as Poor are both located in the Rangitikei catchment and include Rangitikei at Papakai Road and Rangitikei at upstream Rangitikei confluence. Sites classed as Excellent include Makotuku River at SH49 and Mangawhero River upstream Ohakune STP.

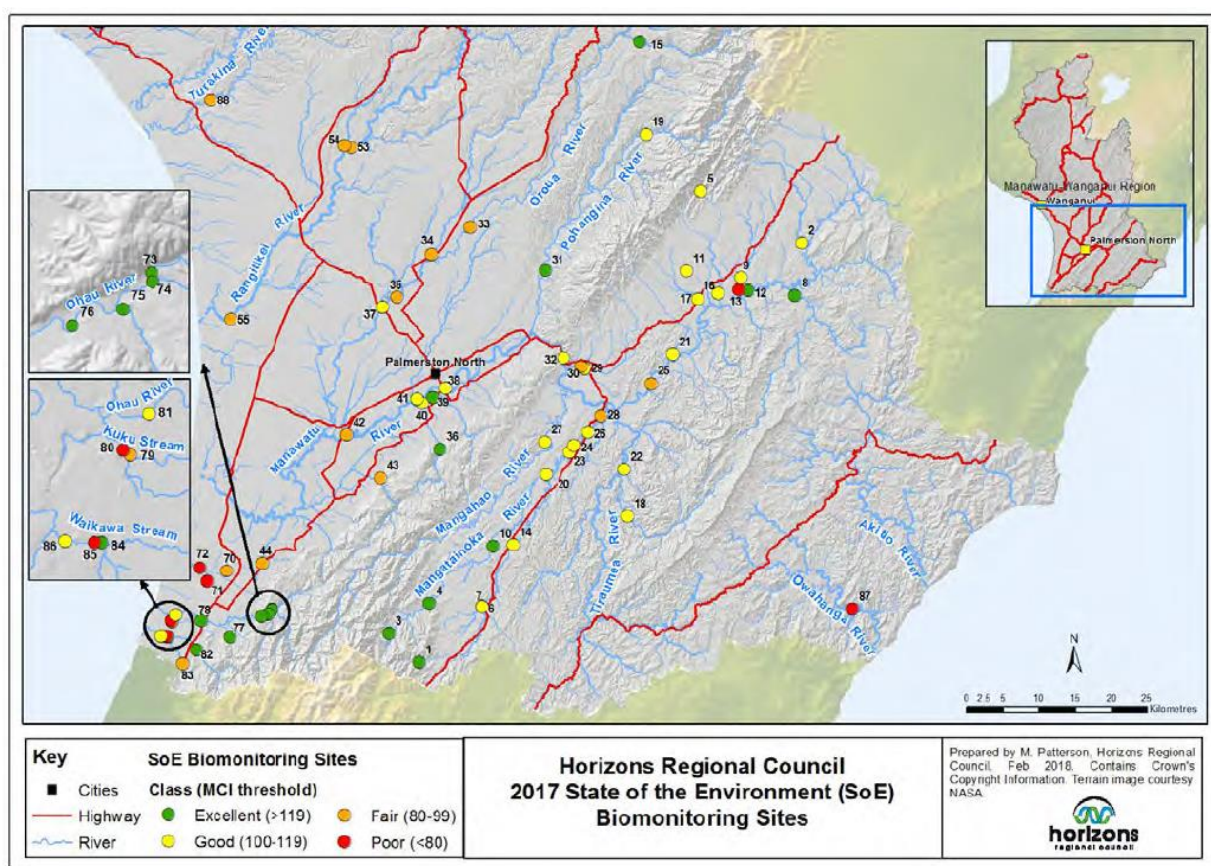


Figure 3 River quality classes based on the MCI for SoE monitoring sites in the southern part of the Manawatu – Wanganui Region sampled in 2016-17

3.2.5 Due to the naturally variable nature of biological monitoring, trend assessment is undertaken over multiple years to eliminate this natural variance, and so to give a true indication of improving or declining water quality. Of the 88 sites reported on, 62 sites had sufficient data (six or more years) to undertake trend analysis. Of these, twelve sites showed statistically significant trends in MCI at face value, with six negative and six positive trends (Table 3). After additional analysis however, only two statistically significant trends remain.

Table 3 Improving and degrading sites for MCI in the Horizons Region (bold indicates sites with the strongest trends, after the Benjamini-Hochberg FDR procedure was applied).

Improving Sites	Degrading Sites
Whanganui River at Pipiriki	Hautapu River upstream Rangitikei
Whanganui River @ Te Maire	Oruakeretaki Stream @ SH2
Mangatainoka River @ SH2 Bridge	Mangatainoka River u/s Tiraumea Confluence
Manawatu River @ Teachers College	Tamaki River @ Stephensons
Kahuterawa Stream @ Johnstons Rata	Tokiahuru Stream @ Karioi
Ōhau River at Gladstone Reserve	Owhahanga River @ Branscombe Bridge

- 3.2.6 The Hautapu River upstream of the Rangitikei confluence has a strong negative (declining) trend in MCI (although since 2008 MCI values appear to have plateaued within the range 69 – 78, but they remain lower than those recorded previously). The Whanganui River at Pipiriki shows a strong positive (improving) trend (but only when data from 1988 were included).
- 3.2.7 MCI provides a useful gauge of ecosystem health throughout the Region and this information helps inform policy development and implementation, as well as informing our non-regulatory programmes for land management and freshwater intervention work programmes.
- 3.2.8 In addition to this annual state and trend reporting, Horizons – in partnership with DairyNZ and NIWA – is currently undertaking an analysis of our regional data to determine drivers of macroinvertebrate health. This work will be ongoing throughout 2018.

Biodiversity Monitoring Strategy

Context

Monitoring of the effectiveness of the protection and enhancement of works under the non-regulatory biodiversity programme is a requirement of method 6-2 in the One Plan. In 2016 the Horizons science and innovation team developed a bush remnants monitoring protocol and have been trialling the use of this protocol. During 2017-18 a peer review of the monitoring protocol was undertaken to inform future implementation.

Activity

- 3.2.9 This monitoring protocol is relatively simple and practical. It aims to provide an initial system for examining changes resulting from the protection and enhancement of priority bush remnants across the region. In order to do this efficiently it is limited to mostly qualitative variables. Therefore the process relies heavily on the skills of the field observer as much of the data collection process is based on visual estimation during rapid ecological assessment (REA) surveys.
- 3.2.10 Variables assessed during monitoring include those that directly respond to any change in site management regimes over time such as pest level, stock access, and understory revegetation. Approximately twelve sites are monitored annually on a rolling five year cycle. This means that approximately sixty sites (out of 200 to be managed) are measured every 5 years. Currently no unmanaged sites are monitored. Overall site scores are calculated based on the percentage of the maximum possible score. Site scores are tracked through time to determine improvement.
- 3.2.11 This protocol recently underwent an external “desktop” review. The monitoring protocol was found to be suitable for initial monitoring of changes in bush remnants, is practical and fast (requiring only a single visit), and is relatively simple to understand and communicate. The current approach enables us to monitor aspects (understory) likely to show important short term change, although it lacks an assessment of mature tree canopy health. Summaries of monitoring data could be enhanced.

- 3.2.12 Other feedback included considering a more integrated approach across the region's landscapes and land uses. It was noted that as the biodiversity program evolves ensuring a wider and more integrated monitoring program will become more important. It will also be important to ensure that links between monitoring and management are strengthened, providing a clear feedback loop identifying if the type of management being applied at a site is driving improvement or not.
- 3.2.13 The current monitoring protocol has been designed to provide a simple tool to monitor effectiveness of regional biodiversity enhancement policy as well as track changes in management outputs at site level, in a cost and time efficient manner. A more comprehensive monitoring programme would require greater resource. The monitoring program is being considered and further refined as part of the larger biodiversity stocktake and review currently underway.

Biodiversity review

Context

The Science and Innovation team, in collaboration with the Biodiversity and Biosecurity team, has initiated a stocktake and review process to assess the effectiveness of the current regional monitoring programme for wetland and forest fragment biodiversity (colloquially known as the Top 100/200 programme) to inform the structure and design of future monitoring of these important habitats.

Activity

- 3.2.14 The first stage of this work programme is to complete a stocktake and review of current processes, tools and site inventory. This work is underway and a series of workshops have been held to identify key areas of focus for the review. Three of the four workshops have taken place during the early stages of 2018, and have largely focussed on current processes and protocols around data collection, storage and curation, as well as identifying current and future needs. The outcomes of these workshops are currently being documented in a report. The final workshop will be held in June to discuss draft findings and recommendations, after which the report will be finalised and made available to council upon completion.

3.3 Activity Progress Report

Project	Key Deliverables	Progress to Date
Wetlands and Bush Remnants	10 actively managed bush remnants surveyed	- Monitoring will be delivered within the reporting year. - A review of these programmes is progressing to schedule. - Mapping of potential ecosystems applying the Singers and Rogers classification system is now underway.
Totara Reserve	Assessment of the trend in native birds	Completed in December 2017
Lakes Monitoring and Prioritisation	- Lake SPI for 11 lakes - Lakes stocktake and	- Lake SPI report due before end of financial year - Lake stocktake contracted, to be completed

	prioritisation report	within calendar year. Lake Prioritisation pending dependant on stocktake outcome.
Information and Advice	▪ Provide biodiversity information and advice as required	▪ Biodiversity-related data, information and advice requests are tracking at just under four per month.
National Engagement	▪ Regular contribution to the Biodiversity Working Group (Regional Council Special Interest Group)	▪ Continued attendance and contribution to Biodiversity Working Group meetings.

Lizzie Daly

SCIENTIST - ECOLOGY

Abby Matthews

SCIENCE AND INNOVATION MANAGER

Jon Roygard

GROUP MANAGER NATURAL RESOURCES AND PARTNERSHIPS

4 Environmental Reporting and Air Quality Monitoring

4.1 Activity Overview

Effective management of the Region's natural resources depends on accurate and timely information about the environment and its health, along with ready access to this information and having it packaged in a way that is understandable for the intended audience. Reporting provides a summary of the information in a way that can inform decision-making and help to raise the community's awareness of natural resources and their management. This includes the state of our natural environment, how it is changing and where there might be opportunities for further growth and development.

The delivery of the 2018 State of the Environment (SoE) report will be a key output for the year. Policy effectiveness monitoring will continue to focus on assisting the Strategy and Policy Team with policy effectiveness monitoring of the implementation of the One Plan, in addition to supporting implementation programmes across the Natural Resources and Partnerships Group and the wider organisation.

The air quality monitoring programme will continue to monitor and report on air quality in Taihape and Taumarunui, the two air-sheds designated under the National Environmental Standard for Air Quality.

The Environmental Reporting and Air Quality Monitoring programmes are measured against four performance measures that require the Science and Innovation Team to report to Council on progress five times per year. As stated in the Annual Plan 2017-18, reporting includes both formal reporting and Council workshops. Measures include:

Performance Measure	Reporting Period					YTD Actual	Target
	1st	2nd	3rd	4th	5th		
Complete State of the Environment report including reviewing and updating environmental indicators* ¹	✓	✓	✓	✓	✓	100%	100%
Undertake policy and programme implementation effectiveness monitoring and provide input into programmes and policies that are in development* ¹	✓	✓	✓	✓	✓	100%	100%
Environmental information is made available to the public via Horizons' website, Environment Committee reporting and on request, including contributions to national level reporting* ¹	✓	✓	✓	✓	✓	100%	100%
Monitor and report on air quality* ¹	✓	✓	✓	✓	✓	100%	100%

*¹ AP/LTP targets

4.2 Activity Highlights

This report covers the reporting period from 1 March to 30 April 2018. A summary of the progress made against the targets for the year is in the table at the end of this section.

Air Quality

Context

New Zealand's National Environmental Standards for Air Quality (NESAQ) require that regional councils monitor and report exceedances of the short-term **World Health Organisation** (WHO) guideline values for outdoor air quality. Monitoring of air quality is undertaken by Horizons in two designated airsheds: Taihape and Taumarunui.

Activity

4.2.1 Data collected over the last 12-month period at Taihape and Taumarunui are presented below. The graphs are from the Horizons AirQuality Matters website and comprise telemetered 'raw' data.

The Beta Attenuation Recorders (BAM) units installed at the Taihape and Taumarunui sites are scheduled to have their annual independent calibration check done by WaterCare staff during the week of 14 May 2018.

Taihape

4.2.2 The daily mean PM₁₀ concentrations recorded at Taihape are shown in 6 below. The monitoring data despite a couple of elevated concentrations in December 2017 and April this year shows compliance with the NESAQ for the 2017 -18 year.

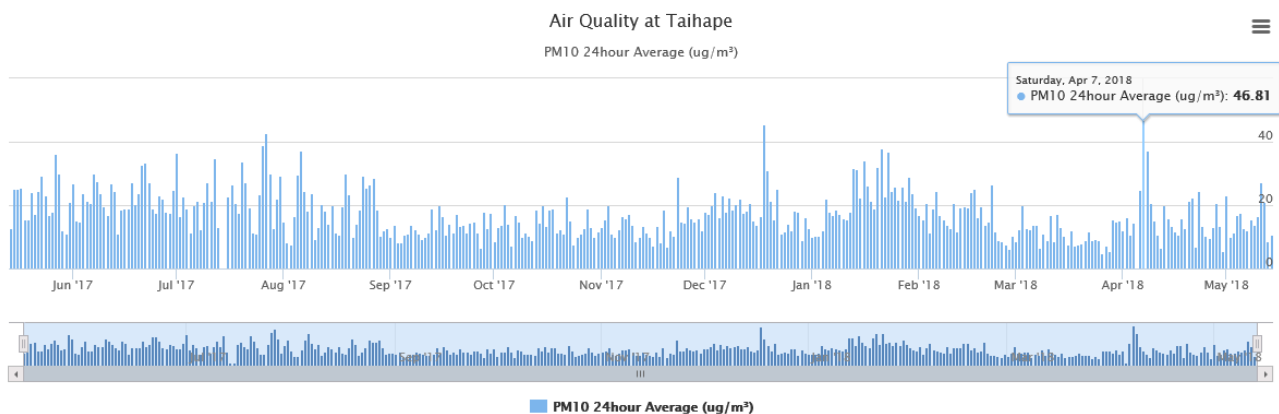


Figure 4 Air quality monitoring for particulate matter at Taihape from mid May 2017 to May 2018, reported as a 24-hour average ($\mu\text{g}/\text{m}^3$)

Taumarunui

4.2.3 The Taumarunui recording site was moved in late January 2018 from the Baptist Friendship Centre at 250 Taupo Road to the Horizons Service Centre yard at 34 Maata Street, Taumarunui. This move will eliminate issues encountered with regular power supply to the BAM unit (seen as gaps in the data the daily mean PM₁₀ concentrations recorded at Taumarunui, as shown in 7, below). The data shows Compliance with the NESAQ for the 2017-18 year.

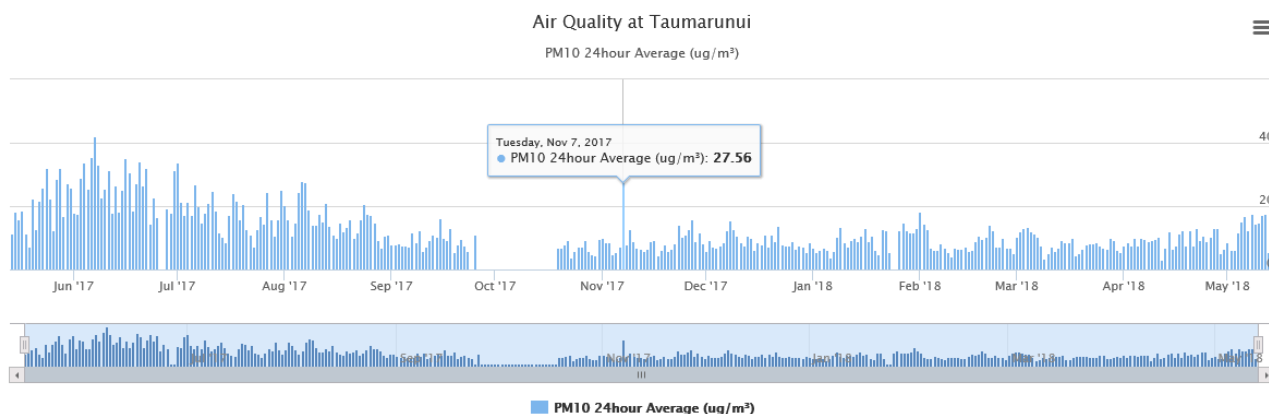


Figure 5 Air quality monitoring for particulate matter at Taumarunui from mid May 2017 to May 2018, reported as a 24-hour average ($\mu\text{g}/\text{m}^3$).

4.3 Spotlight On... Swim Spot Monitoring Programme

Context

Monitoring of the Region's popular swim spots takes place during summer (from the beginning of November to the end of April each year). The aim is to provide the public with up-to-date information about the suitability of our rivers, lakes, estuaries and beaches for recreational activities. The programme is delivered in collaboration with Public Health, who provide health messaging based on the monitoring data Horizons collects.

Weekly results are made available to the public through Horizons' and LAWA websites. Our public campaign promotes our Region as a great place to play, helps communities find the most up to date swim spot information, as well as highlight the work being done to improve the health of waterways in our region.

Activity

4.3.1 This season, 82 sites were monitored weekly from the beginning of November 2018 until the end of April 2018. This included 66 river sites, 11 beaches and 5 lakes. Sampling was carried out Sunday through Tuesday, with runs constantly rotated so that each site was regularly visited during the weekend. This provided more direct communication with the public at swim spots and gave a better indication of the popularity of each site. An increase of swim spot users on weekends was

mainly observed on beach sites, and rivers and lakes near campgrounds. Generally people reacted positively when meeting the monitoring team and showed great interest in the programme.

- 4.3.2 At rivers and estuaries, *Escherichia coli* (*E. coli*) concentrations were monitored as an indicator of faecal contamination, along with percent cover of potentially toxic algae (*Phormidium*). In lakes, *E. coli* concentrations and planktonic cyanobacteria were monitored, with the exception of Hokowhitu Lagoon, where *E. coli* concentrations were accompanied by observations of benthic cover of potentially toxic algae. Enterococci concentrations were monitored at beach sites as faecal indicator organisms in marine waters.
- 4.3.3 Monitoring results were published as soon as available on the Horizons swim spot web site and the “Can I swim here” module on LAWA. A traffic light system (Figure 6) is used to communicate results. A green status indicated safe swimming conditions, amber advised caution and red signalled to not use the site for recreational activities at the time. Public health was immediately informed about all monitoring results and issued the warning status for the site if necessary.



Figure 6 Traffic light system for the reporting of risk grades for swimming.

- 4.3.4 Figure 7 shows 63 of 66 river sites were swimmable (green and amber status) for *E. coli* at least 50% of the time. Fifty one river sites were swimmable at least 75% of time and 19 sites showed a green or amber status 95% of time. Our best river site based on *E. coli* results was Pohangina River at Piripiri, which maintained a green status throughout the season. Six other sites, including three on the Ohau River also maintained a swimmable status but with some *E. coli* results falling into the amber status.
- 4.3.5 Ototoka Stream at Beach Road, Kai Iwi Stream at Archers Bridge and Mowhanau Stream at Footbridge in Whanganui showed almost consistently high *E. coli* levels throughout the season. Therefore, these sites maintained a red status for more than 50% of the time. All three sites are at the bottom of catchments. The high *E. coli* results at these sites were independent of rainfall events. Health warning signage was erected at all three sites during the season and maintained throughout. Options for permanent signage at these sites are currently being discussed with Public Health.

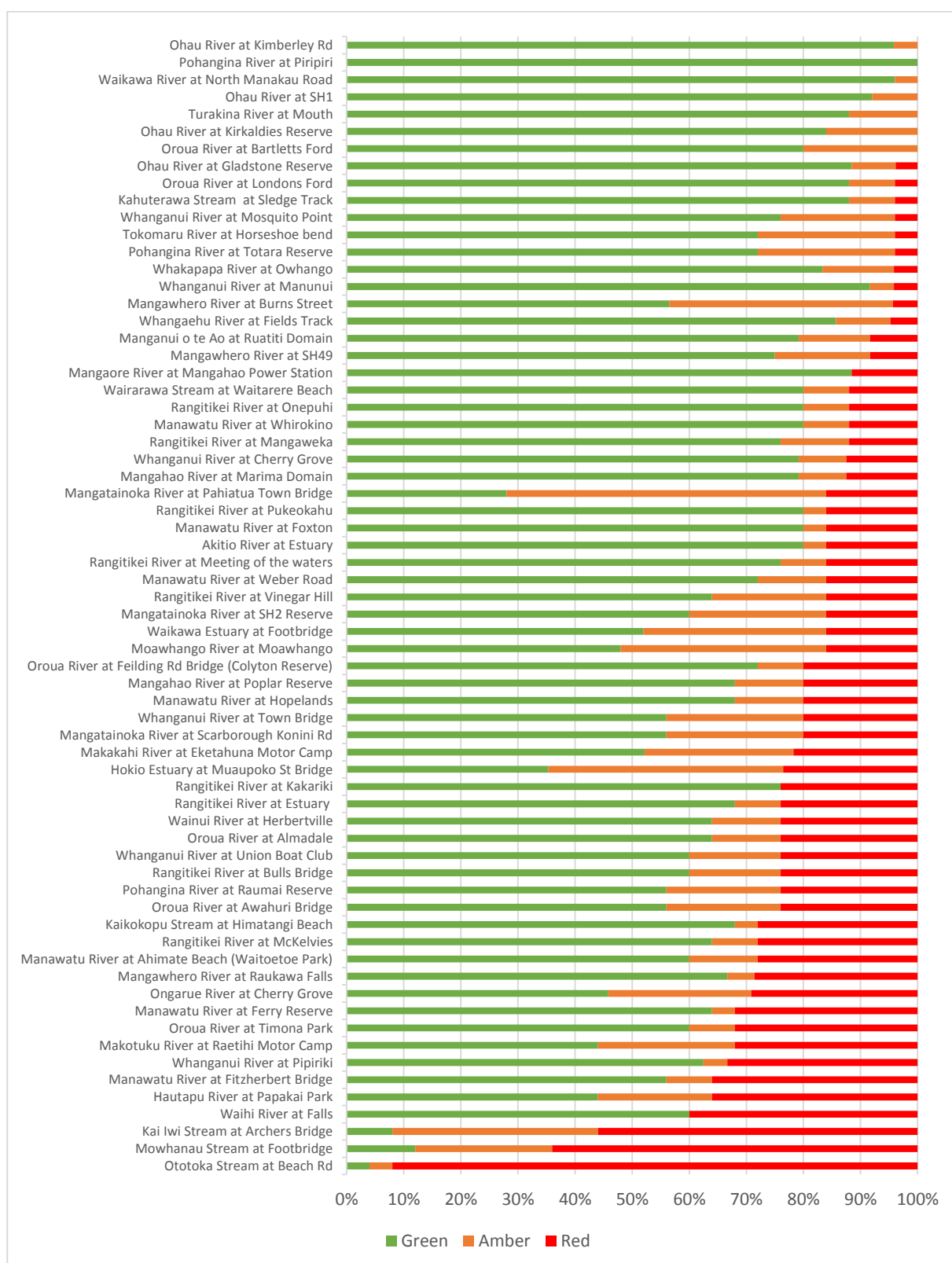


Figure 7 Percentage of green, amber and red status based on *E. coli* results of each river site during the 2017-18 swimming season in order of most to least swimmable.

Faecal Source Tracking

- 4.3.6 To identify potential sources of faecal contamination at the three sites in Whanganui, faecal source tracking was conducted. In addition to the swim spot sites, samples were also taken upstream of the swim spot sites at Kai Iwi stream and Mowhanau stream. The analysis showed ruminant contamination of up to 50% at the Mowhanau and Kai Iwi sites but it was unclear whether the source of contamination was from cows or sheep. At the Kai Iwi stream at Archer's bridge site, faecal sources from birds were also detected. These were not detectable at the upstream site of Kai Iwi stream and therefore indicate that contamination through birds must enter the stream between the two sites.
- 4.3.7 Faecal source tracking at Ototoka stream at Beach Road revealed strong contamination from ruminants, making up 50-100% of the faecal input at the site and specifically identified cows as a contributor (accounting for 10-50%). Another river site with frequent *E. coli* concentration within the red alert range was Makotuku River at Raethi Motor Camp. Faecal source tracking at this site identified ruminants and birds as sources of faecal contamination.
- 4.3.8 Based on these results, stock exclusion from streams in these areas could help improve water quality and swimmability. Stream fencing and riparian planting is already taking place in the Whanganui region close to the identified sites. The results from this season's monitoring suggest that positive effects may not be seen immediately and efforts in these areas to exclude stock from streams should continue.
- 4.3.9 At all other river sites, high *E. coli* values within the red status range were mostly observed during or after heavy rainfall events. Therefore no further site closures at river sites because of high *E. coli* levels were necessary during this season.

Potentially toxic algae (*Phormidium*)

- 4.3.10 In addition to *E. coli*, potentially toxic algae (*Phormidium*) was monitored during the swimming season at the river sites. The red, green and amber status is related to the percentage of benthic algal cover at the site. A green status is achieved when *Phormidium* cover is less than 20%, amber when cover is between 20% and under 50% and a red status is triggered when cover exceeds 50% or when mats are detaching from rocks or are exposed at the water's edge. Once an amber or red status is reached this site must show two consecutive weeks of algae coverage in the lower status range to be moved to a better swimming grade. Not all sites are equally susceptible to *Phormidium* and substrate of the river bed is a key factor.
- 4.3.11 Figure 8 shows *Phormidium* cover was observed at 56 river sites, of which 51 were swimmable (green and amber) at least 50% of the time. Thirty three rivers and streams were swimmable at least 75% of the time and 9 sites were swimmable 95% of the time. When rivers were too turbid to observe *Phormidium* cover, no data was reported and these are shown as 'no visibility' in Figure 8. These occasions were not counted as swimmable, as swimming was generally not advised under these conditions.

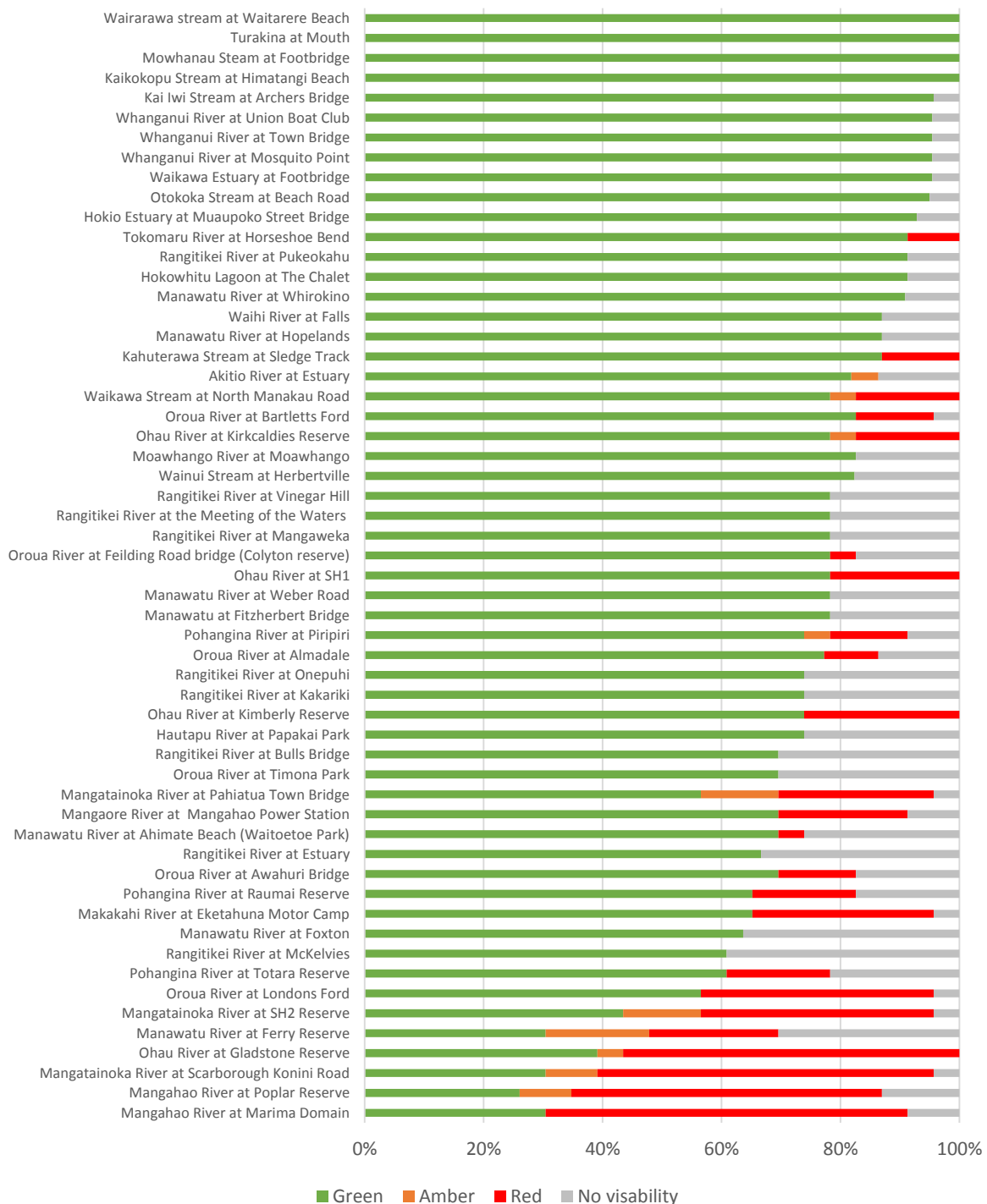


Figure 8 Percentage of green, amber and red status based on potentially toxic algae (*Phormidium*) coverage results of each river site during the 2017/18 swimming season in order of most to least swimmable.

- 4.3.12 Sites with particularly low *Phormidium* cover were those with low potential to grow toxic algae, such as sandy estuaries and sites with deeper and more turbid waters. At many sites in the Rangitīkei and Manawatū rivers, *Phormidium* were observed but on several occasions but visibility was too low to make an observation.
- 4.3.13 Overall, long periods of dry hot weather during this swim season resulted in an increased amount of *Phormidium* cover. Because the change in cover can occur more quickly than can be observed during weekly monitoring, it is important for swim spot users to feel confident identifying *Phormidium* themselves, so direct contact can be avoided. A public education campaign before and during the next swim season could help to achieve this goal.

Lakes and Hokowhitu Lagoon

- 4.3.14 Figure 9 shows all monitored lake sites and Hokowhitu Lagoon were swimmable more than 70% of the time during the season, based on *E. coli* results. Lakes Pauri and Wiritoa were at a green or amber *E. coli* status 100% of the time (Figure 6). Red alerts at Hokowhitu Lagoon were mostly observed during or after high amounts of rain.

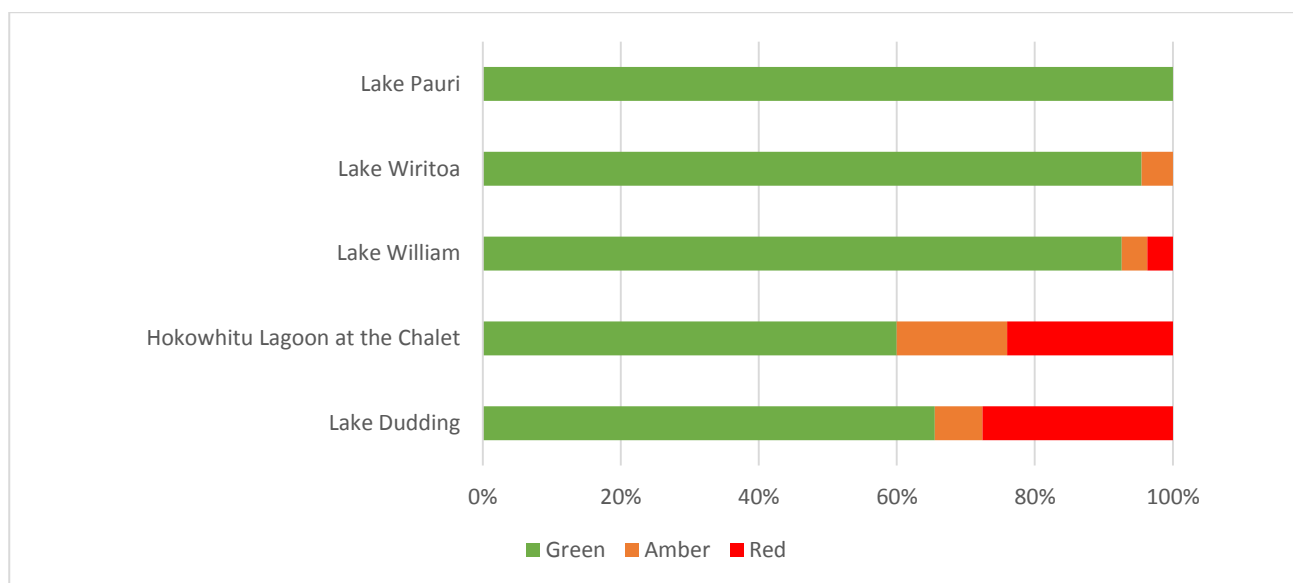


Figure 9 Percentage of green, amber and red status based on *E. coli* concentration at lakes during the 2017/18 swimming season in order of most to least swimmable.

- 4.3.15 Lake Dudding showed unusually frequent *E. coli* concentration at red alert level compared to results from previous years and the State of the Environment programme. These occurred also during long periods of dry weather and were partially overserved during times of high visitor numbers at the lake, such as long weekends or summer holidays. Faecal source tracking samples have been collected and are currently at the laboratory for analysis. The results of this analysis are expected at the end of May 2018. Consultation with Rangitikei District Council revealed leakage of pipes discharging effluent from the camp site to land on the opposite site of the lake. These leaks

have since been fixed but very high *E. coli* concentrations (> 4000 MPN /100ml) were still observed afterwards. Once the results from faecal source tracking are available these can be used to guide effort to reduce *E. coli* in Lake Dudding.

4.3.16 Planktonic cyanobacteria monitoring occurred throughout the whole season and revealed first blooms with potentially toxic species in all lakes (except Hokowhitu Lagoon) at the end of November 2017. Samples were sent for toxicity testing and did not show the production of toxins. However, skin contact with these blooms can still cause irritations and allergic reactions. Because cyanobacteria blooms in lakes can subside and reoccur very quickly and toxin production can take place at any time, it was decided to advise caution (amber alert level) throughout the season for all lakes after the first bloom.

4.3.17 Swimmability at beach sites was generally good throughout the season (Figure 10). With the exception of Hokio beach, all beaches were swimmable 84% of the time or more. Four beaches were swimmable (green or amber) throughout the entire season.

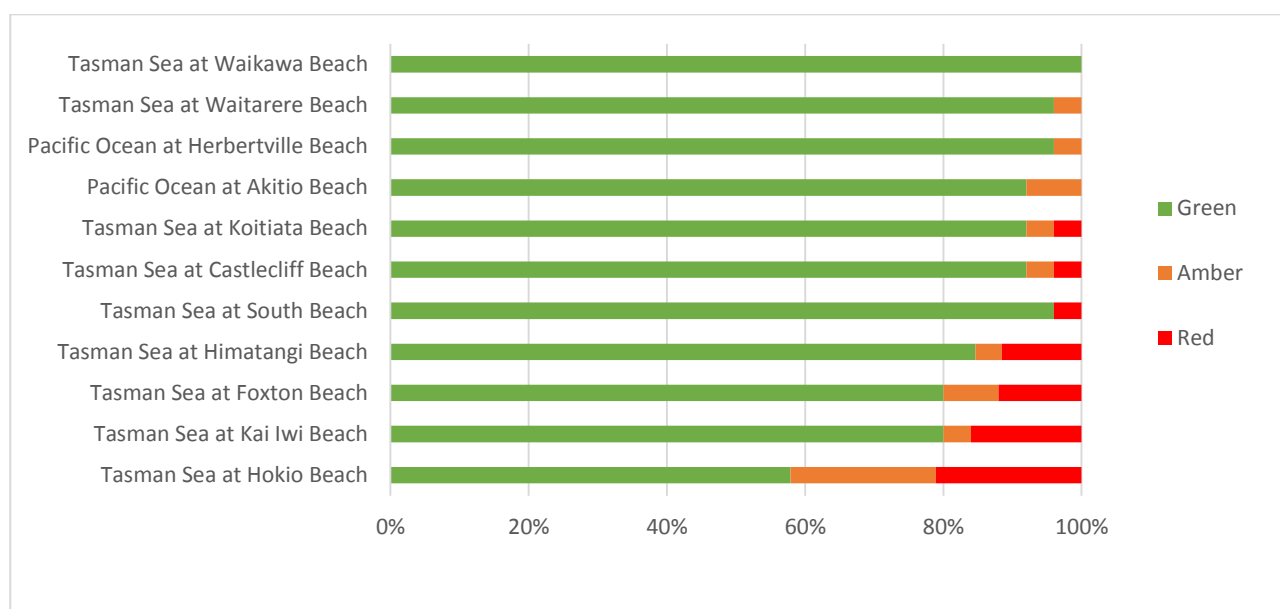


Figure 10 Percentage of green, amber and red status based on Enterococci concentration at beaches during the 2017/18 swimming season in order of most to least swimmable.

4.3.18 Red alerts at beaches were often related to high rainfall events. The closest river sites to each beach almost consistently showed high levels of *E. coli* when high concentrations of Enterococci were detected at the beach. This points to rivers at the main source of faecal contamination at the region's beach sites.

4.3.19 At Hokio beach high Enterococci levels were often consistent with high *E. coli* or high Enterococci levels at the Hokio Estuary. These occasions were not always related to rainfall and other sources of contamination are yet to be identified.

- 4.3.20 Overall conditions for recreational activities throughout the region were good this swim season. Sites with increased faecal contamination were identified early and investigations to identify sources were undertaken. At all other sites, high levels of faecal indicator bacteria were related to high rain fall events, during which swimming is generally not advised. During dry periods toxic algae and planktonic cyanobacteria blooms caused red alert levels at some swim spots. Public education to identify and avoid these organisms is an effective strategy to ensure safety at these sites and we propose that more emphasis be placed on this aspect of the programme during 2018-19.

Public Campaign 2017-18

- 4.3.21 In 2017-18, a summer swim spot public campaign was run alongside the monitoring programme. A key objective of the campaign was to continue the conversation with our communities around when and where they can swim within our region. Further, the campaign provides an opportunity to communicate how our monitoring programme and science helps to inform Horizons' work programmes and initiatives, raising awareness of the wider functions of the Regional Council. Celebrating partnerships and highlighting the work that is already underway to improve water quality is an opportunity to celebrate success and encourage continued participation.
- 4.3.22 Campaign collateral drove people to both Horizons' website and LAWA's Can I Swim Here? pages. Horizons' website received 11,309 individual swim spot map views (an increase of 4,300 from last season), and 11,049 individual swim spot table views, as well as 1,728 individual views on our competition page. LAWA's dedicated Can I Swim Here? page for our region had 7,876 sessions from 5,513 individual users.



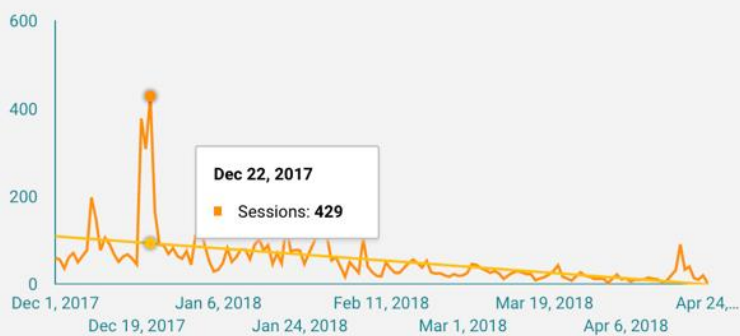
Dec 1, 2017 - Apr 24, 2018

Horizons Region website report

Data from Google Analytics

Sessions	Users	Page Views	% New Sessions	Avg. Session Duration
7,876	5,513	23,772	63.22%	00:02:49
↑ 85.9%	↑ 80.9%	↑ 110.9%	↓ -8.6%	↑ 13.4%

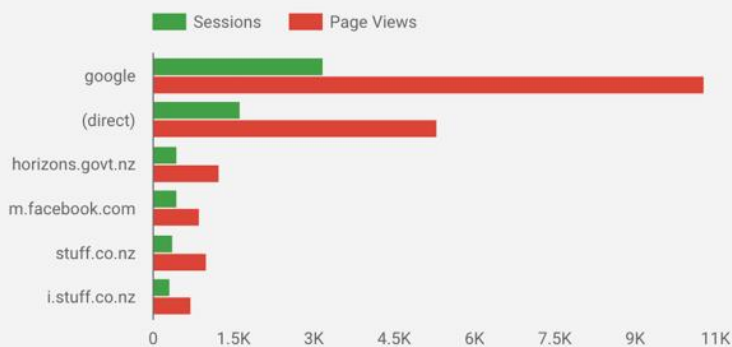
How are site sessions trending?



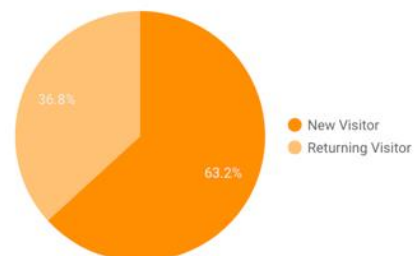
Sessions by location



Which channels are driving engagement?



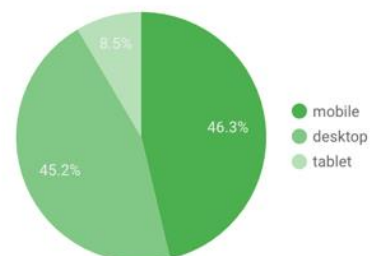
New vs. Returning Users



What are the top pages being viewed?

Page	Page Views
1. /explore-data/manawatu-wanganui-region/	1,378
2. /explore-data/manawatu-wanganui-region/swimming/	1,313
3. /explore-data/manawatu-wanganui-region/river-quality/	913
4. /explore-data/manawatu-wanganui-region/river-quality/manawatu/	580
5. /explore-data/manawatu-wanganui-region/swimming/waikawa-estuary-a...	416

How are we being viewed?



4.3.23 Media releases and opinion pieces helped to educate our communities about our monitoring programme and what we are doing to improve water quality. Over 50 media stories relating to water quality or our campaign were recorded between November and April.

THE COUNTRY | Environment

Popular Whanganui swimming spots get safety green light

6 Dec, 2017 8:00am

3 minutes to read



Swimmers float down the Rangitikei River. Photo/ supplied

Wanganui Chronicle
By: Laurel Stowell



Most of the Whanganui-Manawatu popular swim spots are safe for swimming, Horizons Regional Council chairman Bruce Gordon says.

Council staff are again taking water samples weekly during the summer months at swim

Cynobacteria found at popular Manawātū swim spots

JONO GALUSZKA

Last updated 17:10, December 21 2017



Alixzae Lewis, 9, swims at Horseshoe Bend.

WARWICK SMITHSTUFF

The beautiful summer weather is attracting people to Manawātū swimming holes, but the blessing has come with a curse.

Horizons Regional Council staff have found brown and black algal mats of cyanobacteria at swim spots throughout the region, prompting MidCentral DHB's medical officer of health Dr Rob Weir to issue a warning.

Cyanobacteria can produce harmful toxins, which do not have to be swallowed to make people vomit or suffer from diarrhoea and skin irritations.



Signs are warning of Cyanobacteria at swimming holes.

WARWICK SMITHSTUFF

NEW ZEALAND

NZ's best and worst swimming spots revealed in new website

20 Dec, 2017 12:00pm

5 minutes to read



A public health officer revealed in a media briefing that contact with the phormidium algae could cause eye irritation, breathing difficulties if inhaled, and stomach upsets. Source: Taupo District Council



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THE COUNTRY | Environment

Water is improving in Dannevirke region

17 Feb, 2018 7:00am

Quick Read



Water quality has improved in the Dannevirke and Central Hawke's Bay region.

Dannevirke News



An independent report has shown that water quality for sediment and E. coli have improved over the past seven to 10 years in the Horizons Region, which includes Taranaki.

There are encouraging signs that interventions are contributing to water quality improvements.

The study was commissioned jointly by the Ministry for the Environment and Horizons Regional Council to understand improving water quality trends in the region. Ministry for the Environment Deputy Secretary — Water Cheryl Barnes says the study shows considerable progress can be made in reasonably short timeframes.

"The key was taking a planned, whole of catchment approach and prioritising effort and investment where it would make the most difference."

- 4.3.24 Horizons' social media channels were used throughout the campaign as another way to connect with our communities. Post ranged from promoting swim spot locations and informing if there had been a change in conditions such as increased cover of potentially toxic algae (Phormidium), through to encouraging entries into our competitions. While it is hard to track sentiment, anecdotally we would say comments and conversations differed from last year's campaign where we spent a lot of time responding to negative comments, explaining the monitoring programme and talking about our role. This year our communities did most of the talking, including use of our monitoring data and talking positively about their swim spots. We reached 52,717 people from 25 posts, this converted to 4,044 click-throughs, 597 engagements (likes, comments and shares), and 10,244 views of two videos.
- 4.3.25 Three competitions were run as part of the campaign; Spruce Up Your Swim Spot, #swiminourregion photo competition, and Mosquito Point artwork. These were primarily promoted through social media, with Mediaworks contracted throughout the region to get people to vote for their swim spot for the Spruce Up.
- 4.3.26 The Spruce Up competition received 1,170 unique votes (up from 450 votes last year), with a total reach through Facebook of 52,216 people and 4,112 click-throughs and engagement. Cherry Grove in Taumarunui took out first place and will involve conversations with Ruapehu District Council, iwi and community members on what they would like to see spruced up at the site prior to next season.
- 4.3.27 Last season's winner of Horizons' #swiminourregion photo competition redeemed her prize by taking her class whitewater rafting on the Rangitikei River. This provided great video footage that we used to help promote this summer's competition <https://www.youtube.com/watch?v=mZY1Q-1ldU0>. This season we received 110 entries, with a total reach through Facebook of 109,766 people and 5,890 click-throughs and 1,149 engagements. The winner was selected by Horizons chair, chief executive and Manawatū Standard's photojournalist David Unwin. Amanda Hodge will choose her \$1500 water themed prize prior to the start of next season.



Figure 11 #swiminourregion winner Amanda Hodge's entry

4.3.28 All 28 entries of the Mosquito Point competition were received from Wanganui High School's design visual communications class. The winner's entry will be unveiled on site 25 May 2018 in the presence of Horizons, Whanganui District Council, iwi, and Wanganui High School representatives.

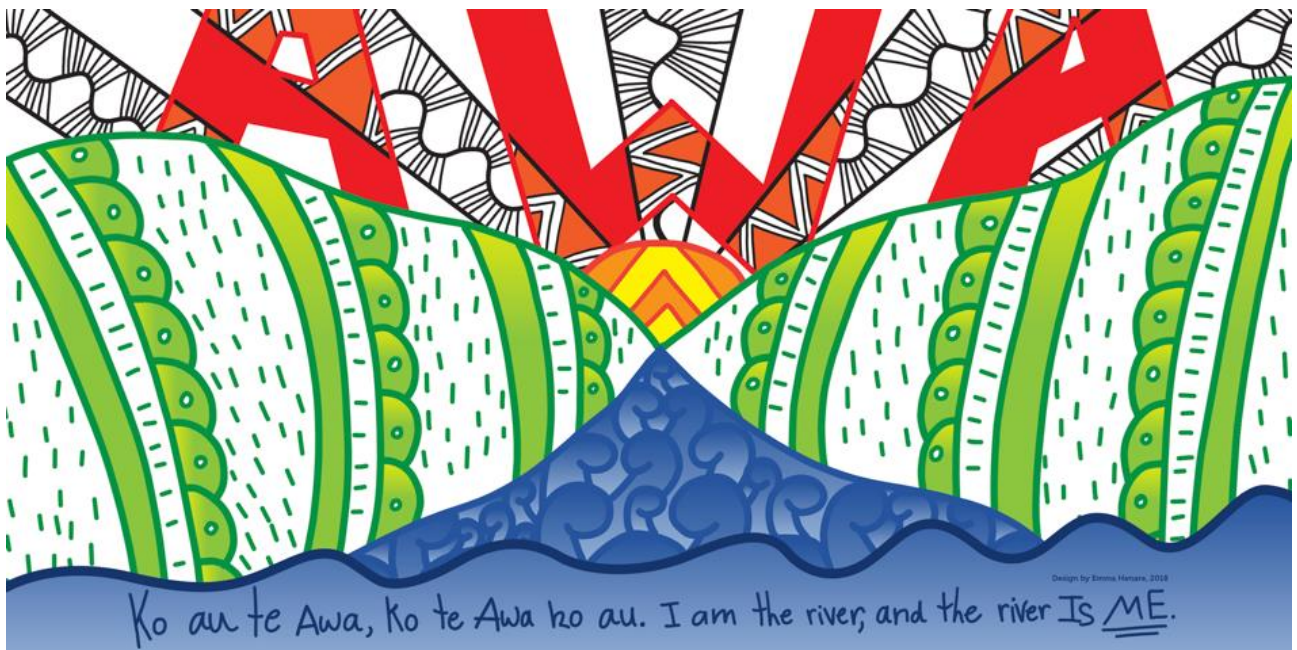


Figure 12 Mosquito Point winner Emma Henare's artwork, with elements from Grace Smith's entry.

- 4.3.29 District specific editions of Across the Region highlighting the swim spot monitoring programme and competitions, 2007-2016 water quality trends, what we are doing to improve freshwater, and councillors quotes were delivered to approximately 98,000 households and an online database of over 1,000 people.
- 4.3.30 In addition to our own external communications, we contracted Mediaworks to help promote our monitoring and campaign. This included MoreFM in Manawatu and Whanganui taking 'the first swim of summer, as well radio adverts across our region, an online video on demand advert, as well as social media posts through their own channels promoting the Spruce Up Your Swim Spot competition. Horizons science and innovation manager and media communications manager also joined the Mike West in the Morning crew at Himatangi's Beach Dig.
- 4.3.31 Two monitoring staff vehicles were branded with campaign material for the summer, working as moving billboards throughout the region.
- 4.3.32 While communication with our communities was the primary goal of this campaign, it was also critical to engage our internal stakeholders too. The monitoring programme and campaign were presented all staff and council members to ensure buy-in.

4.4 Activity Progress Report

Project	Key Deliverables	Progress to Date
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Project	Key Deliverables	Progress to Date
Air Monitoring and Reporting	Air quality monitoring and reporting	Air quality monitoring continues in the Taihape and Taumarunui airsheds.
	Air quality public education campaign – cleaner heating	- The 2017-18 public education campaign has been down-scaled due to the budgeted cost being diverted to moving the Taumarunui monitoring site. - Social media posts and radio advertising campaign promoting the early collection of firewood and clean burning in progress.
Envirolink	Secure Envirolink-funded science relevant to Horizons	Nine Envirolink grants for a total of \$176,799 in funding have been secured this financial year. Note that three of these grants were submitted on behalf of the regional sector and have national relevance as well as being useful to Horizons.
LAWA website	Supply information as required	- The annual update of water quality information for the LAWA website was released in September. The new “Can I Swim Here?” module followed in December 2017. - Groundwater quality data is currently being prepared for the release of this new module. - The annual update of water quality information for the Rivers, Lakes and Coastal modules is also in preparation. Staff continue to work with LAWA via the SWIM group to ensure the methodology for analysing these data is robust and in line with current best practice.
	Development of new modules	Support will be provided as needed.
State of Environment Reporting	Project plan for delivery of the 2018 SoE report	Water quantity and quality data analysis and reporting of Air, Biodiversity and Biosecurity, Fluvial and Land content is underway.
Catchment Summaries and Report Cards	- Key catchment information identified - Reporting framework developed	Progress on the Upper Manawātū Catchment Summary is on hold pending the updated water quality state and trend analysis.
Public Information and RMA Advice	Information provision to the public and external agencies.	- Information provision to external organisations has continued. - Media requests have focused on swimmability and water availability as key topics of interest.
Community Engagement	Information provision via websites, public engagement and documentation	The team continues to promote and share information collected via science research and monitoring through a range of mechanisms, including the Irrigation NZ newsletter, Horizons’ Swim Spot campaign, and reporting to Council.
National Engagement	Contribution to national forums	- Staff continue to lead and participate in regional council special interest groups and national working groups. - Staff are involved in the development of the National Environmental Monitoring Standard for Discrete Water Quality, Periphyton and Macroinvertebrates.

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