



# WATER QUALITY AND QUANTITY

## 1 ACTIVITY OVERVIEW

The Water Quality and Quantity Activity of the Annual Plan includes the work programmes of Horizons' Freshwater & Partnerships Team and the Science and Innovation Team.

Horizons' Freshwater & Partnerships Team works closely with other Horizons teams and people external to the organisation, to implement water quality and aquatic habitat improvement works. This work draws on monitoring and research undertaken by Horizons' Science and Innovation and Environmental Data teams, along with that of other agencies, to priorities and focus implementation efforts.

Both programmes actively seek funding from other sources to provide external science advice and facilitate the acceleration of works. This includes Freshwater Improvement Funding administered through the Ministry for the Environment for the Manawatū, Whangaehu, and Lake Waipu/Rātana Catchment, and the Community Environmental Fund for the Waikawa Catchment and funding of science advice through the Ministry of Innovation, Business and Employment's Envirolink fund of approximately \$120,000 per annum.

Implementation activities include riparian fencing and planting for water quality improvement and fish habitat enhancement, the identification and enhancement of whitebait spawning habitat and fish passage improvement, sewage treatment plant upgrades, work with horticulture growers and harvesting of lake weed.

Science activities include monitoring and reporting of water quantity for both surface water and groundwater, and the quality of groundwater, rivers, lakes, estuaries and the coast. More than 80 popular swim spots are monitored weekly throughout the bathing season (November – April). In addition to guiding implementation programmes, science and research also informs consent decision-making and policy development and implementation. Communication of science data and information is covered in the Environmental Reporting and Air Quality Monitoring section of this report.

This new format item presents the Water Quality and Quantity Activity regionally (where appropriate) and/or for each of the **Freshwater Management Units (FMUs)** that make up the Manawatū-Whanganui Region, integrating the implementation work of the Freshwater and Partnerships Team and the water quality and quantity activities of the Science and Innovation and Environmental Data teams. This includes the:

- Regional Water Quality and Quantity Programme;
- Whanganui and Kai Iwi;
- Whangaehu – including the Whangaehu FIF projects;
- Rangitīkei-Turakina – including the Lake Waipu (Rātana) FIF project;
- Manawatū – including the Manawatū River Accord and FIF project;
- Horowhenua – including the Lake Horowhenua Accord and FIF project, as well as freshwater improvement work with horticulture growers; and
- Coastal Tararua.

This report documents the year-end result for the Freshwater and Partnerships Team and provides an update for the Science work programmes from the previous report, including some updates for the new financial year.



Figure 1 Freshwater Management Units in the Horizons Region

## 2 REGIONAL WATER QUALITY AND QUANTITY PROGRAMME

### 2.1 Regional Freshwater & Partnerships Overview

#### PROGRESS AGAINST ANNUAL PLAN TARGETS

2.1.1 The Freshwater & Partnerships programme links with a range of national and regional policies and strategies. The programme aims to deliver freshwater enhancement work in partnership with others to improve water quality and aquatic health outcomes, and facilitating community involvement. Some of the work also informs restoration options and also seeks to build capacity. The programme delivers work across five key components:

- Regional freshwater programme, outside of the Manawatū and Whangaehu Catchments;
- Manawatū Accord and Freshwater Improvement Fund project;
- Whangaehu Catchment Freshwater Improvement Fund project;
- Waipu Catchment Freshwater Improvement Fund project to remove the Rātana **waste water treatment plant (WWTP)** discharge from Lake Waipu and irrigate to land and develop a restoration plan for Lake Waipu; and
- Lake Horowhenua Accord and Freshwater Improvement Fund project.

2.1.2 A summary of progress against Annual Plan targets is presented in this section of the report, and project updates on specific works are presented in the relevant FMU summary sections below.

2.1.3 Work programmes were interrupted by Covid-19 over the later part of the year. Overall, the stream fencing targets were all met with 107 km completed overall for a target of 79 km (Table 1). Nearly double the targeted amount of plants were planted, however one target was missed by a few hundred plants. Fish pass work was the most impacted by Covid-19 and these targets will be carried forward to the new financial year. Thirteen community projects were completed for a target of 14. Map 1 shows the locations of completed works over the year.

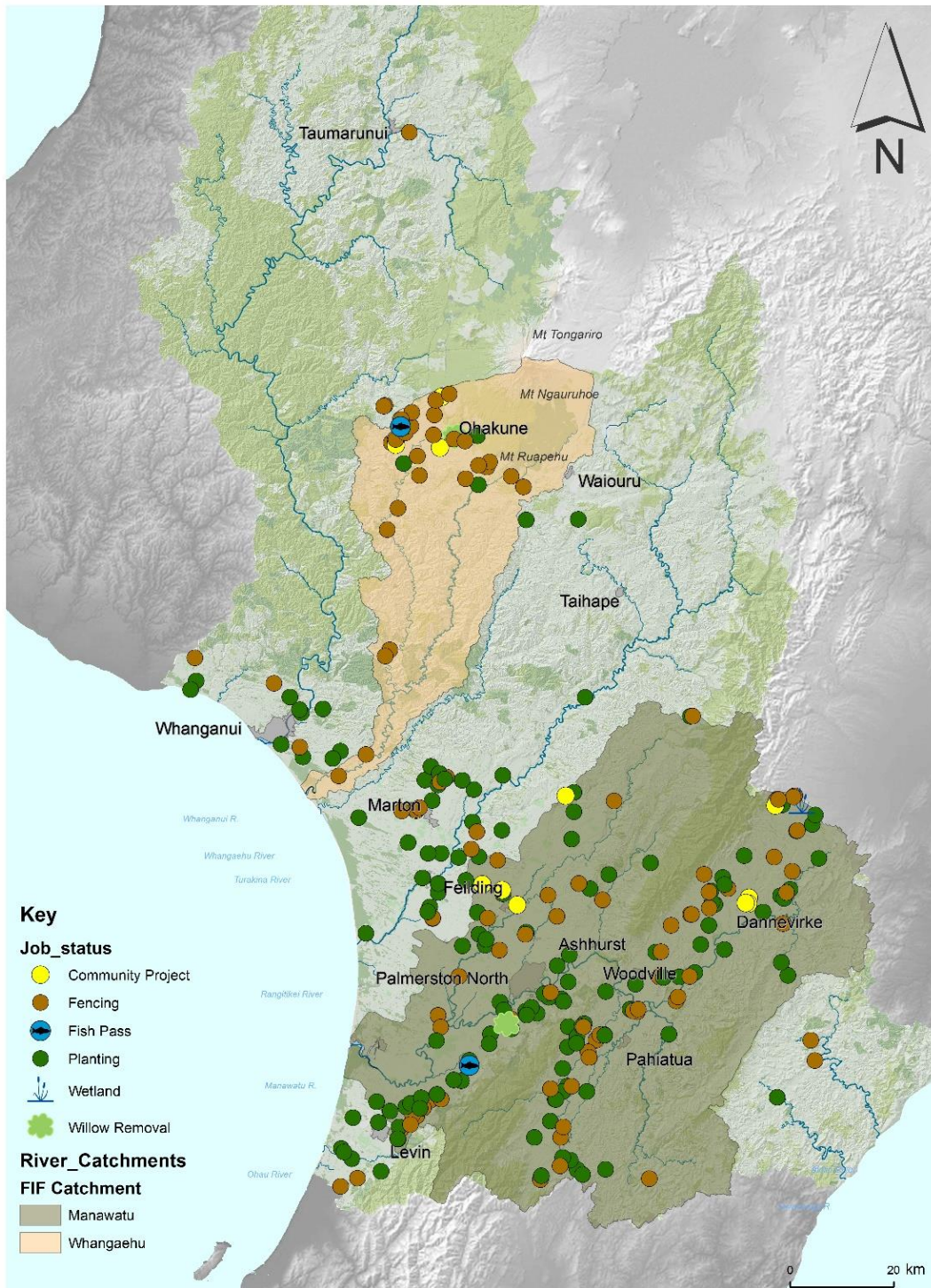
2.1.4 Enquires continue to be received on a daily basis from landowners who wish to undertake riparian planting this current winter and stream fencing this coming summer. These enquires are currently being registered; however, with current staff capacity a site visit is being organised in 6 to 12 weeks, depending on the capacity of the Freshwater Adviser working in the catchment.

2.1.5 The Regional Programme has received significant funding via the Jobs for Nature Fund and a paper on this was presented to Council in July. Work is underway with the Ministry for the Environment to establish the contract for the project.

Table 1: Freshwater & Partnerships programme progress on the 2019-20 Annual Plan targets as at 30 June 2020.

	Riparian fencing (km)			Riparian planting		
	Target	Complete	Percent complete	Target	Complete	Percent complete
Regional	12	22.382	187%	20,000	42,073	210%
Manawatū	50	56.004	112%	40,000	77,396	194%
Whangaehu	17	29.355	173%	3,333	3,095	93%
<b>Total<sup>1</sup></b>	<b>79</b>	<b>107.741</b>	<b>136%</b>	<b>63,333</b>	<b>122,564</b>	<b>193%</b>
	Fish Passes			Community projects		
	Target	Complete	Percent complete	Target	Complete	Percent complete
Regional	1	1	100%	1	1	100%
Manawatū	4	1	25%	9	8	89%
Whangaehu	2	1	50%	4	4	100%
<b>Total<sup>1</sup></b>	<b>7</b>	<b>3</b>	<b>43%</b>	<b>14</b>	<b>13</b>	<b>92%</b>

<sup>1</sup> NB: The totals in these target tables represent an overall total and achieving these totals does not necessarily mean all targets have been met, as it is the individual targets that are in the Annual Plan.



**Freshwater projects completed 2019-21**

Map prepared by L Ferguson, NRP. July 2020

Figure 2 Freshwater implementation projects for stream fencing, riparian planting, community projects and fish passes completed in the 2019-20 financial year.

## 2.2 Regional Water Quality & Quantity Science Programme Overview

### ANNUAL PLAN TARGETS

2.2.1 The science programme reports on two annual targets, as outlined in Table 2. These were both met in the 2019-2020 year.

Table 2 Water Quality and Quantity Annual Plan targets for 2020-21

Performance Measures for Levels of Service	Target 2020-21
Water quantity and water quality information is made available to the public via LAWA ( <a href="http://www.lawa.org.nz">http://www.lawa.org.nz</a> ) and Horizons' ( <a href="http://horizons.govt.nz">http://horizons.govt.nz</a> ) websites.	Data provided to LAWA as required
Annual report on water quantity and quality monitoring, and research activity and its findings.	1

## 2.3 Regional Project Updates

### MONITORING NETWORK REVIEW

2.3.1 Water quality and quantity monitoring is overseen by Horizons' Science and Innovation Team, but delivered in partnership with the Environmental Data, Consents Monitoring and Freshwater and Partnerships teams. Much of this activity focusses on improving knowledge and understanding of the Region's freshwater and coastal environments by monitoring the state of the environment, tracking changes over time and identifying areas of emerging pressure. Water quantity, quality monitoring and biomonitoring programmes currently encompass:

- River flow at 65 sites, groundwater levels at 192 sites and measurement of water use at more than 350 sites across the Region;
- River water quality at 90 state of environment sites, 32 discharges and 52 sites located upstream and downstream of discharges;
- Water quality at 9 coastal and estuary sites, and habitat mapping of 2 estuaries;
- Groundwater quality at 32 sites;
- Water quality in 15 lakes and habitat monitoring in approximately 10 lakes;
- 82 popular swim spots throughout the bathing season (November to April);
- Macroinvertebrates at 74 sites and periphyton at 63 sites.

2.3.2 During 2019-20 the Science and Innovation Team has been working with staff from Horizons' River Management, Environmental Data and Emergency Management teams to review Horizons' environmental monitoring network to ensure it is effective, efficient and fit for purpose to meet both current and future information requirements. This includes responding to national policy direction, such the recently released **National Policy Statement for Freshwater Management (NPS-FM)** and **National Environmental Standard for Freshwater (NES-FW)**.

2.3.3 This project seeks to assess Horizons' environmental data requirements, identify areas which may be currently over-represented and any redundancies in the network, establish potential gaps and recommend additional sites and / or parameters which may be required to:

- Understand our water resources;
- Prepare and protect our communities from natural hazards;
- Monitor the State of the Environment;
- Monitor the efficiency and effectiveness of national and regional policies and plans; and
- Monitor the impact of resource consents within the Region

The network review is now in the reporting phase, with timing of delivery set to inform long-term planning discussions from August 2020.

2.3.4 A complementary piece of work is a dedicated review of the lakes monitoring network in light of the monitoring requirements in the [NPS-FM](#) and recommendations in Horizons' [2019 State of Environment \(SoE\) report](#). This review outlines the rationale used to select the proposed long-term lake monitoring sites to represent all FMUs with natural geomorphic lake types in the Horizons Region. Three options for future monitoring are presented in the report, and all options retain the current SoE monitoring of 15 aeolian/dune lakes.

2.3.5 Monitoring costs and lake access issues continue to present barriers to the development of this programme. As outlined in the May 2020 Environment Committee report, the Science Team is working with Xerra Earth Observations Institute to explore complementary methods, such as lake water quality monitoring by satellite remote sensing, which offers the potential for more frequent and cost-effective monitoring of some water quality parameters (e.g. chlorophyll-a, turbidity, suspended particulate matter), cyanobacteria blooms, macrophytes and algal growth in at least 57 lakes in the Region. A workshop with Xerra is planned for early August 2020 to discuss the potential development of this monitoring.

2.3.6 The monitoring network review projects will inform the Long-term Plan process. It is noted that the reviews have been undertaken without the full detail of the revisions to the National Policy Statement for Freshwater Management. Further work will be required for these projects once that detail is available.

## **LAND-USE MAPPING**

2.3.7 Land-use information is important for a range of purposes including investigating links between land-use and outcomes for water quality. This has been identified as a significant information gap nationally ([MfE, 2019](#)). Previous land-use maps for the Region have been limited in their static nature and were infrequently reproduced due to being both cost and time-intensive; the

last complete map of land-use in the Region was compiled by Horizons in 2008 to inform development of the One Plan.

- 2.3.8 To update land-use information for the Region, Horizons commissioned Manaaki Whenua – Landcare Research to provide an updated land-use map representing land-use in 2018 and also provide a tool to enable Horizons to update land-use information on a regular basis. This approach enables consistency between versions of the map as the same methodology is followed to generate each update. The project is currently in the final stages, with the classification and integration of data sources complete. This report will inform future science and policy work programmes.

## **WATER QUANTITY**

- 2.3.9 Following the summer drought that occurred across much of the Region, most rivers are now recorded within expected flow ranges for this time of year. In almost all areas, cumulative rainfall totals remain below the long-term average.
- 2.3.10 Water use measurement and reporting is a key monitoring programme that informs region-wide water allocation policy and consent decision-making. It also helps Horizons meet its obligations under the National Regulations on Water Use and Reporting Regulations. Revision of these Regulations is due to be released by the Ministry for the Environment in July-August, and will include some changes that are expected to include: a requirement for all water takes of 5 l/s or greater to report water-use data electronically, i.e. telemetered or logged, not just metered, and change to the time-step of reported data from hourly to 15 minute data. It is understood that the timeframe for compliance of all takes is approximately 6 years, with a phased-in approach, e.g. takes 20 l/s or greater must be telemetered by 2022, 10-20 l/s by 2024 and 5-10 l/s by 2026. Takes of less than 5 l/s are expected to remain outside of the regulations.
- 2.3.11 Horizons' long-standing water metering programme places Horizons in a good position to meet the anticipated new requirements in relatively short order. An assessment is currently underway of the status of the existing water metering in the Region compared to the new requirements and to assess whether the currently budgeted programmes will allow the deadlines to be met.

## **FISH PASSAGE**

- 2.3.12 Recent announcements for the Jobs for Nature Fund have included funding for the project proposed for improving native fish populations through fish barrier remediation. This project will result in significant areas of habitat being opened up to migratory fish populations, with a minimum of 25 barriers to be remediated through this fund. This will result in at least 1,250 kilometres of stream habitat throughout the Region becoming accessible to migratory fish



species. Funding to this level allows a full range of options to be considered for remediation, ranging from replacement of culverts with bridges barrier removal to installation of mussel rope through culverts. Council confirmed Horizons' commitment to the project in June and the process to enter into a contract with the Ministry for the Environment is underway.

## LAKE OUTLETS REVIEW

- 2.3.13 One of the key challenges for the Region's coastal dune lakes is the current state of lake weirs, which continue to degrade over time. The Aeolian Lakes Outlet Report concludes that, of the 50 coastal dune lake outlets visited, three have been assessed as critical (two of which are currently monitored for SoE water quality) and require immediate action to prevent the weirs from collapsing. Nine lake outlets have been assessed as highly degraded (three are currently monitored for SoE water quality) and need scheduled attention due to a potential risk of collapse. Where these weirs create barriers to fish migration into coastal lakes there may be potential to address some of these issues through potential alignment with the recently announced fish passage project.

## LAKES380 – OUR LAKES' HEALTH: PAST, PRESENT, FUTURE PROJECT

- 2.3.14 Horizons is participating in the "[Lakes380 – Our lakes' health: past, present, future](#)" project funded by the **Ministry of Business and Employment's (MBIE<sup>2</sup>)** Endeavour Fund and run jointly by **Geological and Nuclear Science (GNS<sup>3</sup>)** and Cawthron Institute in partnership with iwi and hapū, and supported by several regional councils including Horizons.
- 2.3.15 Sampling at 12 lakes in the Region was planned from 27-31 July including: Lakes Wiritoa and Pauri, both aeolian (dune) formed lakes in the Whanganui FMU; Lakes Waipu and Rotokauwau, located in the Turakina-Whangaehu FMU; Pukepuke Lagoon and Lakes Dudding, Heaton, William, Koitiata and Alice all aeolian (dune) formed lakes located in the Rangitikei FMU; and Voss and Karere Lagoons, both riverine (oxbow) formed lakes in the Manawatū FMU. The three lakes sampled in 2019 (Oporoa, Kawau and Westmere) are now listed on the updated [Lakes380 website](#), with results shown in a factsheet for Lake Oporoa in Taihape (Figure 3). The results provide an indication of the types of vegetation that would historically have been present, and how the vegetation types have evolved in relation to human activities in and around the lake.
- 2.3.16 Four additional lakes are planned to be sampled in 2021 including: two landslide lakes (Nemunamu and Ngaruru), one volcanic lake (Ohakune) and one peat lake (Otamataraha).

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<sup>2</sup> Ministry of Business, Innovation and Employment.

<sup>3</sup> Geological and Nuclear Sciences.

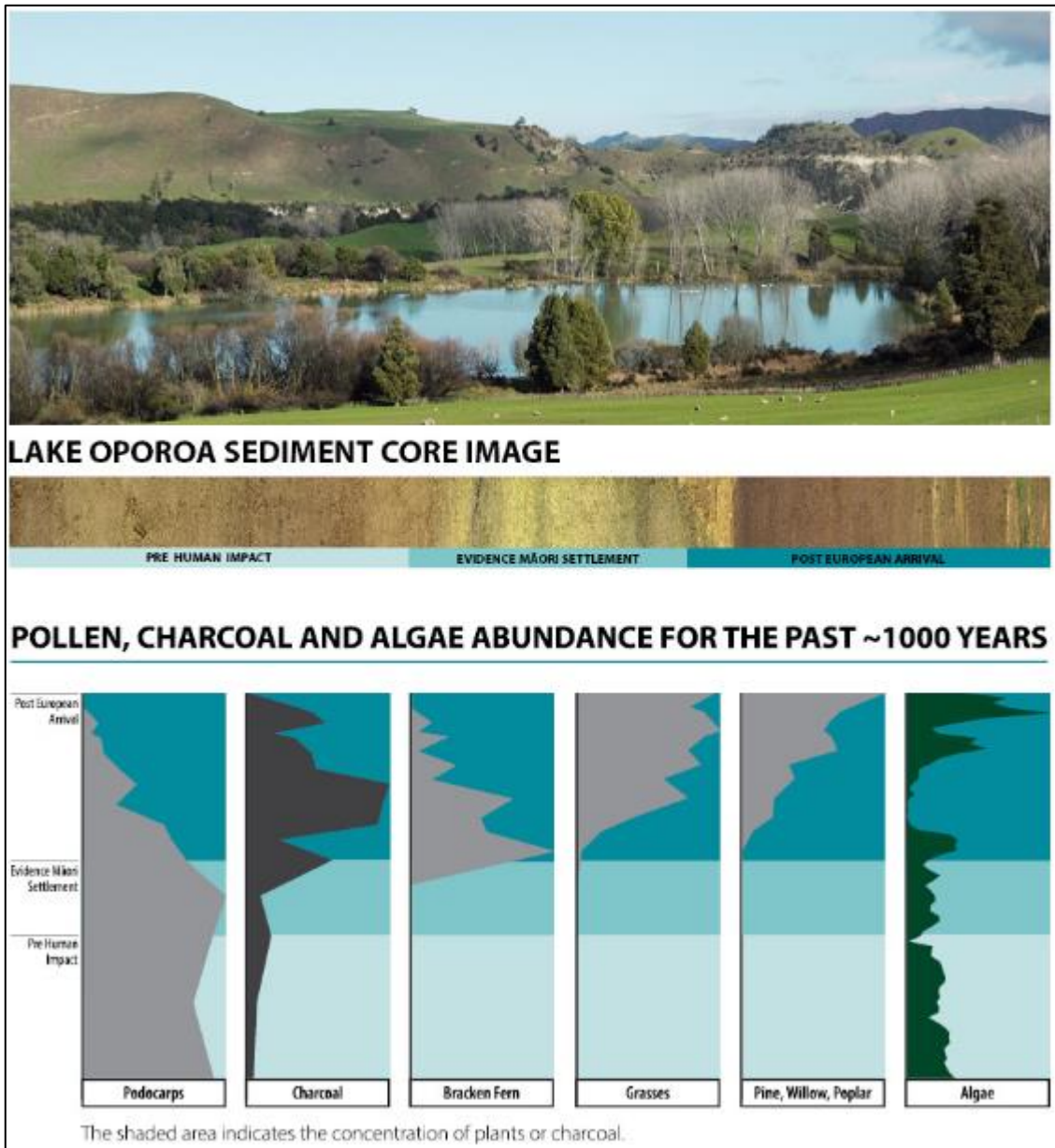


Figure 3 Lakes380 sediment core information for Lake Oporoa ([Lakes380.com](http://Lakes380.com)).

## 2.4 Whanganui & Kai Iwi

- 2.4.1 The Whanganui catchment encompasses the Whanganui River, Manganui o te Ao, Retaruke, Ohura, Ōngarue, Taringamotu, Whangamomona, Tangarakau, Whakapapa and Pungapunga Rivers and the upland and coastal lakes. The Whanganui is the country's third longest river and its longest navigable river. The Kai Iwi streams are located west of Whanganui.

### SOIL MAPPING IN EAST WHANGANUI

Understanding the properties of soil types and where they occur in the landscape is a key component of understanding how nutrients behave on the surface and below the root zone. [S-Map](#) is a soil information system developed and managed by Manaaki Whenua - Landcare Research. It provides a higher resolution and more detail than the Fundamental Soil Layer and also provides key data for the OVERSEER model. The Fundamental Soil layer has national coverage, however its scale and detail level are inappropriate for catchment-scale nutrient modelling and analysis.

- 2.4.2 Quality soil information is an information gap for most of the region, with only 20 percent coverage prior to 2020. Soil mapping was completed by Manaaki Whenua for the lowland area to the east of Whanganui during 2019-20 and data will be available online in August 2020 on the [S-Map](#) website.

### FINE-SCALE INTERTIDAL MONITORING OF WHANGANUI ESTUARY

- 2.4.3 Whanganui Estuary is highly vulnerable to muddiness due to having both a predicted sediment load > 10 times the natural load, and a thick layer of mud overlying coarse sand and gravels in the lower estuary (Wriggle, 2018<sup>4</sup>). Mud is one of the primary stressors of ecological health in estuaries, and to better understand changes in sedimentation and the subsequent effects of sediment on the ecological health of the estuary, Horizons has commissioned Salt Ecology to undertake a fine-scale monitoring annually from 2019 to 2021.
- 2.4.4 Salt Ecology completed the second of the three surveys in 2019-20 with results indicating high sedimentation, increased mud and decline in sensitive species. The third survey is scheduled for 2021 and will help determine patterns over time. The summary report reference is Forrest, B., Stevens, L. and Rabel, H. (2020). *Fine Scale Intertidal Monitoring of Whanganui Estuary*. Salt Ecology client report prepared for Horizons Regional Council, June 2020.

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<sup>4</sup> Stevens, L. (2018). *Whangaehu Estuary Sedimentation Rate Monitoring Study*. Wriggle Coastal Management client report prepared for Horizons Regional Council, January 2018.

## 2.5 Whangaehu

- 2.5.1 The Whangaehu River is a large catchment covering almost 2,000 km<sup>2</sup> with a total stream length encompassing 3,326 km of tributaries such as the Mangawhero and Makotuku. The headwaters of the Whangaehu are the crater lake of Mt Ruapehu on the Central Plateau, with the river winding through the Ruapehu and Whanganui districts before entering the Tasman Sea 8 km south-east of Whanganui. The volcanic influence on this catchment means that the pH in the Whangaehu mainstem can vary from neutral to acidic and this can impact fish and macroinvertebrate communities.
- 2.5.2 A significant proportion of the science and freshwater improvement work is carried out in the catchment. Key projects include Whangaehu Freshwater Improvement Fund (FIF) project as well as the Lake Waipu-Rātana FIF project.

### WHANGAEHU FRESHWATER IMPROVEMENT FUND PROJECT

- 2.5.3 This programme focuses on the delivery of the Ngā Wai Ora o Te Whangaehu FIF project, which focuses on the protection and enhancement of waterways within the Whangaehu Catchment. The main components of the programme are supporting stock exclusion from waterways, riparian enhancement and planting where desirable, aquatic habitat enhancement, supporting industry and community-led initiatives, and a joint project with Ngati Rangī.
- 2.5.4 During the reporting period the Whangaehu Freshwater Improvement Fund Community Grant applications opened for projects in the 2020-21 financial year. Applications are opened until 7 August 2020. This is the last year for community projects specific to the Whangaehu Catchment with the Freshwater Improvement Fund project on track to be completed by the end of June 2021.
- 2.5.5 We were able to remove one barrier to fish passage between coming out of lockdown and the start of trout spawning, a window of a few days. This involved removal of an old concrete ford across the Makotuku (Figure 4 and Figure 5). The removal of this fish barrier has opened up an additional 19.685 kilometres of stream habitat to migratory fish species. Unfortunately, the other fixes couldn't be completed prior to the restrictions concerning trout spawning and the end of the financial year. These are now planned to occur in the 2020-21 financial year.

### SEDIMENTATION MONITORING OF WHANGAEHU ESTUARY

- 2.5.6 Salt Ecology completed a third year (2018-20) of sediment rate monitoring in Whangaehu Estuary to provide data on sedimentation trends over time.



Figure 4: Fish barrier (old ford) on the Makotuku River prior to removal.



Figure 5: Same area of the Makotuku River after removal of the fish barrier.

## 2.6 Rangitikei-Turakina

2.6.1 The Rangitikei River is 253 km long and covers an area of 3,948 km<sup>2</sup>. Streams total a further 6,214 km. The Rangitikei catchment has a number of tributaries including the Moawhango, Hautapu, Kawhatu and Porewa rivers. The Turakina catchment encompasses the Turakina and Mangapapa Rivers and covers an area of 962 km<sup>2</sup>.

### LAKE WAIPU/RĀTANA FRESHWATER IMPROVEMENT FUND PROJECT

2.6.2 The Lake Waipu FIF project seeks to remove the discharge into the lake from the Rātana Wastewater Treatment Plant (WWTP). This is to be led by Rangitikei District Council (RDC) as the consent holder and Horizons' project relates to monitoring removal of the discharge from the

lake and to understand the lake's internal processes. The aim is to develop a restoration plan that includes addressing the legacy issue resulting from the current discharge.

- 2.6.3 During the last 12 months little progress has been made on the acquiring through purchase the land required for the irrigation of the WWTP discharge. Discussions are currently occurring between Manawatu District Council, Rangitikei District Council, Horizons, and MfE around potential lease and purchase options, and how lease options would align with Central Government funding compared to land purchase.
- 2.6.4 During the last financial year Horizons commissioned a report on the health of the kakahi (freshwater mussel) population in Lake Waipu. Monitoring found kakahi at high densities at the four locations that were sampled. However, the monitoring shows a lack of recruitment occurring within the lake. To better understand possible reasons for the lack of recruitment a native and pest fish survey has been booked in for the 2020-21 financial year to understand the presence of host species within the lake to enable kakahi to complete their life cycle. The report reference is Fenwick, M., Burton, T. (2020). Kakahi survey of Lake Waipu. Prepared for Horizons Regional Council. NIWA client report number:2020104HN.

#### **NUTRIENT FLOW PATHWAYS FROM INTENSIVE WINTER GRAZING ON GRAVEL SOILS – A PILOT STUDY**

- 2.6.5 Horizons and Massey University undertook a pilot study between 2018-20 to investigate water and nutrient flow pathways on gravel soils in the Rangitikei catchment. Soils overlaying gravel terraces adjacent to the Rangitikei River are often used for intensive crop grazing and the wintering of cattle due to their well-drained nature and resistance to pugging. However, these well-drained soils pose a potential risk in terms of nutrient leaching (particularly nitrate-N) and, in turn, nitrate transport to the river via shallow subsurface flow pathways. A sound understanding and knowledge of these pathways is essential to develop and implement the most effective in-field or edge-of-field mitigation measures.
- 2.6.6 A pilot study was established on a sheep and beef farm near Hunterville to collect preliminary data on the surface and shallow groundwater quality in an area of gravel terraces, adjacent to the Rangitikei River, which are used for intensive winter grazing. The main objective of the pilot study was to monitor and analyse the monthly quality of the surface and shallow groundwater flowing from the intensively grazed terraces at the case study farm. The study aimed to make some general inferences as to the potential transport pathways of contaminants (namely nitrate-N, dissolved reactive P and *E. coli*) at the study site.
- 2.6.7 Preliminary results have identified nitrate-N concentrations in shallow groundwater are elevated, particularly in late spring and early summer. Combined with the context of shallow soils

overlaying a gravel base in close proximity to the river, this indicates some of this nitrate-N enters the Rangitikei River via lateral groundwater flow.

- 2.6.8 These results contrast with an earlier but similar study investigating nutrient pathways on a sand country farm environment in Santoft. In that case, surface drains were likely to be the primary mechanism by which nutrients left the farm boundary, rather than shallow groundwater transport and the bypassing of these drains, as suggested by the current study. These studies demonstrate the range of processes in different locations and inform the management techniques required in different physiographic/geomorphic environments to reduce nutrient loss to waterways. The report reference is Burkitt, L., Singh, R., Horne, D. and Bretherton, M. (2020). Assessment of water and nutrient flow pathways from intensive winter grazing on gravel soils in the Rangitikei Catchment – a pilot study. Report prepared for Horizons Regional Council, 2020.

#### **PFAS MONITORING FOR OHAKEA**

- 2.6.9 Horizons has been working with Defence around the ongoing monitoring of **per- and poly-fluoralkyl (PFAS)** and related compounds around Ohakea Air Force base. The NZ Defence Force is currently funding the establishment of a monitoring network and Horizons are funding the first year of monitoring. The installation of six piezometers around Ohakea is underway to monitor the PFAS plume created by the use of fire-fighting foam at the base. The installation of these piezometers is part of a wider plan to monitor the movement of the plume in groundwater and surface water. Over time, four of the six piezometers will be installed at a depth of 10 metres on the road reserve around the Ohakea area and the remaining two piezometers will be nested, covering shallow, mid and deep depths. One of the nested piezometers will be located on Defence Force land and the others will occupy part of the road reserve around the Ohakea area. Sampling at these sites will be supplemented by four existing water supply wells and collection of samples from three surface water sites. Sampling is recommended to take place every six months starting in September 2020. Pattle Delamore Partners Ltd has designed the monitoring programme and will undertake sampling in September 2020.

## **2.7 Manawatū**

- 2.7.1 The Manawatū catchment is large and complex, covering nearly 600,000 hectares, and capturing water from multiple mountain ranges (Taranui, Ruahine and Puketoi ranges). The main tributaries include the Manawatū, Oroua, Pohangina, Tiraumea, Mangatainoka and Mangahao rivers, and it is the only river system in New Zealand that traverses the range from which it

originates. The catchment contains a range of coastal dune lakes and lagoons, and ultimately transitions into the Manawatū estuary before joining with the sea.

### MANAWATŪ RIVER ACCORD/FIF PROJECT

- 2.7.2 The Manawatū River Leaders' Accord Action Plan includes an array of activities related to improving water quality, to achieve the goals of the Accord. This activity funds works to improve water quality in the Manawatū catchment as part of the Accord, including by excluding stock from streams, riparian planting, improving fish passages and supporting community projects. The project also includes work with Horowhenua District Council around land treatment of Tokomaru wastewater and an urban streams project with Palmerston North City Council. During this financial year and the following three years, the targeted rate is to be used as Horizons' contribution to the Freshwater Improvement Fund project.
- 2.7.3 The current planting season will include a number of community planting days in the Manawatū catchment. A number of these days are funded through the Manawatū River Leaders Accord, which has recently opened a funding round for community projects for the 2020-21 financial year. Applications to the fund close on 3 October 2020.



Figure 6: Community planting day in the Kiwitea catchment (top) and the Upper Manawatū (bottom)

### WATER QUANTITY

- 2.7.4 Rainfall in the Manawatū is now tracking at about average at most sites based on monthly totals, however annual cumulative deficits remain across the catchment.
- 2.7.5 River flows at the Manawatū at Weber Road and Manawatū at Teachers College flow monitoring sites are now within the average range following relatively low flows throughout May and early June. A similar pattern was seen in the Mangatainoka and Oroua rivers.



- 2.7.6 Groundwater levels are still under some pressure from the dry summer and have not yet recovered. Most of the bores we monitor are showing a low or below average level with only a handful currently high or above average.

### **MANAWATŪ CATCHMENT STOCKTAKE**

- 2.7.7 The Manawatū catchment stocktake report is an overview of the Manawatū catchment in relation to water quality. Information is presented at both catchment level and at the water management zone level, for both surface water and groundwater. The intent is that the report will provide information to policy makers and members of the public.
- 2.7.8 The report begins with a summary of regulatory activity in the catchment and how this informs decisions related to water quality. It goes on to present and discuss water quality state and trends in relation to both One Plan targets and the National Objectives Framework. Historical background, cultural sites of significance, land-use practices and biodiversity are all discussed in relation to water quality throughout the report. Gaps in our current knowledge are identified throughout.
- 2.7.9 Finally, the report discusses the effectiveness of current interventions, which will ultimately help to inform future regulatory and non-regulatory initiatives. The report is undergoing internal review and will be available shortly.

## **2.8 Horowhenua**

- 2.8.1 The Horowhenua is one of the Region's smallest but most complex FMUs. Major tributaries include the Ohau River and Waikawa/Manakau streams and their respective estuaries, Lake Waiwiri (Papiatonga) and Lake Horowhenua, which discharges to the Hokio Stream and estuary.

### **LAKE HOROWHENUA ACCORD AND FIF PROJECT**

- 2.8.2 During the reporting an item was brought to Council about progressing the construction of the boat ramp near the confluence of the Arawhata Stream and Lake Horowhenua. This has resulted in the awarding of the tender to the preferred supplier. We are currently working through the commencement date for the works and the associated resource consent conditions.

### **WATER QUANTITY**

- 2.8.3 The Horowhenua FMU was one of those least impacted by the drought experienced throughout the Region. Groundwater levels during the May-June period are still low, with most bores we monitor showing either a low or below average level. River flows in the Ohau River and rainfall remain typical for this time of year.

## HOROWHENUA WORK PROGRAMME

2.8.4 There have been several research and monitoring programmes carried out in the Horowhenua FMU; however, there are still research gaps that need to be remedied to enable us to prepare for implementation of the 'Action for Healthy Waterways' package, inform the 10-year review of Horizons' One Plan, and inform interventions for water quality improvement in the FMU. This programme will take stock of all previous and ongoing work and address gaps in our knowledge. Work in this space either currently underway or recently completed includes:

- Integrated sediment and drainage management plan for the Arawhata catchment (This is contracted to Tonkin + Taylor and due for completion August - October 2020). More information below;
- An assessment of vegetable growing contributions to water quality in the Horowhenua catchment. This is contracted to PDP and in progress, PageBloomer were subcontracted to undertake Overseer modelling to estimate nutrient losses from Horticulture and this work is now complete.);
- Land-use map (Manaaki Whenua, completed July 2020). More information above;
- Monitoring Network Review (Horizons Regional Council, due September 2020). More information above;
- Sustainable Farming Fund – Future Proofing Vegetable Production (LandWISE three-year project to end June 2021).

7.5.2 The following are planned projects and monitoring programmes for 2020-21 in the Horowhenua FMU to further address knowledge gaps:

- Exploratory groundwater model for Lake Horowhenua that can further refine the catchment water balance, estimate groundwater travel times and further enable investigation of contaminant transport.
- S-Map soil mapping to inform contaminant models, catchment analysis and improve OVERSEER inputs.
- Summer monitoring survey to address any immediate gaps in spatial coverage for water quality and quantity to inform catchment characterisation.
- Implementation of a new monitoring programme to provide sufficient information for consent decision-making, the development of catchment interventions and NPS-FM implementation.

2.8.5 The above programme for the 2020-21 year will align with and support the recent Jobs for Nature funding for the development of interventions within the Horowhenua catchment with a particular focus on nitrogen mitigation. With this in mind work has recently been commissioned to look at options for constructed wetlands within the Arawhata catchment. This project will be developed further during the development of the contract with the Ministry for the Environment and consultation/engagement with the local community.

## **INTEGRATED SEDIMENT AND DRAINAGE MANAGEMENT PLAN IN THE ARAWHATA CATCHMENT**

- 2.8.6 The development of an integrated sediment and drainage management plan for the Arawhata catchment was commissioned from Tonkin + Taylor in 2019-20. As an historic water race, the Arawhata stream and its tributary drains are prone to surface flooding on farms in storm events, causing damage to crops and sediment runoff into the Arawhata Stream. Previous work has focused on individual landowner interventions to reduce sediment loss and the sediment trap at the downstream point of the Arawhata Stream. However, the goal of this project is to develop an understanding of the drainage network more holistically and propose key interventions at various points in the network to improve drainage service and reduce the loss of sediment and nutrients to the stream/lake. This work began in late 2019 and is due for completion in October 2020, having been delayed due to COVID-19 lockdown.
- 2.8.7 The project is also now linked with the recent Central Government Jobs for Nature funding received for constructing a wetland complex and other catchment water quality interventions in the Arawhata Stream.

## **S-MAP IN HOROWHENUA**

- 2.8.8 During 2019-20, soil mapping for [S-Map](#) was undertaken in the Whanganui FMU (see above). During 2020-21, the lowland area of the Horowhenua FMU will be the focus for soil mapping to help inform catchment studies and implementation programmes, and assist in the freshwater limit-setting processes required under the NPS-FM. S-Map data is useful in catchment-based nutrient loss modelling and analysis, and is a key input for the OVERSEER model. Therefore it will also assist in improving estimates of contaminant loss from intensive farming land-use in the catchment.

## **SYNOPTIC MONITORING OF ŌHAU AND WAIKAWA ESTUARIES**

- 2.8.9 Salt Ecology completed the second of three planned synoptic surveys in the Ōhau Estuary (2018, 2020 and 2021) and is finalising the third report on the Waikawa Estuary (2018-20).
- 2.8.10 The 2020 results for Ōhau Estuary indicate there is high nutrient enrichment (eutrophication) affecting an estimated 0.75 ha of the upper estuary, comprising about 5% of the total estuary area. Symptoms included high algae concentrations and very low dissolved oxygen concentrations. Repeat synoptic monitoring in the summer of 2021 will further define the extent and potential causes of the eutrophication impacts.

While the report is being finalised, preliminary findings for Waikawa Estuary indicate strong symptoms of eutrophication with large parts of the upper estuary currently experiencing severely

low oxygen levels. These low levels result from excessive phytoplankton blooms responding to elevated inputs of nutrients and, to a lesser degree, sediments. The spatial extent of high enrichment conditions (i.e. low oxygen, elevated organic content, mud and nutrients) was ~2.7ha (40%) of the subtidal area, a large increase on the ~0.5ha (9%) recorded in 2019. In light of the findings, the report makes a number of recommendations around further monitoring, surveying and catchment investigations to better understand the sources and drivers of sediment and nutrient enrichment in the catchment. These recommendations will feed into our broader Horowhenua work programme (section 0). The two reference reports are: Stevens, L., O'Neill-Stevens, S. and Forrest, B. (2020a). *Synoptic Subtidal Monitoring of Ōhau Estuary*. Salt Ecology Client Report prepared for Horizons Regional Council, June 2020; and Stevens, L., O'Neill-Stevens, S. and Forrest, B. (2020b). *Synoptic Subtidal Monitoring of Waikawa Estuary*. Salt Ecology Client Report prepared for Horizons Regional Council, June 2020.

## 2.9 Coastal Tararua

2.9.1 Coastal Tararua is the region's third smallest FMU. The area includes a total of 15 tributaries that reach the coast with major tributaries including the Ākitio and Owahanga rivers. Due to limited availability groundwater is not well-utilised in coastal Tararua and groundwater levels are currently not monitored in this catchment. River water quality monitoring in these catchments is limited with just two sites. Changes to national policy may require adjustments to the monitoring network.

### AKITIO WEIRS

2.9.2 The Ākitio River includes important habitat for a number of our indigenous diadromous (migratory between fresh and salt water) fish species. Restoring the connectivity between headwater stream ecosystems and the coast by removing barriers to fish passage is a key focus in this catchment.

2.9.3 The mainstem of the Akitio River has two weirs along it, one known as the 'saltwater weir' and the other the 'rabbit weir'. During the 2019-20 financial year two reports were commissioned with one on the possible effects of the weirs' removal on the river morphology recommending a monitoring methodology if they were to be removed while the other report looked at the position of the saltwater wedge if the lower weir was to be removed.

2.9.4 The removal of the lower weir is expected to increase the extent of saline intrusion to between 100 metres and 2 km upstream of the existing lower weir under present conditions. The removal of the weir will affect upstream water levels and eventually a tidal signal will be seen about 2 km upstream of the weir compared with the existing ~ 4.6 km of backwatering due to the weir.

- 2.9.5 The projected impacts of climate change will mean an overall decrease in rainfall for the two larger catchments (Ākitio and Owahanga) over the next 20 years. However, extreme weather events, causing droughts and flooding, are likely to become more frequent. Around 2120, rising sea levels and vertical land movement in the Akitio area are predicted to lead to an increase in the upstream extent of saline intrusion of the order of 6 km or more upstream of the existing w
- 2.9.6 Additional work has been commissioned to look at the cost:benefit analysis of either removing the weirs or leaving them in place. Once this work is completed the results will be taken back to the Ākitio community to discuss the next steps. The removal of these two weirs would be the two most significant actions that could presently be taken for fish passage within the Horizons Region, opening up access to a significant amount of habitat for migratory fish species and increasing the area available for inanga spawning in the Ākitio Catchment. The two reference reports regarding this are: Conn, S. (2019). *Akitio River weir removal monitoring framework*. Tonkin + Taylor Ltd. Client report prepared for Horizons Regional Council. Job number 1011861; and Gee, E., & Allis, M. (2020). *Salt intrusion after removal of a weir*. NIWA client report prepared for Horizons Regional Council. No: 2020118HN.

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