



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 prioritise 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 the **Freshwater Improvement Fund (FIF)** for the Manawatū, Whangaehu and Lake Waipu/Rātana Catchments, **Public Waterways Ecosystem Restoration (PWER)** for the Regional Stream Fencing and Riparian Planting programme, and Enhancing Fish Populations through Fish Barrier Remediation, and the Community Environmental Fund for the Waikawa Catchment. These are all administered through the **Ministry for the Environment (MfE)**. Funding of science advice through the **Ministry of Innovation, Business and Employment's (MBIE)** Envirolink fund totals approximately \$120,000 per annum.

Implementation activities include riparian fencing and planting for water quality improvement and fish habitat enhancement, 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 primarily covered in the Environmental Reporting and Air Quality Monitoring section of this report.

This 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 & 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 & 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;
- Waiopēhu – including the Lake Horowhenua Accord and FIF project, as well as freshwater improvement work with horticulture growers; and
- Puketoi ki Tai – coastal Tararua area.

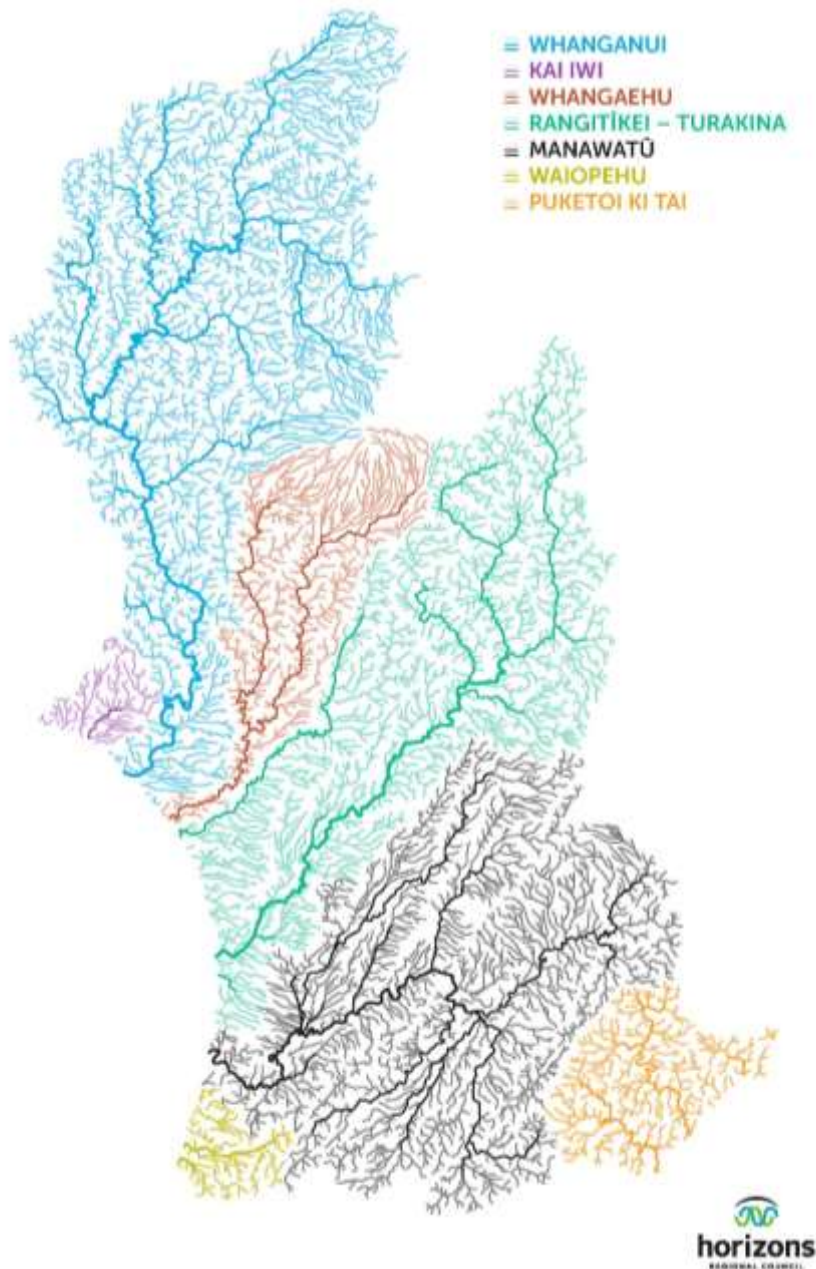


Figure 1: Freshwater Management Units in the Horizons Region

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 to facilitate community involvement. Some of the work also informs restoration options and seeks to build capacity. The programme delivers work across six key components, each of which includes funding from Central Government:

- Regional freshwater programme, outside the Manawatū and Whangaehu Catchments (includes the Jobs for Nature stream fencing and riparian planting programme);
- Manawatū Accord and Freshwater Improvement Fund project;
- Whangaehu Catchment Freshwater Improvement Fund project;
- Enhancing fish populations through fish barrier remediation Jobs for Nature project;
- Waipu Catchment Freshwater Improvement Fund project to remove the Rātana **waste water treatment plant (WWTP)** discharge from Lake Waipu and irrigate to land while also developing a restoration plan for Lake Waipu; and
- Lake Horowhenua Accord and Lake Horowhenua Jobs for Nature 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.

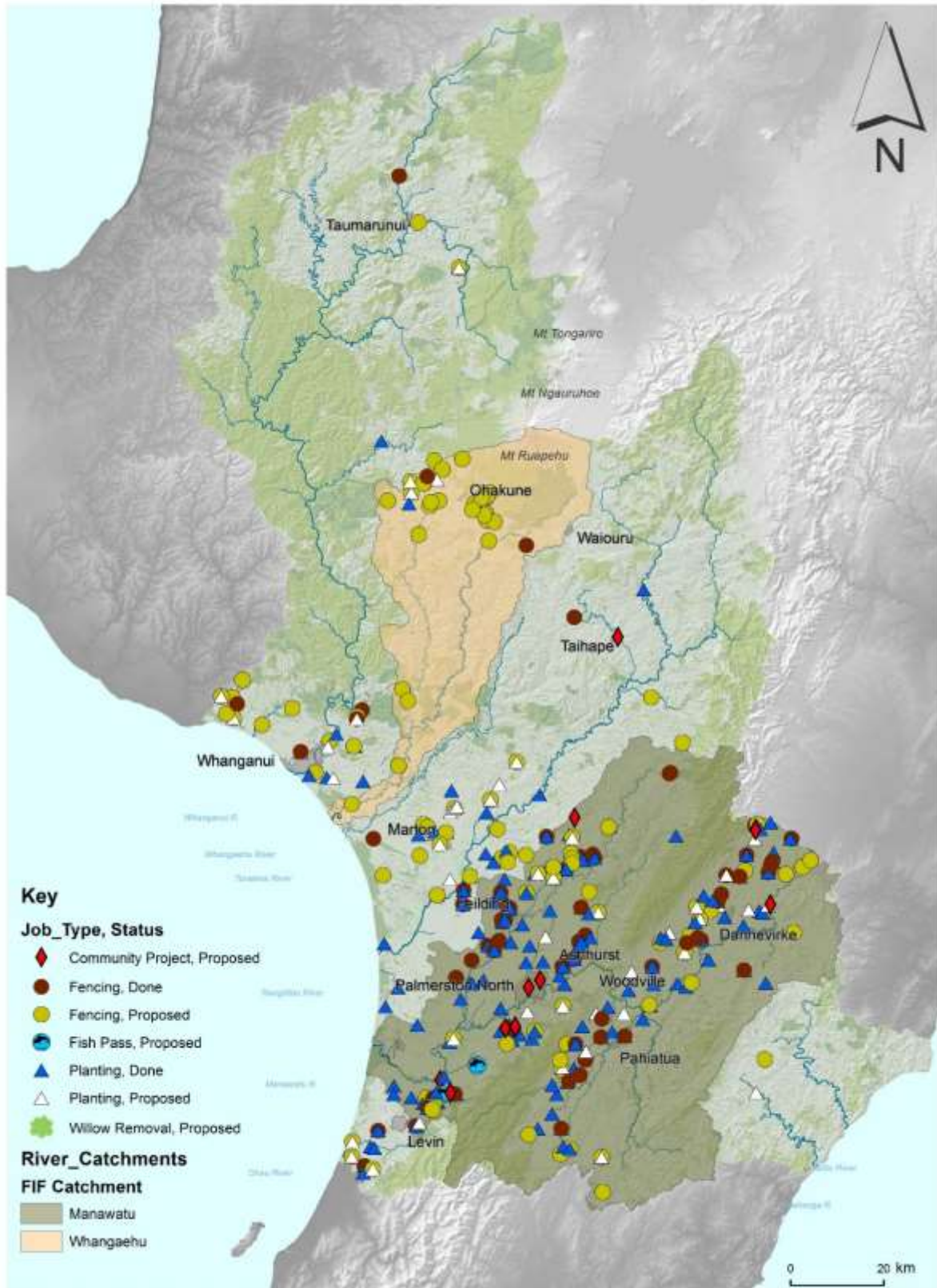
Table 1: Freshwater & Partnerships programme progress on the 2020-21 Annual Plan targets as at 31 December 2020.

Riparian fencing (km)					Riparian planting			
	Target	Allocated	Complete	% complete	Target	Allocated	Complete	% complete
Regional	12	2.540	2.316	84% ¹	20,000	14,905	15,241	149%
Jobs for Nature ²	35	38.041	7.774	22%	35,000	27,185	14,642	42%
Manawatū	50	97.5	49.6	99.2%	40,000	114,500	90,802	227%
Whangaehu	17	40.35	.1480	1%	3,333	3,987	2,023	61%
Total³	102	178.4	59.84		78,333	160,577	122,708	156%
Fish passes					Community projects			
	Target	Allocated	Complete	% complete	Target	Allocated	Complete	% complete
Regional	1	0	0	0%	1	1	1	100%
Jobs for Nature	5	0	0	0%	n/a	n/a	n/a	n/a
Manawatū	4	3	0	0%	9	12	2	22%
Whangaehu	2	0	0	0%	3	8	0	0%
Total³	7	0	0		13	21	3	23%

¹ % is based on works completed in both the Regional and Jobs for Nature programmes.

² Currently not an annual plan target however, both the Regional and Jobs for Nature projects count towards the Annual Plan targets for the Regional Freshwater Programme.

³ 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 Grant Projects

Map prepared by L Ferguson, NRP, 4 February 2021

Figure 2: Freshwater implementation projects for stream fencing, riparian planting, community projects, and fish passes for the 2020-21 financial year (as at 31 December 2020).

JOBS FOR NATURE PROJECTS

- 2.1.3 In July 2020 Council resolved to enter into three Jobs for Nature “Quick-start” projects. These projects are funded through the broad Jobs for Nature Fund, and more specifically are referred to by the Ministry for the Environment as Public Waterway Ecosystem Restoration Fund projects.
- 2.1.4 The Deeds of Funding for the Stream Fencing and Riparian Planting programme, and enhancing fish populations through fish barrier remediation have been signed and the first meetings of the Governance Groups occurred in October 2020.
- 2.1.5 During the reporting period the following positions were added to the team as a result of the additional funding:
- Three Freshwater Advisors (2.5 FTEs) started in October 2020 for the Regional Stream Fencing and Riparian Planting programme. Additional winter staff recruitment is underway for two fixed term positions (6 months), with a proposed start date of April;
 - The Fish Passage Coordinator (Tessa Stevens) joined us in October 2020;
 - Four research assistants on fixed four-year contracts joined us in October and November 2020 with three summer students also starting at the same time. An additional 12-week contract is currently being recruited for the Fish Passage team;
 - Advertising has commenced for the Freshwater Coordinator – Lake Horowhenua position.

ENHANCING FISH POPULATIONS THROUGH FISH BARRIER REMEDIATION

- 2.1.6 This project commenced at the beginning of October and is well underway within the two focus catchments – Ōhau and Waikawa. The Fish Passage team consists of eight members but dropped to five when the summer student 12-week contracts ended at the beginning of February 2021. A fourth 12-week contract was being advertised.
- 2.1.7 This four-year project has just completed quarter 2 of year 1 and overall is on schedule to achieve the deliverables prior to the end of the first project and financial year. Key focus areas for the team have been: stream walking (to assess barriers to fish migration), monitoring of fish and kakahi populations, and remediation of identified barriers. Stream walking in the two focus catchments has been progressing well, but with some difficulty due to the areas containing numerous lifestyle properties. This makes landowners more difficult to contact and without permissions, certain sections of river/ stream have not been assessed. Letter drops and cold calling attempts continue to be made in these focus catchments. In addition to this, the team have progressed with certain catchments in the Manawatū where landowner permissions are more readily available.

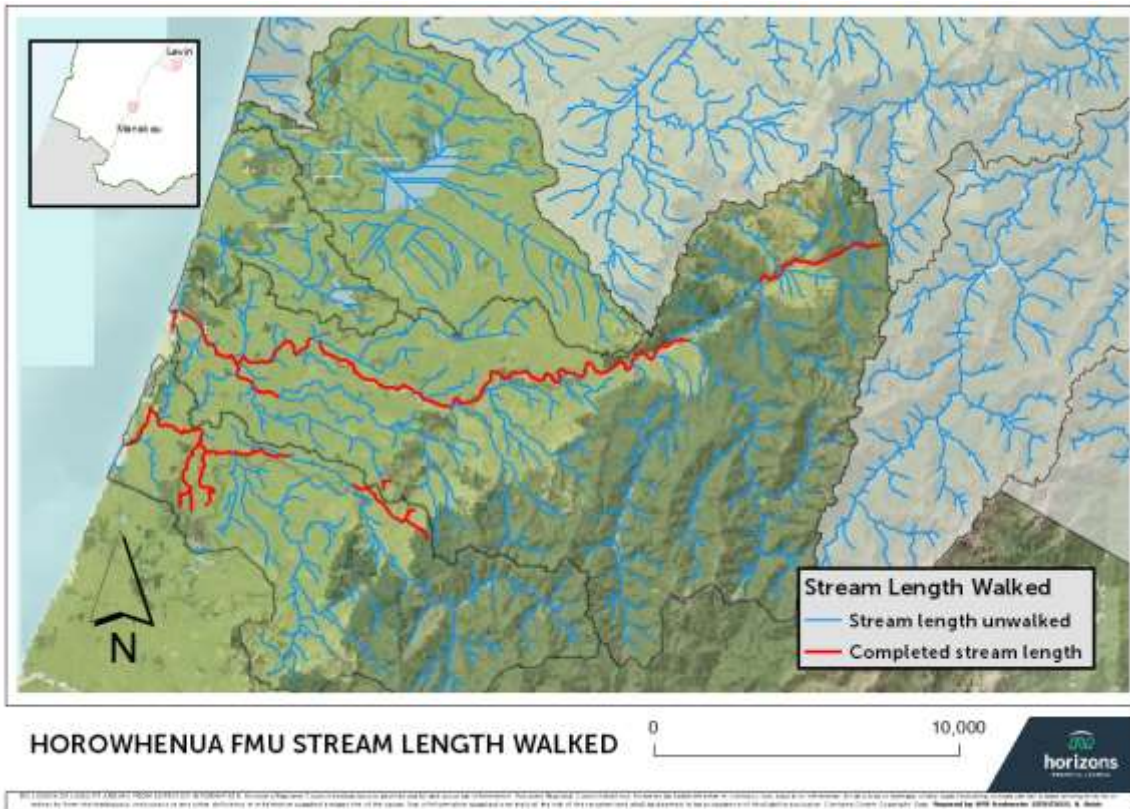


Figure 3: Stream length walked in Ōhau and Waikawa Catchments.

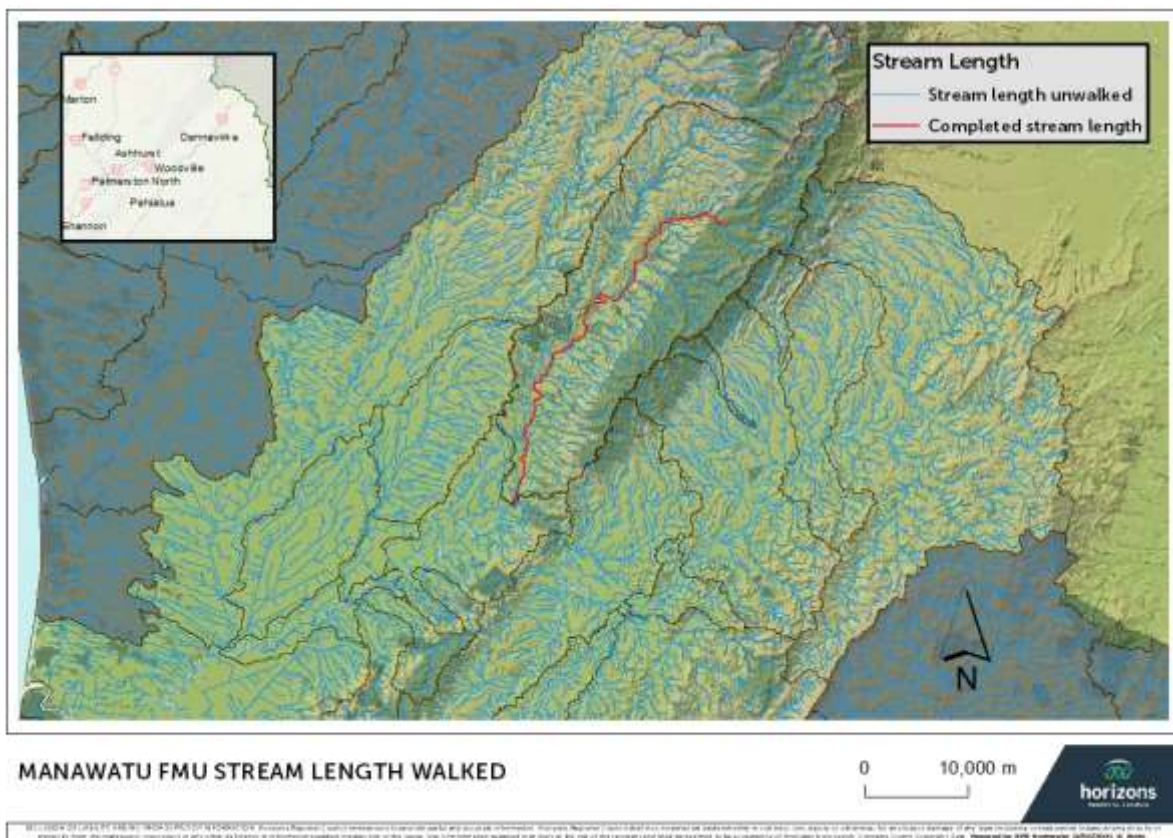


Figure 4: Stream length walked in Manawātū Catchment.

2.1.8

2.1.9 Fish and kākahi (freshwater mussel) monitoring has been progressing well with seven fishing sites and four kakahi sites completed. A report is to be commissioned on the current state of the region's fish and kakahi populations through Massey University, with scoping of the project underway.



Figure 5: Top left and right: Kakahi surveys in the Tararua area (both sites had kakahi present). Bottom left: Fyke net training survey in the Purua Stream, Whanganui. Bottom right: A giant kokopu found during the survey.

2.1.10 The project has a target of five sites this year for barrier remediation. At the time of reporting, one was complete with the remaining four scheduled for completion during February 2021.



Figure 6: Fish barrier remediated in a tributary of the Waikawa Stream. Photo on the left shows prior to remediation (a drop due to a wooden board covering entrance to culvert) and photo on the right after remediation by removing the board.

2.2 Regional Water Quality & Quantity Science Programme Overview

MONITORING PROGRAMMES

2.2.1 Water quality and quantity monitoring is overseen by Horizons Science & Innovation team, but delivered in partnership with the Environmental Data, Consents Monitoring and Freshwater & 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 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 four coastal and seven estuary sites, and ecological condition and/or sedimentation of five estuaries;
- Groundwater quality at 35 sites;
- Water quality in 17 lakes and submerged plants in approximately eight lakes annually;
- 82 popular swim spots throughout the bathing season (November to April);
- Macroinvertebrates at 95 sites and periphyton at 63 sites.

2.2.2 The monitoring network is undergoing a review in response to national policy requirements, and to better inform decision-making and implementation programmes.

State of the regional water resource

2.2.3 Spring was warm and wet for much of New Zealand, and particularly for the Horizons Region. It signalled a turnaround from low winter rainfall, with spring and early summer rainfall at average or above average throughout much of the region, and particularly on the western side of the ranges. Average conditions for each site were benchmarked over the length of record for each site, at least 20 years in most cases.

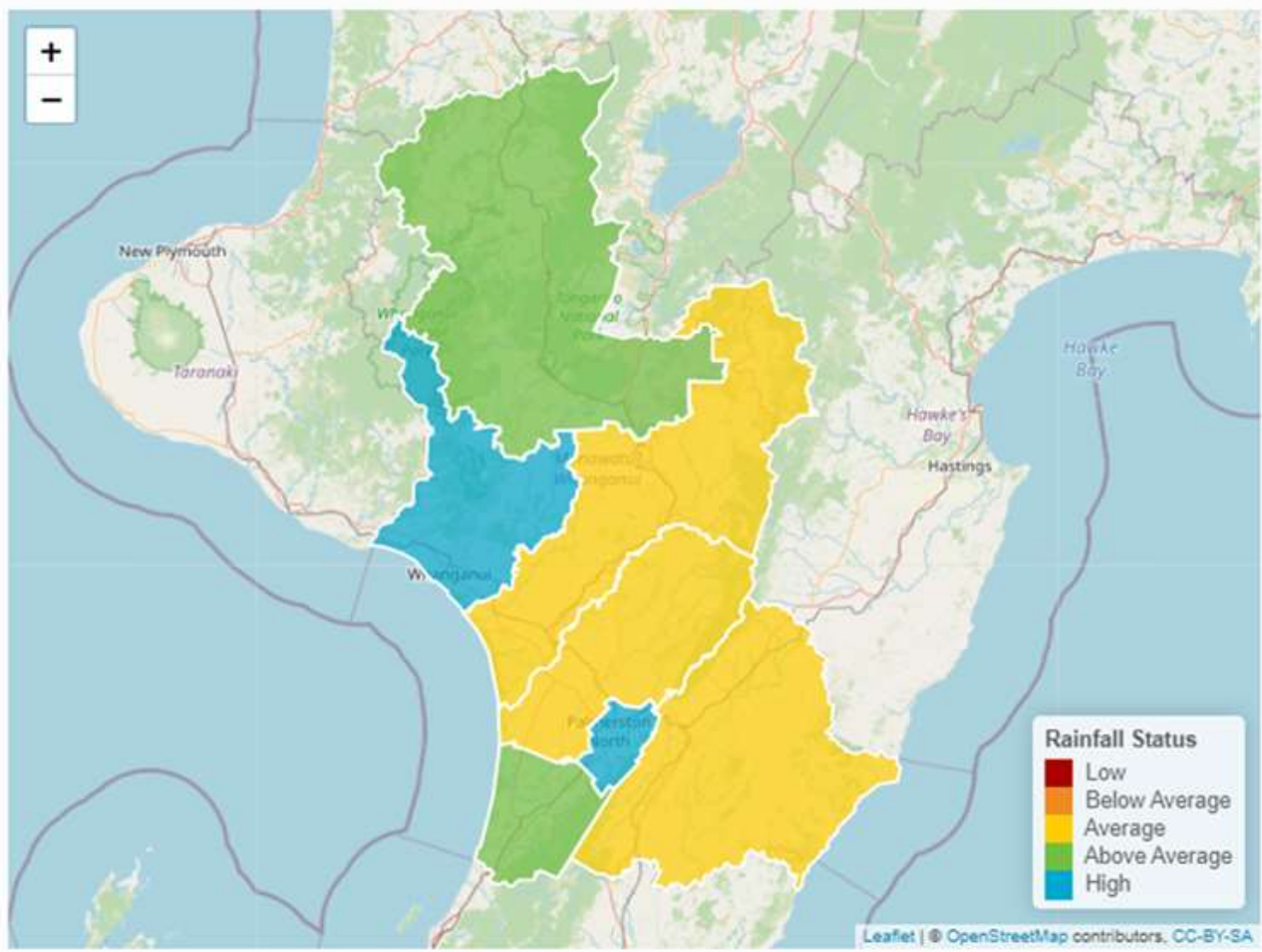


Figure 7 Hydrological status as determined by rainfall quantities over the preceding four months at 10 representative sites, February 2021.

2.2.4 This spring rainfall increased groundwater levels across the region, enabling further support of river levels during summer low flows. Prior to Christmas, approximately 50% of the bores Horizons monitors monthly for water levels were either low or below average. By February 2021 this had dropped to about 20% of monitored bores (Figure 8), with low groundwater levels persisting in the rural Manawatū area.

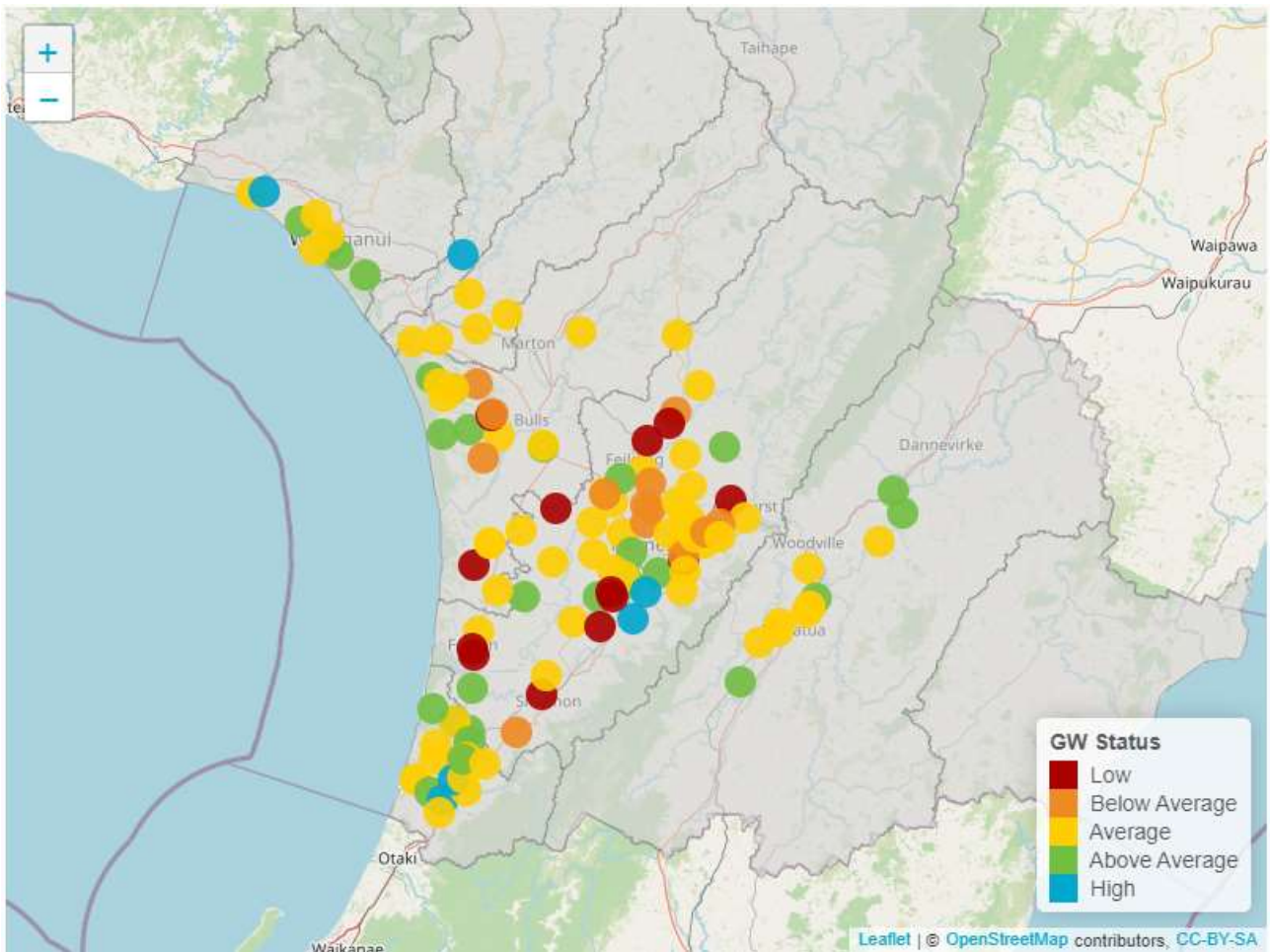


Figure 8: Groundwater level status as determined by monthly monitoring at 130 bores, January 2021.

2.2.5 As outlined above, the warm relatively wet spring had river flows follow a more 'typical' summer pattern, with low flows occurring later in the season. Low flows have started to occur at a few sites, but overall river flow status is currently 'average', based on long-term records for the last 20 years at 11 key flow monitoring sites. Figure 10 shows the river flow status as at 10 February 2021 compared to the same date in 2020.

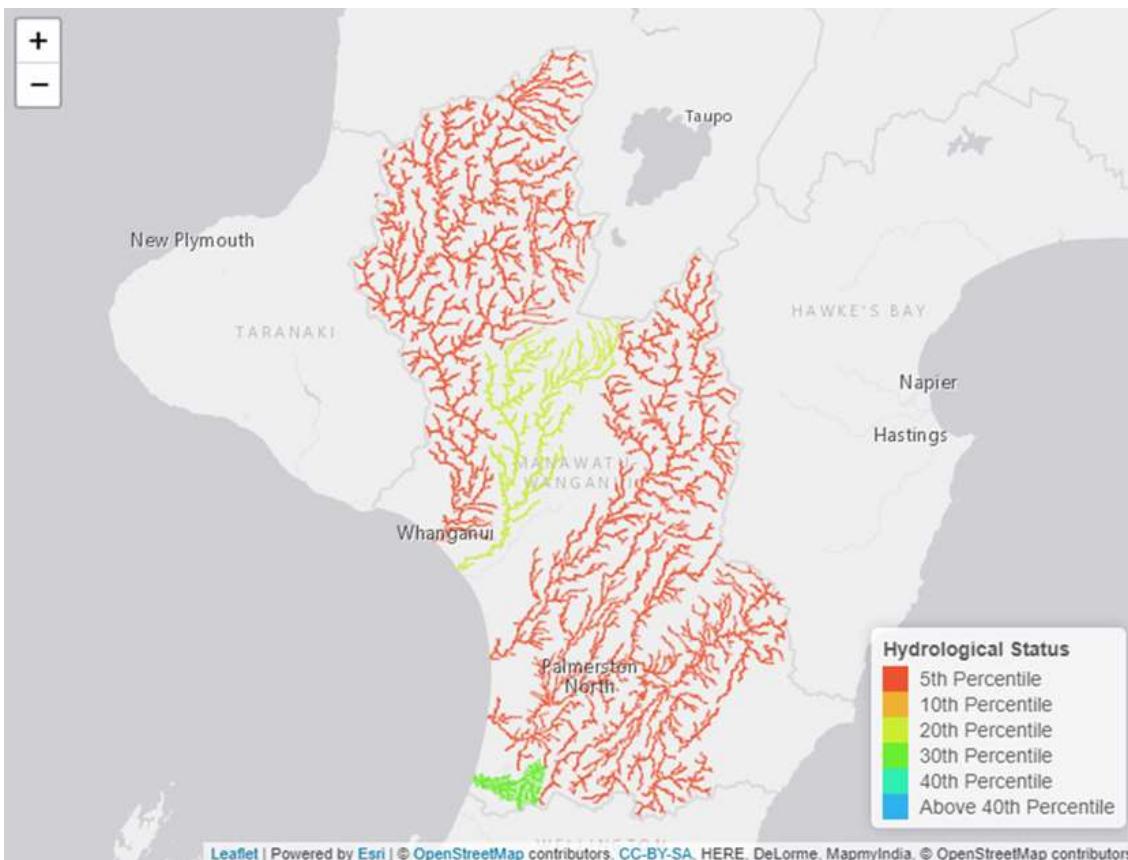
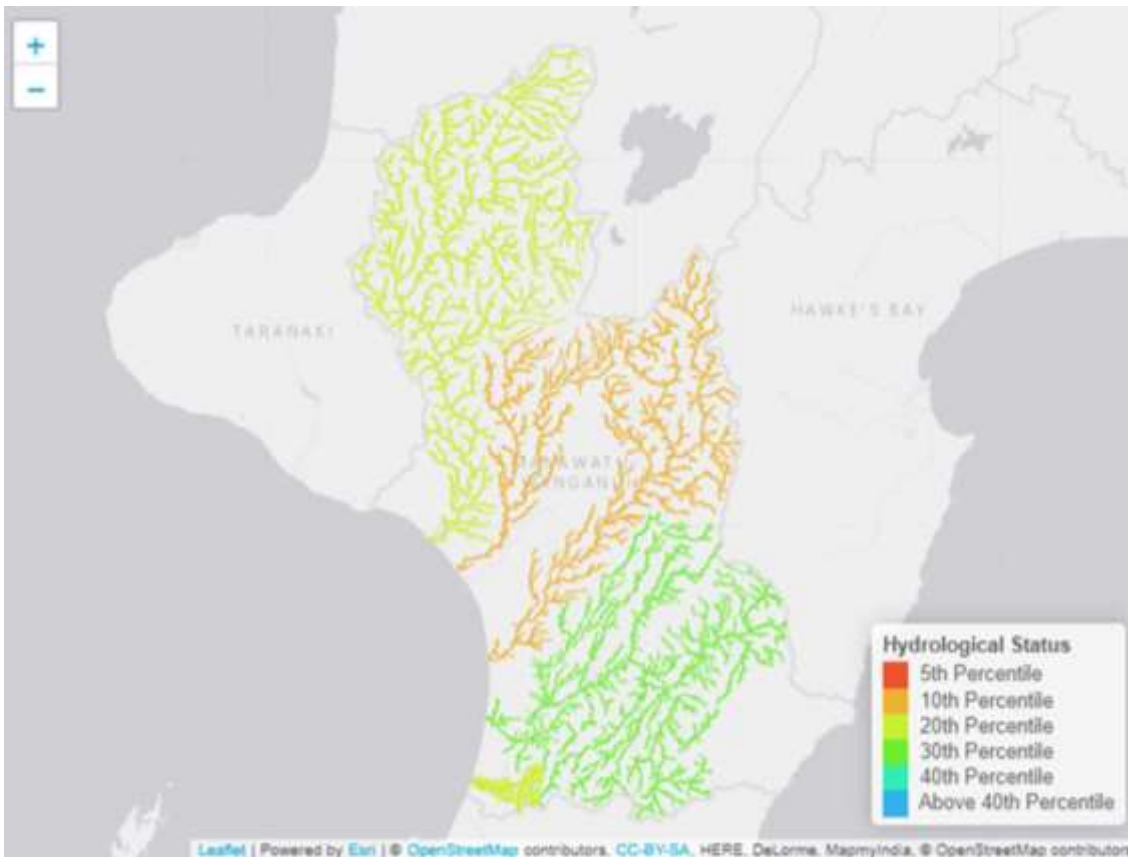


Figure 9: Hydrological status as determined by river flow over the preceding four months at 11 representative sites, February 2021 (top image), compared to the same date in 2020 (bottom image).

- 2.2.6 There were few low flow restrictions across the region for most of the summer to date. Some municipal water supplies have recently been required to limit or step-down abstractions as river flows began to decrease. As at 15 February, there are 39 consent holders experiencing some level of low flow restriction, across 14 flow monitoring sites. A number of sites were nearing low flow restriction levels. This pattern is expected for this time of the year.
- 2.2.7 The telemetered water use programme continues, with the programme of annual inspections is progressing well. A key challenge for this programme is access to communications in certain areas of the region and the team has made good progress in resolving a number of these issues. Cell-phone reception issues have been able to be resolved in some areas with the adoption of new technology to overcome the shortfall in signal in difficult terrain.

LAKES MONITORING

- 2.2.8 **State of Environment (SOE)** monitoring of lakes in the region has recently expanded to include monthly sampling of Hokowhitu Lagoon, commencing in November 2020, and Lake Papaitonga, commencing in December 2020. Hokowhitu Lagoon is a shallow riverine (oxbow) lake adjacent to the Manawatū River in Palmerston North which is popular for public recreation including picnicking, walking, fishing, kayaking and canoe polo. Lake Papaitonga (Waiwiri) is a shallow coastal dune lake situated just south of Lake Horowhenua. A scenic reserve with a walking path borders the lake and is managed by the Department of Conservation. These lakes were added to the SoE monitoring programme because of their public access and representative lake type in their respective catchments. This is a further step in meeting the requirement under the 2020 **National Policy Statement for Freshwater Management (NPS-FM)** for regional councils to monitor a set of lake sites that adequately represent each of the regions' **Freshwater Management Units (FMUs)**. Further recommendations to work toward this requirement have been proposed in the Long-term Plan.
- 2.2.9 Annual assessments for **Lake Submerged Plant Indicators** (LakeSPI) of ecological condition were carried out by NIWA for eight lakes in December 2020, six of which had been previously assessed, namely: Lake Dudding (2001, 2015), Pukepuke Lagoon (2001 and 2015), Lake Wiritoa (2001 and 2015), Lake Pauri (2015), Lake Alice (2015) and Lake Namunamu (2016). Two – Hokowhitu Lagoon in Palmerston North and Lake Virginia in Whanganui – were assessed for the first time. The results and report will be completed later in the year. This monitoring will inform assessment of lake state against new water quality attributes required under the 2020 **National Policy Statement for Freshwater Management (NPS-FM)**.

2.2.10 Microplastics are among contaminants of emerging concern for aquatic systems. The **Global Lake Ecological Observatory Network (GLEON)** has begun a study named **Global Lake Microplastics (GALACTIC)**, and Horizons has participated by sampling Lake Wairarapa and Lake Pouri in November 2020. The objective is to sample lakes worldwide to identify the occurrence of microplastics in surface water of different freshwater systems based on watershed and lake features (land-use, population, catchment area, etc.). Samples were sent to the University of Milano-Bicocca in Italy for processing free of charge. This will lead to a collective research paper, helping to advance global research around microplastics in freshwater systems.

ESTUARY ECOLOGICAL CONDITION MONITORING

2.2.11 Ecological condition and/or sedimentation monitoring of five estuaries was conducted by Salt Ecology in December 2020. Preliminary results showed that both the Waikawa and Ōhau systems had been well flushed by recent flooding at the time of sampling. The Waikawa in particular had less bottom waters with depleted dissolved oxygen than 12 months previously, but there are still obvious nutrient enrichment problems. The Ōhau estuary looked to be in good condition. There were also a few notable changes in the other estuaries monitored. Manawatū Estuary showed around 20 mm of sediment erosion at the monitoring sites. In contrast, Whanganui Estuary showed a build-up of sediment (accretion). The Whangaehu Estuary sediment results were quite variable. All the sites appear to be telling a story vividly showing how dynamic the estuaries are.

2.2.12 Full results and reports will be completed in June 2021 and this will include considerations for future monitoring.

CONTACT RECREATION WATER QUALITY MONITORING

2.2.13 Monitoring of more than 80 popular swim spots around the region began on 1 November 2020. The programme is delivered in collaboration with MidCentral Public Health Service, local councils and Ngā Waihua o Paerangi Trust. Monitoring results are reported weekly, as they become available, via both Horizons (<http://www.horizons.govt.nz>) and the LAWA (<http://www.LAWA.org.nz>) websites.

2.2.14 Results to date have been variable. In general, beaches sampled across the region have been mostly swimmable with a few exceedances at times. Further re-samples on these occasions (in line with recreational guidelines) have not warranted any beach closures and have to date returned results within the guideline values for swimmability. River sites have, on occasion, exceeded recreational guidelines for both *E. coli* and potentially toxic algae thresholds across the region. The Mangatainoka River, in particular, has been graded unsuitable for swimming at times due to potentially toxic algae levels.

- 2.2.15 The Kaikokopu Stream has had cautionary signage erected by public health due to a high reading of *E.coli* (14,100 MPN/100mL, and a follow-up result of 798 MPN/100mL (NB levels higher than 540 MPN/100mL is deemed unsuitable for swimming) directly prior to the Himitangi Big Dig weekend. It was anticipated the signage would be removed in the short term, depending on results.
- 2.2.16 Faecal source tracking is planned for four streams in late February 2021 (delayed from the 2019-20 season by COVID-19) as part of the programme. These include Kaikokopu Stream at Himitangi Beach, as well as Wairarawa Stream at Waitarere Beach, Wainui Stream at Herbertville and the Ōngarue at Cherry Grove monitoring site.
- 2.2.17 Whanganui lakes Wiritoa and Pauri have been suitable for swimming for much of the season to date. Potentially toxic algae monitoring was added to Hokowhitu Lagoon this season, and aside from a brief exceedance over the New Year period the levels were either amber or green (caution advised and suitable for swimming, respectively).
- 2.2.18 Lake Dudding was deemed unsuitable for swimming and warning signs erected between 16 November 2020 and 21 January 2021 due to high bio-volumes of potentially toxic algae. The closure at Lake Dudding this season has been longer than the closure in the 2019-20 season. The poor ecological health of the lake is highlighted in a recent report titled Duddings Lake by Gibbs *et al.* (2020) which outlines restoration options for the lake recommended by an expert panel following a workshop held in May 2019.
- 2.2.19 Figure 9 below shows the most recent contact recreation results displayed on LAWA and the Horizons website for Lake Dudding. It shows the site to be at amber alert due to elevated bio volumes of cyanobacteria. Lake Dudding has a long-term grade of poor based on five years of sampling.

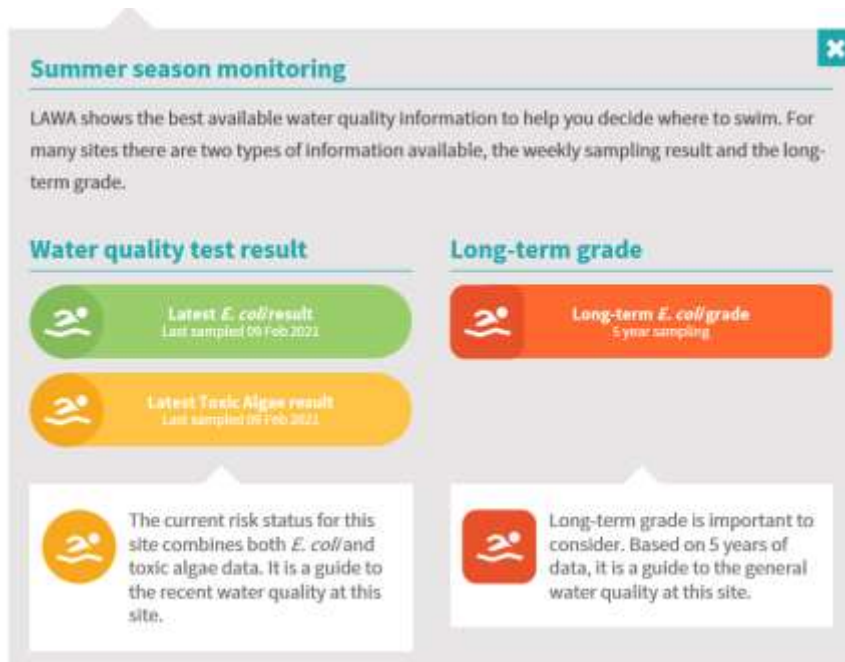


Figure 9 Screenshot of results for Lake Dudding on the LAWA site for the week of 9 February 2021

ENVIRONMENTAL DNA FISH MONITORING PROJECT

- 2.2.20 The Science and Innovation team is supporting sector-wide and regionally specific development of **Environmental DNA (eDNA)** tools for fish monitoring; eDNA is DNA that is isolated from an environmental sample, such as water or soil, rather than from the individual specimen itself. Living organisms constantly lose a stream of genetic material, through the loss of skin cells, scales, hair, excretion of slime, faecal material, reproductive material or other forms of living matter. By collecting DNA from the environment, in many cases we can work out what species are living within that environment, with some caveats.
- 2.2.21 The use of these tools for fish monitoring, and likely a range of other monitoring programmes, is expected to result in significant efficiency gain in staff time, cost and potentially increased power to detect species and characterise communities. Compared to the cost of traditional fish monitoring, eDNA is relative quick, simple and low cost. It is, however, a relatively new technique in New Zealand and given the many benefits of eDNA sampling, it is currently being investigated by most regional councils or unitary authorities, as well as Central Government organisations such as the Department of Conservation, and was the subject of a recent Envirolink tools project titled Molecular tools for characterising freshwater fish communities in New Zealand (Banks J, Kelly L, and Clapcott J, 2020). Prepared for Ministry of Business, Innovation and the Environment, Envirolink CAWX1802. Cawthron Report No. 3573. 66 pp. plus appendices.).

- 2.2.22 This technique, given its low cost and ease of use, is well suited for councils, research agencies, iwi/hapū, community groups, school groups and others looking to understand fish populations within local waterways.
- 2.2.23 During 2020-21, the Science and Innovation team is undertaking sampling to help address four distinct streams of work. The first is supporting a high replication project being run across New Zealand by local government. This project is exploring statistical measures of certainty based around number of sample replicates (replicates are individual samples that are collected multiple times under the same conditions to assess the variability in the results). This study will inform how many sample replicates are necessary for a given statistical certainty of measurement. This will help the sector gain robust confidence around how thoroughly to sample.
- 2.2.24 The second project is investigating the application of recorded fish DNA sequences to identify the presence of fish species in waterways. Presently, many recorded DNA sequences relate to only a single individual fish, which may be from another part of New Zealand. This can lead to false negative results when a species is present but not detected, as the DNA from the environment is too different from the corresponding DNA stored on the central database. For example, if the record was from an individual banded kokopu in the South Island, it may not necessarily relate to an individual banded kokopu caught in the north of the Horizons region. This is particularly problematic for non-migratory species because they are isolated to specific locations, so there is likely to be less genetic flow between populations. Through this project, eDNA sampling will be undertaken alongside traditional fish monitoring protocols. The known fish species from the traditional monitoring, identified by experienced staff, can then be used to ground truth the eDNA results. This gives any user in the Horizons region confidence that the technique is picking up species that are in the waterway or alternatively, identifies species that may need to be better characterised within the region.
- 2.2.25 The third project is exploring the effectiveness of remediated fish barriers. By sampling sections of waterway both upstream and downstream of a barrier, we can compare both presence/absence of fish species, as well as changes in relative biomass, to get an idea of whether a barrier is partially or fully impeding fish passage. If we repeat this process after having remediated a barrier, the expectation would be that the fish populations upstream and downstream of the barrier become much closer in composition following the fix. This stream of work will test this approach on barriers that are known to exist and are already identified for remediation by the freshwater team in this financial year.
- 2.2.26 The final project is a pilot study investigating a technique to characterise fish populations within a lake. A minimum amount of information is required to start

investigating the viability of eDNA in lakes and this pilot is expected to help direct future conversation. As this is a pilot study, further work will be required to fully inform this monitoring technique within lakes.

- 2.2.27 A short internal report outlining the findings of this project is intended to be completed in the 2021–22 financial year.

SUMMER BIOMONITORING PROGRAMMES

- 2.2.28 Summer water quality monitoring this year includes a range of projects centring on biological monitoring in the Horizons region, such as fish and macroinvertebrate monitoring. Much of this monitoring is flow dependant, so low flows and stable weather conditions throughout summer have allowed significant progress to be made.
- 2.2.29 As at early February, staff were more than halfway through macroinvertebrate monitoring, and on track to be completed by end of March. Fish monitoring programmes are also underway and we anticipate that this work will be completed by end of April.

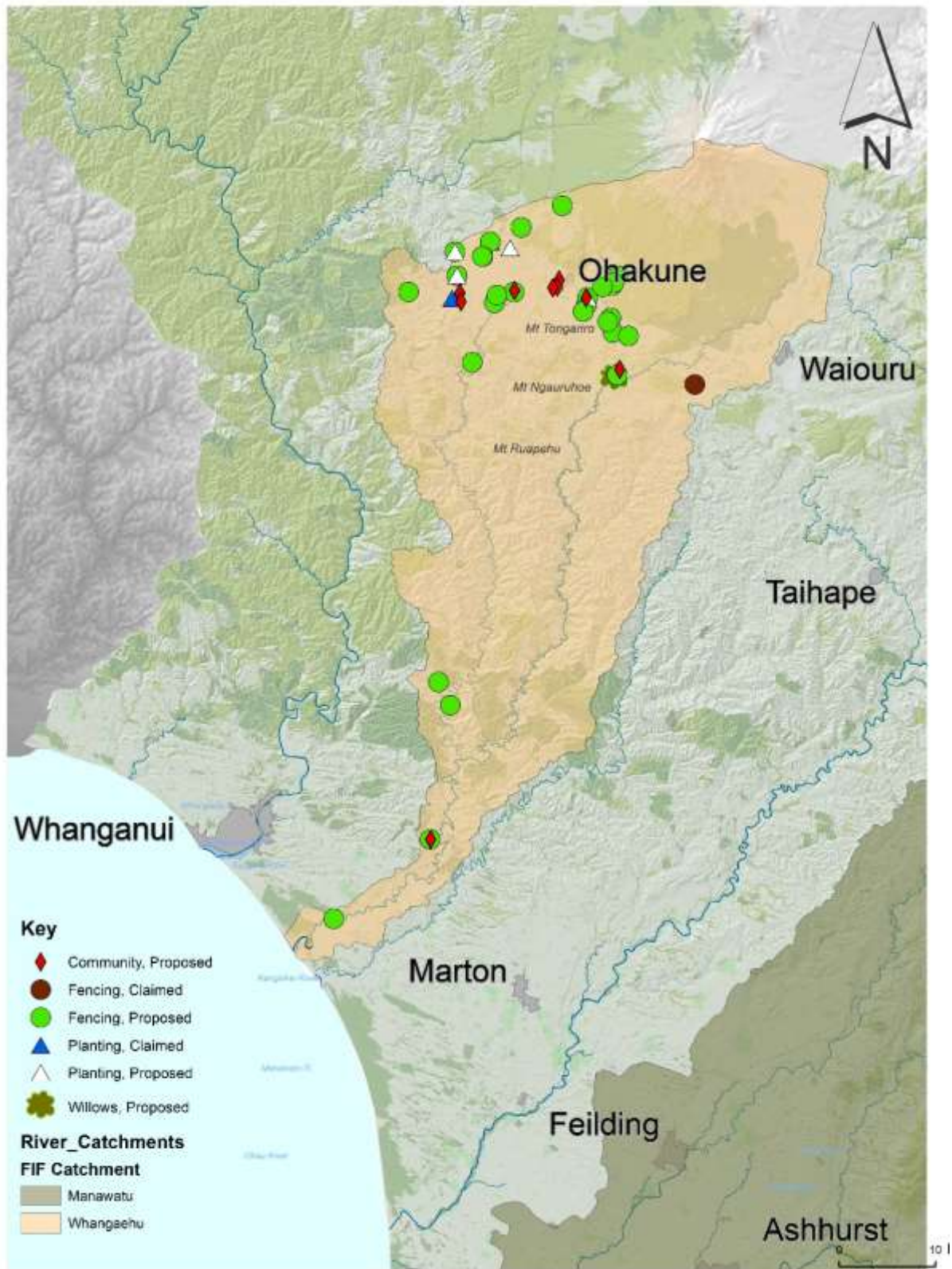
2.3 Whanganui and Kai Iwi FMU

- 2.3.1 This financial year, 9.432 km of stream fencing and 3,050 riparian plants have been allocated and 5.315 km of stream fencing has been completed and 1,693 riparian plants planted within the Whanganui Catchment. Some 9.235 km of stream fencing and 3,480 riparian plants have been allocated and 1.925 km of stream fencing completed along the Kai Iwi and Ototoke Streams within the Kai Iwi Catchment.

2.4 Whangaehu FMU

WHANGAEHU FRESHWATER IMPROVEMENT FUND (FIF) PROJECT

- 2.4.1 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.
- 2.4.2 With the Whangaehu FIF project set to end in June, stream fencing and riparian planting allocations are now fully allocated. Any new landowners and enquiries in this catchment are being signed up under the Jobs for Nature (previously the Regional Freshwater Programme) to enable works to be completed.



Whangaehu FIF projects January 2021

Map prepared by L Ferguson, NRP Group. 12 January 2021.

Figure 10: Stream fencing, riparian planting, and community projects that are proposed to be undertaken or have been completed in the Whangaehu Catchment.

2.5 Rangitīkei-Turakina FMU

PFAS MONITORING FOR OHAKEA

- 2.5.1 Horizons has been working with the **New Zealand Defence Force (NZDF)** on the ongoing monitoring of **per- and poly-fluoroalkyl substances (PFAS)** and related compounds around Air Force Base Ohakea. PFAS are a large group of manufactured compounds that have industrial and consumer applications and have been in firefighting foam used at the base. A monitoring programme was specially designed by Pattle Delamore Partners Ltd this year to monitor the movement of the PFAS plume over time⁴.
- 2.5.2 The first round of sampling was undertaken in September 2020 with preliminary results showing PFAS concentrations either similar to, or slightly below, the ranges previously recorded for existing monitoring locations. These results are in general agreement with the predictions from the groundwater modelling. Staff met with the Ohakea Water Contamination Committee at Manawatū District Council in December 2021 to discuss the preliminary results. The monitoring report is being finalised, and another round of sampling was to begin in late February 2021. A copy of the report will be made available on Horizons' website.

FLUVIAL PROGRAMME

- 2.5.3 During 2020-21, fluvial surveying is focussing on the Kawhatau River, a key gravel source for the Rangitīkei River. This survey will extend beyond (i.e. up-stream of) previous surveys in the Kawhatau that focussed on the gravel beaches only, to further our understanding of the fluvial processes occurring throughout the wider catchment.

STREAM FENCING AND RIPARIAN PLANTING

- 2.5.4 This financial year 19.531 km of stream fencing and 28,810 riparian plants have been allocated within the Rangitīkei- Turakina FMU. To date, 6.294 km of stream fencing has been completed and 23,479 riparian plants planted.

LAKE WAIPU/RĀTANA FRESHWATER IMPROVEMENT FUND (FIF) PROJECT

- 2.5.5 As part of the FIF project Horizons commissioned NIWA to complete a native and pest fish survey of Lake Waipu on 7 and 8 December 2020. This work is to understand the availability of host species for kakahi (freshwater mussel) recruitment within the lake and the ongoing sustainability of the kakahi population. The native species shortfin

⁴ PDP (2020) RNZAF Base Ohakea PFAS Investigation: Long Term Monitoring Plan

and longfin eels, and common bully were found in the lake, with the only introduced species encountered being goldfish. A final report is due prior to the end of June 2021.



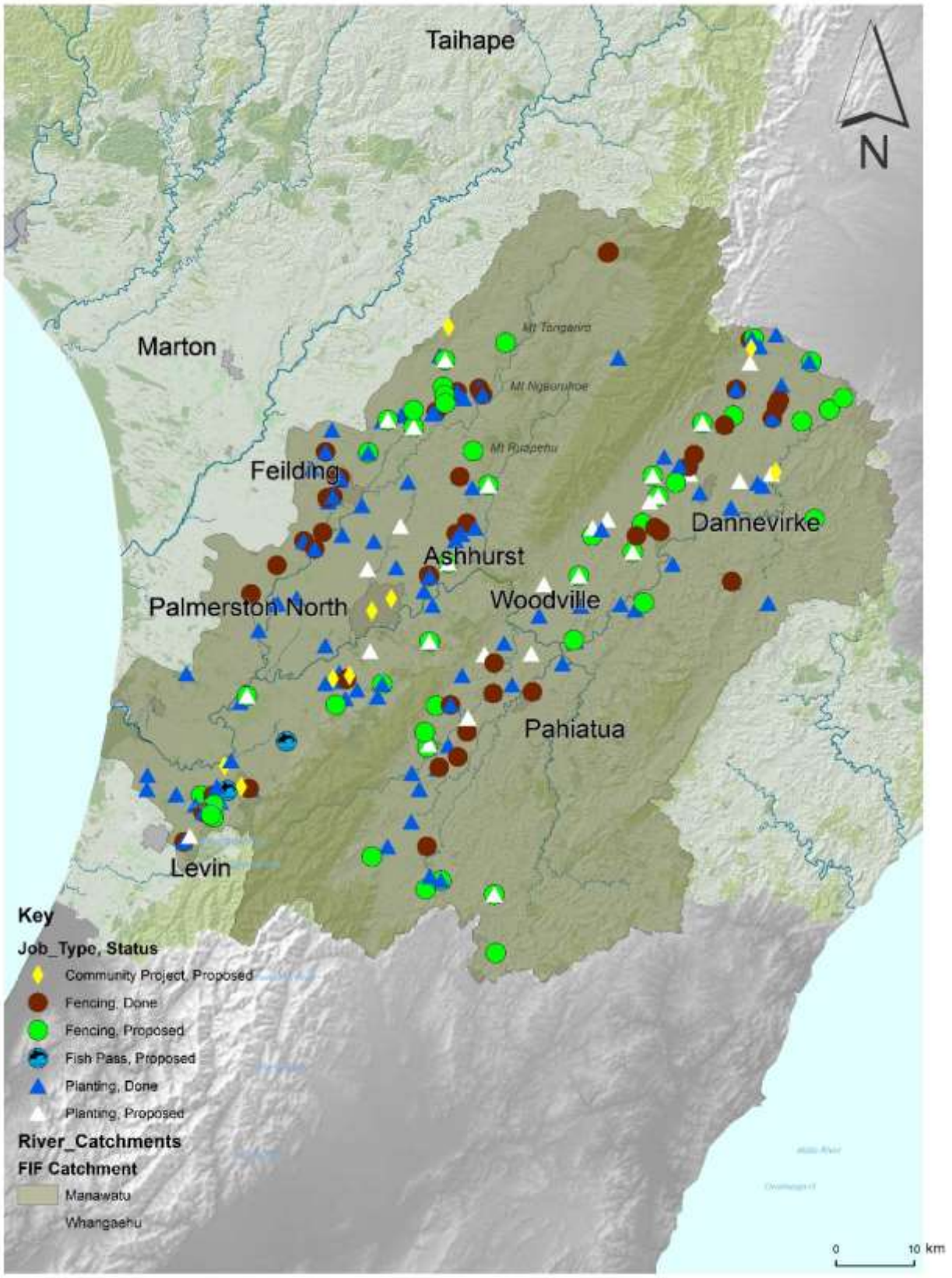
Figure 11: Left: Fish that were caught during the native and pest fish survey being processed. Right: Conditions were grim as processing of the fish samples continued.

2.5.6 Horizons staff have been working with Rangitikei District Council (RDC) and MfE to update the project plan for the wastewater management component of this project, which is seeking to cease the discharge to water (to Lake Waipu) and to fully apply the wastewater to land. A meeting was held with RDC, MfE, Horizons and landowners during December 2020 to progress this project further. The work programme and annual work plan are to be updated to reflect the proposed changes while the end date of the project (June 2023) remains the same.

2.6 Manawatū FMU

MANAWATU FRESHWATER IMPROVEMENT FUND (FIF) PROJECT

2.6.1 The first quarter of year three has been a busy one with the riparian planting season coming to an end, the third round of community-led projects have been received and enquiries for stream fencing and riparian planting continue to arrive, with an increase noted around the time of the new stock exclusion regulations being introduced. With current allocation for stream fencing and riparian planting, new applications are no longer being sought for this financial year and are being allocated to next financial year.



Manawatu awa FIF projects January 2021

Map prepared by L.Ferguson, NRP Group, January 2021

Figure 12: Stream fencing, riparian planting and community projects proposed to be undertaken or completed in the Manawatū Catchment.

2.6.2 The Manawatū Accord Community Grants received 15 applications seeking \$212,665 in funding. The decision-making panel agreed to fund eight new projects and one additional project (Plastic Pollution) is in year two of its programmed milestones. This gives a total of \$88,136.00 of projects being funded this financial year. These are;

- Construction of a Bioreactor – Te Maunga Farms Ltd;
- Manawatu River Road enhancement and access – Te Kauru hapū collective and B & P Drysdale;
- Save our native fish (riparian fencing and planting) – Buckley Golf Club, Shannon;
- Seeing, understanding & believing – a farmer-led project into waterway improvement (workshops to share knowledge of wider catchment project) – KapAg on behalf of Linton Streams Catchment Group;
- Source of Kiwitea (continuation of planting a large gully system) – M & L Wills;
- Waoku Stream Restoration Project (riparian fencing & planting) – D Okano;
- Nguturoa Stream Restoration (riparian fencing, weed & pest control, preserve & connect bush remnants) – C Finnigan on behalf of Linton Stream Catchment Group; and
- Whakaora Tapuata (weed control, riparian planting, cultural & awa monitoring) – Te Kauru hapū collective.

2.6.3 The second quarterly report for the year, covering the period October through December, was completed and submitted to MfE.

2.6.4 A Manawatū Accord Leaders Forum meeting was held on 2 December 2020, where the Chair (Richard Thompson) announced he would be retiring from the position in coming months. A replacement chair will be found in due course. At the Accord meeting it was confirmed that Horowhenua District Council would host the Manawatū River Improvement Festival on 27 February 2021 at the Manawatū River Loop Reserve (Foxton).

2.7 Waioupehu FMU

2.7.1 The Waioupehu FMU (formerly Horowhenua) encompasses the Lake Horowhenua and Lake Waiwiri, and the Ōhau and Waikawa River Catchments. Lake Horowhenua is a taonga for local iwi/hapū and has a degraded state below many national bottom lines for water quality. Toxic cyanobacteria causes the lake to be regularly closed for recreation. This is related to large amounts of sediment and nutrients entering the lake and the legacy contaminants already present.

2.7.2 The Ōhau and Waikawa estuaries also show signs of nutrient enrichment, with **estuary trophic index (ETI)** scores within the moderate and poor categories. These catchments are at risk of further eutrophication as a result of land use. Further investigation is needed to establish the state of health in Hokio, Waiwiri and Wairarawa estuaries.

2.7.3 The Ōhau River itself is generally in good health, with a number of water quality and ecosystem health attributes achieving **National Objectives Framework (NOF)** Band A or Band B. The Waikawa Stream and its tributary the Manakau Stream, show mixed results.

WORK TO DATE

2.7.4 Work to improve the state of freshwater in Waiopēhu has been underway since 2013, with Horizons working in partnership with the Lake Horowhenua Trust, Lake Horowhenua Domain Board, Horowhenua District Council, Horizons Regional Council, and the Department of Conservation as co-signatories to the Lake Horowhenua Accord. Past and ongoing initiatives include:

- The installation of a fish pass over the Lake Horowhenua Weir to enable fish migration between the sea and the lake (Freshwater Clean-up Fund).
- Construction of a sediment trap at the bottom of the Arawhata Stream, predicted to reduce sediment phosphorus loads into the lake via streams by more than 25% (Freshwater Clean-up Fund).
- Lake weed harvesting to reduce cyanobacteria blooms and the toxicity effects of the lake weed on fish in the spring (Freshwater Clean-up Fund).
- Sediment and erosion control plans for vegetable growers covering 80 per cent of the horticultural land in the Arawhata Sub-catchment of the Lake Horowhenua Catchment (Freshwater Clean-up Fund).
- Riparian fencing of 16 km has been erected and 24,000 plants put in along stream banks by local communities and landowners with support from Horizons and the Freshwater Clean-Up Fund.
- The Future Proofing Vegetable Production project led by LandWISE, which focusses on working with growers in the Horowhenua to develop use of precise nutrient prescription, precise nutrient application, maximise retention of nutrients and recapture nitrates that move beyond the root zone (Sustainable Farming Fund).

FUTURE FOCUS

2.7.5 The focus for the next few years in the Waiopēhu FMU will be to launch the weed harvester on Lake Horowhenua, complete the Jobs for Nature Lake Horowhenua wetlands project and upgrade our water quality monitoring programme to inform water quality interventions through Jobs for Nature and complete freshwater accounting for the FMU to inform the implementation of the new **National Policy Statement for Freshwater Management (NPS-FM)**.

WEED HARVESTER

2.7.6 Lake weed harvesting was recommended as a key restoration option for Lake Horowhenua, incorporated into the Lake Horowhenua Accord and the Lake Accord Action Plan. Lake weed alters the chemistry of the lake by increasing the pH of the

water, lowering the nitrogen concentration and providing a favourable environment for phosphorus release and promoting cyanobacteria blooms. Harvesting weed interrupts this cycle and provides an environment more favourable to fish and other aquatic life, including native lake weeds.

- 2.7.7 Construction of the Arawhata boat ramp (Figure 13) that will enable launch of the weed harvester onto Lake Horowhenua began in November 2020 and is due for completion by May 2021.



Figure 13. Progress at the Arawhata boat ramp. Photo taken 17 February 2021.

JOBS FOR NATURE

- 2.7.8 In 2020, a four-year \$12.5 million project was announced for a Lake Horowhenua wetlands programme to remediate nutrients and sediment in the Lake Horowhenua Catchment. This project is funded through the Covid-19 recovery programme “Jobs for Nature” (\$11.2 million) by the Ministry for Environment (MfE) and partly funded by Horizons (\$1.3 million). The purpose of the project is to establish a wetlands complex within the Arawhata Sub-catchment and an associated works programme of other interventions around the lake to improve water quality and aquatic health in the catchment.

- 2.7.9 Key elements of the proposed work programme are:

- Establish a Governance Group (by June 2021).
- Produce reports and modelling of the groundwater and nutrient/sediment pathways and sources within the FMU to refine the placement of interventions for water quality improvement (by June 2024).

- Implement at least one intervention that will result in water quality improvement in the FMU, including designing and building a wetland complex (by 2024).
- Communicate information on the lake and FMU to iwi/hapū and the community.
- Employ one Freshwater Coordinator – Lake Horowhenua and three monitoring/science staff.

2.7.10 The four-year funding term for this project commenced on July 1 2020, however negotiations to finalise the contract with MfE are still in progress. With the end of the first year of the project nearing, staff have been preparing the programme of work for Year 1, however implementation depends on the project being contracted. To date the following preparation has been underway:

- A workshop with technical experts held in August 2020 to refine information and data gaps.
- Development of an upgraded monitoring programme to support wetland design and wider catchment interventions is being finalised.
- Jacobs were contracted to conduct a wetland feasibility study in the Arawhata Sub-catchment, including conceptual designs. This work is in the draft report stage.
- The draft Sedimentation and Drainage Management Plan for the Arawhata sub-catchment has been completed by Tonkin + Taylor and a workshop will be held in late February to discuss the findings and recommendations.

Planned activity in the coming months includes:

- Employment of the Freshwater Coordinator – Lake Horowhenua and three monitoring staff.
- Commence the development of a nutrient and sediment budget and process for freshwater accounting.
- Develop a groundwater conceptual model to inform the nutrient budget
- Further work to design and implement the constructed wetland project.

2.7.11 Some of our existing programmes dovetail into the Jobs for Nature work, including the Integrated Sedimentation and Drainage Management Plan for the Arawhata Sub-catchment which was scoped in 2019 and is near completion. The upgraded monitoring programme will also inform the NPS-FM freshwater accounting process which has been included as a key outcome in the design of the programme.

MONITORING AND SCIENCE

2.7.12 Lake Horowhenua and its tributaries have been monitored monthly for nutrients, sediment and *E. coli* and flow since 2013. Water quality state and trends are available on [LAWA](#). Continuous flow and turbidity monitoring at the base of the Arawhata Sub-catchment has been in place since 2018 and continuous flow monitoring was installed on the Pātiki and Mangaroa streams in 2019. There are currently 17 groundwater level

monitoring sites in the Horowhenua Catchment and monthly lake level measurements were recently established for Lake Waiwiri.

2.7.13 Between 2016 and 2019, an intensive fortnightly monitoring programme was implemented in the Ōhau and Waikawa Catchments to inform nutrient sources and surface water groundwater interactions. This data will be used to inform estuary limit setting, a project currently in the scoping stage.

2.7.14 The monitoring programme to support the Jobs for Nature project is currently being refined, with the following proposed on top of the established State of Environment programme:

- A synoptic survey of the Arawhata, Mangaroa and Pātiki streams. Radon, tritium, nitrate and isotopes will be sampled to establish the groundwater/surface water interactions and determine nutrient sources. This is a one-off investigation taking place in late February/early March 2021.
- An extended groundwater monitoring programme for groundwater level and water quality. Additional groundwater bores will be established, particularly in the Arawhata Sub-catchment, to determine groundwater flow and nutrient pathways.
- Additional continuous flow, nitrate and turbidity surface water sites will be established further up the Arawhata Catchment than the current site at Hokio Beach Road, to capture high rainfall events and identify nutrient and sediment transport in more specific locations.
- Nested piezometers will be installed around the perimeter of the lake to establish the groundwater gradient and refine the lake water balance.

2.7.15 A conceptual model for the Horowhenua FMU is in the scoping stage and the intensive monitoring will help inform a more detailed and refined groundwater model in later years of the project.

2.7.16 During the quarter ending 31 December 2020, under the Future Proofing Vegetable Production project, LandWISE have been setting up replicated nitrogen application trials on 12 vegetable growers' paddocks. The trials are to validate soil tests, nitrate quick tests and the associated FAR Nitrate Mass Balance tool to make informed fertiliser application decisions. Over the next month, field walks across the trial blocks are planned with the wider growing community to reach as many growers as possible.

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