NATIONAL PERFORMANCE REVIEW 2018–2019

water NEW ZEALAND
The New Zealand Water & Wastes Association Waiora Aotearoa

COVER IMAGE:

Overlooking the lakes and Water Treatment Plant at Te Marua, Water New Zealand's Lesley Smith and her Mum Anne take in the view. Water is taken from the Hutt River at Kaitoke, to supply water into the wellington water network, distributing it as far south as Karori.

The river is protected by the Hutt Water Collection Area, which consists of around 9000 ha of lush podocarp and beach forest at the southern end of the Tararua Ranges. The lakes can hold enough water to supply the four cities (Lower Hutt, Porirua, upper Hutt and Wellington) for 21 days.

Photographer:
Tony Smith (Lesley's Dad)

NATIONAL PERFORMANCE REVIEW 2018-2019

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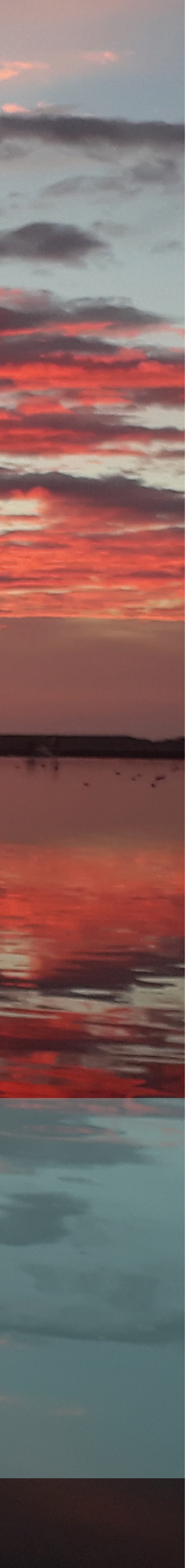
One of two of Timaru's waste stabilisation ponds at dawn. The 15 hectare ponds treat wastewater from the towns of Geraldine, Pleasant Point, Temuka, and Timaru. The pond and wetland areas attract birds and other wildlife, with a perimeter specifically for this purpose. An example of how wastewater treatment plants and nature can and often do, cohabit the same environment.

Photographer: Russell Grant, Timaru District Council



FOREWORD

The National Performance Review (NPR) is an annual assessment of drinking water, wastewater, and stormwater service delivery across New Zealand. This process is co-ordinated by Water New Zealand, an independent not-for-profit organisation representing water professionals and organisations.

Data and financing for this project are provided by participating entities on a voluntary basis. Their efforts demonstrate a strong commitment within the sector to transparently providing information on service delivery, and finding opportunities to improve. Water New Zealand extends thanks to all involved in the process.

Water New Zealand's staff are guided by a project advisory group which represents participating entities. Our thanks to the following individuals who supported the 2018-19 review:

- Mark Baker, Queenstown Lakes District Council
- Robert Blakemore, Wellington Water
- Martyn Cole, Kapiti Coast District Council
- Laurence Edwards, Wellington Water
- Mike Schruer, Tasman District Council
- Grant Stuart, Watercare

Thank you also to the talented photographers who participated in the Water New Zealand photo competition, many of whose pictures adorn this report.

The recent formation of Taumata Arowai, the water sector's new regulator, which is set to reshape oversight of the water industry, makes it more important than ever that a factual evidence base is used to guide decisions. Water New Zealand is pleased to provide the information in the NPR as a basis for understanding the current state of the sector.

Disclaimer

Water New Zealand endeavours to provide data that is as consistent and accurate as possible. Our quality review process is outlined in the companion document National Performance Review: Quality Assessment Process (Water New Zealand, 2019). The reliability of this information is limited by the data that individual participants have made available.

When making performance comparisons of water services, it is important to note influences outside of an organisation's control, such as customer mix, service area density, topography, quality of source water, and receiving environments, which all influence performance outcomes.

Performance outcomes are also influenced by data collection and reporting systems. Participant systems range from pen-and-paper-based data collection to comprehensive data management technologies. This can mean participants with robust reporting methods rank comparatively poorly against those with less sophisticated methods. For example, a comprehensive customer complaints management system is likely to record more complaints than a pen-and-paper-based system due to more accurate data capture.

Contacting water service managers to get an understanding of any limitations or performance drivers is recommended when making decisions based on the data.

EXECUTIVE SUMMARY

The National Performance Review (NPR) is an annual assessment of New Zealand's drinking water, wastewater, and stormwater service provision. Its aim is to provide participants and stakeholders with accessible and comparable data, as well as to identify opportunities to improve service delivery.

This year's Review covers two Council Controlled Organisations (CCOs), and 42 of 64 territorial authorities with responsibility for water supply, wastewater, and stormwater services.[1] Collectively, these entities provide these services for 4,467,620 New Zealanders (approximately 91% of the population). Appendix I: *Participant acronyms and categorisation* provides information on the entities reporting to the Review.

This report collates water, wastewater, and stormwater service provision information at a national level. Comparative performance is available via an online data portal, with related links provided throughout this report. Supporting resources outlining data definitions and quality assurance processes are also available from the Review's website: www.waternz.org.nz/NationalPerformanceReview.

The Review provides a performance assessment of the critical aspects of water, wastewater, and stormwater service provision, and the protection of public health and the environment in a reliable, resilient, economically sustainable, resource-efficient, and customer-focused manner. It also looks at the capacity and capabilities of the sector's workforce.

The NPR has been undertaken annually since 2008. Many of the trends evident in this year's data have been dealt with in previous years' reports. In the 2017/18 report, several trends were noted which remain just as pertinent this year. While commentary has not been provided in this report, the challenges and opportunities these issues present still remain. Recurring themes with more detailed commentary in last year's report are:

- Most water suppliers could economically reduce water-loss levels. Total water loss was around 18% of water supplied.
- The proportion of residential properties with individual water meters is gradually growing. Over half of New Zealand's residential properties now have water meters in place.
- Blockages to the wastewater system remain the leading cause of dry-weather overflows. Industry efforts to address the causes of blockages, such as wet-wipe flushing, remain as important as ever.

This year's report shows several promising trends. Spending on existing assets is nearly matching depreciation, suggesting that assets are being maintained to keep up with existing levels of service. Gaps between budgeted and actual expenditure are closing, signalling pressures preventing project delivery in the sector are reducing at pace. Over $1.2 billion dollars of capital projects were delivered in the 2018/19 calendar year.

Despite record levels of spending, charges have increased little in recent years, and remain modest, with the average household paying just under $850 per year for water and wastewater services. Customer-focused performance metrics, such as complaints and response tracking, are now well embedded within most water suppliers' operations, which is a marked change from five years ago prior to the introduction of mandatory reporting.

Continued population growth and increasing awareness of the importance of environmental protection, however, continue to create challenges for the sector. The NPR has highlighted issues and opportunities for the sector to improve its performance, which are outlined here:

High vacancy levels in the water sector appear to be driven by growth in employee numbers.

Total vacancies are nearly 10% of total staff employed, confirming staff attraction remains a pressing industry need. Efforts to attract and retain staff into the water sector require concerted effort and will be a core focus of Water New Zealand in 2020. This year's data suggests this is driven by

1 The Chatham Islands are not included in this Review.

employment growth rather than staff leaving the sector. Repeat participants reported an additional 135 jobs on the previous year. In the coming five years, 11% of the workforce is due to retire, about what would be expected for a typical workforce where most workers commence careers at age 20 and retire at 65.

Around one third of the sector's staff have no formal qualifications.

Data suggests around one third of staff employed in the water sector have no relevant formal qualification. This highlights the important role continuing professional development must play in ensuring a skilled workforce. To this end, a Water Industry Professionals Association was established in 2019 to provide a framework for continual professional development. The challenge now is for the industry to support this initiative to ensure its success.

Source water for drinking water supplies is not comprehensively managed.

The government enquiry into the 2016 Havelock North drinking water contamination event found there were gaps in resource management in relation to source water protection for drinking water supplies *(Government Inquiry into Havelock North Drinking Water, 2017)*.

Management of source waters is a regional council responsibility (not the responsibility of participants in this Review), however understanding catchment risks is a critical component of ensuring safe drinking water (a core function of Review participants). For this reason, source water protection has been introduced into the National Performance Review.

Less than half (17 of 43) of participants had identified the zone from which water was sourced for their drinking water supplies. Nearly one third of participants did not respond to this and other questions on source water management, suggesting they are not aware of regional councils' activities to protect source water for drinking water supplies, or that the regional council does not have measures in place.

Only four participants provided a response suggesting they were actively engaged in any regional council processes for protecting source water, and the only comprehensive response was provided by Hastings District Council. It appears, therefore, that the Havelock North enquiry findings have catalysed an improvement in that district, but that the learnings have not translated into action in other jurisdictions.

Responsibilities of the new water regulator, Taumata Arowai, include the management of risks to sources of drinking water. Acting now to understand and manage source water risks will ease water suppliers' transition into the new regulatory regime.

Wet weather wastewater overflows are generally un-consented and not well understood.

Stormwater and groundwater makes its way into wastewater pipes especially during periods of heavy rain. The complete containment of sewage in wet weather is not always possible, and in heavy rainfall events the capacity of sewerage infrastructure can be exceeded, causing wastewater overflows.

Over 1,000 wet weather-related wastewater overflow events were recorded in 2019 across 28 jurisdictions, yet only seven of these (Auckland, Christchurch, Dunedin, Grey, Nelson, Tauranga, and Whangarei) held consents for such overflows. Without consents in place to proactively address wet weather overflows the issue becomes largely out of site and out of mind. Public and officials have limited opportunity to input into Level of Service discussions that necessarily require trade-offs between infrastructure spending and public environmental health, leaving these as the sole discretion of the network owner.

Review data suggests the number of wet weather overflows occurring is significantly higher than reported. Where participants had in place SCADA monitoring of overflow locations the average number of overflows was twice that of participants who replied on verbal reports alone. The extent of overflows is, therefore, likely larger than stated. Again, the absence of consents means there are no formal drivers to put in place monitoring systems for wastewater overflows.

Approaches to the design and modelling of sewers to contain wet weather surcharges presents further issues. There are no prescribed standards or guidelines for approaching this task, leading to inconsistent approaches and patchy understanding around New Zealand. In reporting on sewage design and modelling data quality, the NPR's independent auditor commented that "[w]e believe that the industry in general has poor information/knowledge of the performance of the wastewater and combined sewer networks during wet weather".

Compliance actions in response to wastewater treatment plant consent non-conformance is rare.

Participants reported a total of 627 non-conformances with wastewater treatment plant consents. In the same period only eleven compliance actions were taken in relation to these consents (six abatement notices, two infringement notices, one enforcement order, and two prosecutions) indicating that formal processes to remedy non-conformance are rare. The low number of compliance actions continues a trend evident in previous years.

Management of stormwater quality is not yet widespread.

Stormwater quality monitoring programmes and/or catchment management plans are in place for just over half the Review's participants. Consents for stormwater discharge are even less widespread. Only eight participants had all stormwater discharges consented. Most commonly, participants had consents for less than 10% of the network, and six participants had no stormwater discharge consents whatsoever.

With some areas leading the implementation of stormwater quality improvements, an opportunity is created for those getting started to leap-frog planning, consenting, and operational practices to improve stormwater quality through the learning experiences of others. The annual stormwater conference is one such knowledge-sharing opportunity.

Water and wastewater charges present significant affordability challenges for some of New Zealand's lowest income earners.

Average water and wastewater charges are modest, at slightly under $850 per year, however water and wastewater charges vary significantly around New Zealand. Figures show that consumers are paying over three times as much ($863/year versus $262/year) in some areas as in others for water, and over ten times as much ($1,217 versus $116/year) for wastewater services. In the most expensive jurisdiction the average customer will have a water and wastewater bill of over $1,700.

Workers on minimum wage would, therefore, have to work 115 hours to pay their bill. For those who depend on the single living-alone superannuation payment, the highest water and wastewater bill constitutes over 8% of their income. For those dependent on the sole parent support payment, it constitutes more than 10% of their income.

While rates relief and customer support services are generally dispensed by councils, water managers still need to keep the financial realities of vulnerable customers in mind when planning works and budgets. It is these often-overlooked members of our community on whom the sector's funding decisions will have the greatest impact.

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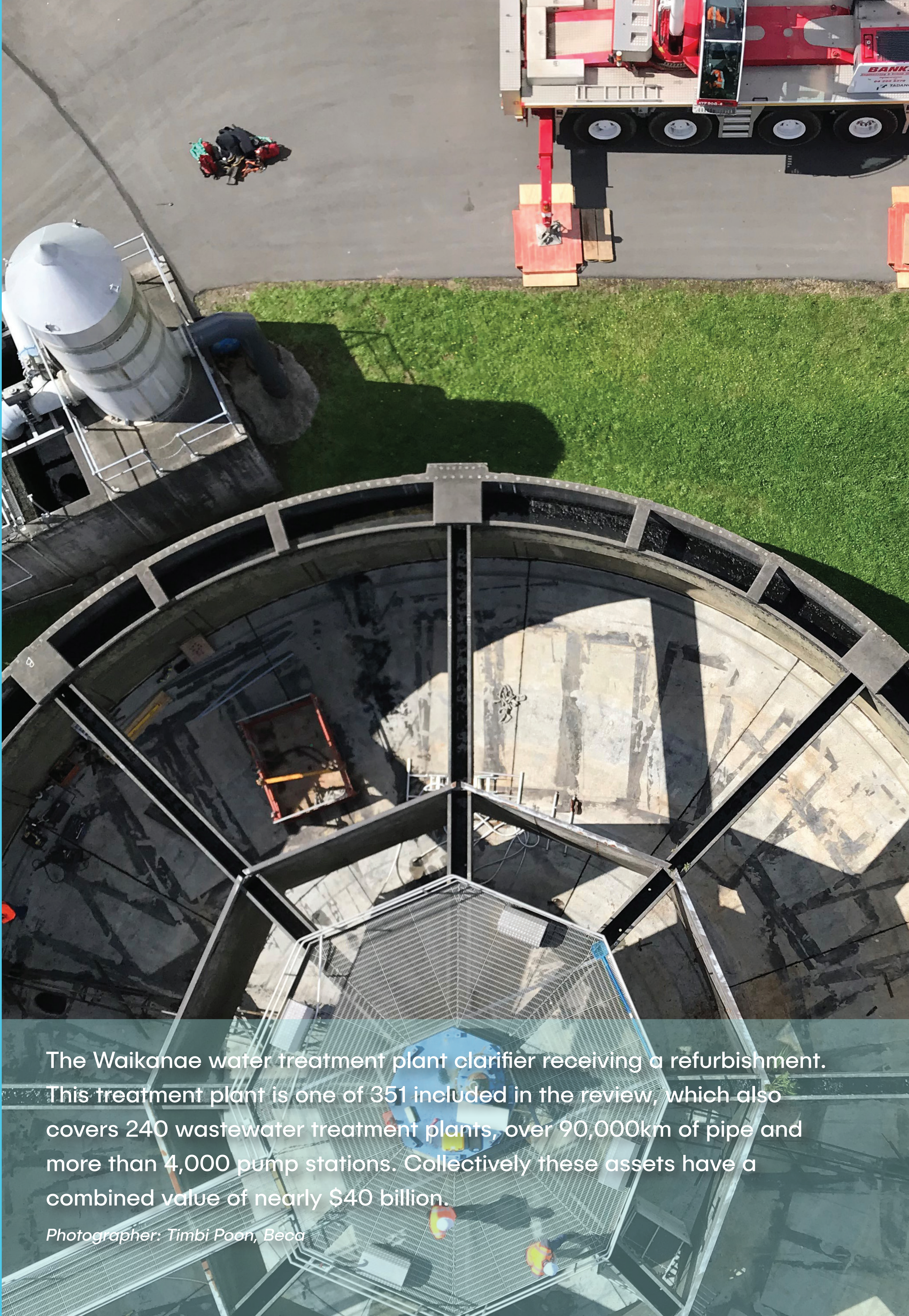


The Waikanae water treatment plant clarifier receiving a refurbishment. This treatment plant is one of 351 included in the review, which also covers 240 wastewater treatment plants, over 90,000km of pipe and more than 4,000 pump stations. Collectively these assets have a combined value of nearly $40 billion.

Photographer: Timbi Poon, Beca

1 ABOUT THE NATIONAL PERFORMANCE REVIEW

1.1 Purpose

The National Performance Review is an annual assessment of drinking water, wastewater, and stormwater services, led by water service managers to provide them with information to enhance their service delivery. The Review also collates information on services into a single place to inform decision-making. The Water Services Managers Group, Water New Zealand board, and National Performance Review Advisory Group all draw on information in this report to inform the sector's performance improvement initiatives.

Central government, researchers, service providers, and other stakeholders are also encouraged to use the data as an evidence base for 3 Waters-related decisions. In registering for the Review, participants acknowledge that their information will be made available in the public domain. Information requests, and collaboration with third parties seeking data to assist them in advancing the sector's interests, are welcomed.

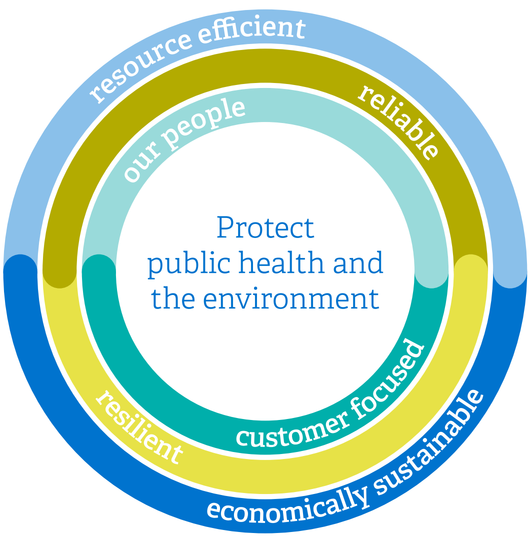
1.2 Information covered by the report

The National Performance Review (NPR) is an annual assessment of drinking water, wastewater, and stormwater service delivery throughout New Zealand. This report uses colour-coded figures to show information about each of these services individually.

This report provides a high-level summary of data and trends, often presented using Box and Whisker plots. Information to assist in the interpretation of these is included in Appendix III: *Box and whisker plots*. Individual participant data presented in comparative benchmarks is provided separately via an online data portal, with related links throughout this report. The data portal and other supporting information are listed in *1.1 Supporting material*, and are available from www.waternz.org.nz/NationalPerformanceReview.

Each chapter of the report relates to a core element of water service delivery, shown in Figure 1. This report does not focus on drinking and freshwater quality, which are covered by the *Annual Report on Drinking Water Quality (Ministry of Health, 2019)* and the freshwater chapter of *Environment Aotearoa 2019* (Ministry for the Environment, 2019).

Figure 1: Aspects of 3 Waters service provision addressed by the National Performance Review



The NPR has been produced annually since 2008. Data in this report relates to the period 1 July 2018 to 30 June 2019, referred to as FY 2019 throughout this report. Only participants with five years' concurrent data (FY 2015 to FY 2019), listed in Appendix 1, are shown in trended figures.

1.3 Review participants

Reporting entities include two council-controlled organisations, Watercare and Wellington Water, which provide services to Auckland and Wellington regions respectively. The remainder are territorial councils which have responsibility for water, wastewater, and stormwater service delivery.

A list of participants and abbreviations used to refer to them in this report is included in Appendix I: *Review participants*. In general, each of these entities provides water, wastewater, and stormwater services to all urban areas in the council's jurisdiction. There are exceptions, however, which are listed in Appendix II: *Reporting exceptions*.

Participants have been classified as small, medium, or large to assist in comparisons of like entities (primarily through the data portal). Participants classified as small serve fewer than 20,000 water and wastewater properties (a property with both a water and wastewater connection is counted as two), and participants classified as large service more than 90,000 water and wastewater properties. A list of classifications is shown in Appendix I.

1.4 Supporting material

This report provides an overview of the National Performance Review process, data, and trends. The Review itself includes a number of supporting resources, all available at: www.waternz.org.nz/NationalPerformanceReview
Previous years' reports, dating back to 2008, are also available via this link.

1.4.1 Data portal

The data portal shows individual participant comparisons. Links to associated information in the data portal is listed in each of the relevant sections of this report.

1.4.2 Data quality assurance processes

The National Performance Review has in place a series of processes to review the quality and consistency of information in this report. These are outlined in the companion document Quality Assessment Process (Water New Zealand, 2019).

Independent audits are conducted as part of this process. An annual report summarising the audit findings is available for each year's Review.

1.4.3 Data definitions

National Performance Review 2018/19 Definition Guidelines (Water New Zealand, 2019) provides detailed definitions of data and confidence gradings, as well as a summary of changes to measures from previous years.

References to definition guidelines are generally provided in figures and tables using indicator codes delineated with brackets. Codes for data definitions are included for definition guidelines to be cross-referenced with figures and tables in this report. Codes adhere to the following format:

- Characters1-2: Denotes whether the data is related to Water Supply (WS), Wastewater (WW), or Stormwater (SW).
- Character 3: Denotes whether information refers to Background (B), Asset (A), Social (S), Environmental (E), or Financial (F) characteristics.
- Characters 4-5: Numbering to delineate between the different data points.

For example, indicator SWB1 relates to stormwater background data, and is the first data point listed in the definition guidelines.

The Pukete Wastewater Treatment Plant is Hamilton's only wastewater treatment facility, responsible for treating all the citys wastewater. Here workers inspect the Pukete outfall which discharges wastewater that has been through the treatment process into the Waikato river.

Photographer: Martin Scott, Hamilton City Council

2 OUR PEOPLE

2.1 Workforce profile

Participants in the NPR employed 4,133 full-time employees: 2,590 directly as staff and a further 1,543 as contractors. A breakdown for each participant is available via the data portal link below.

Data portal link 1: Number of staff, contractors, and vacancies per participant
https://www.waternz.org.nz/workforce

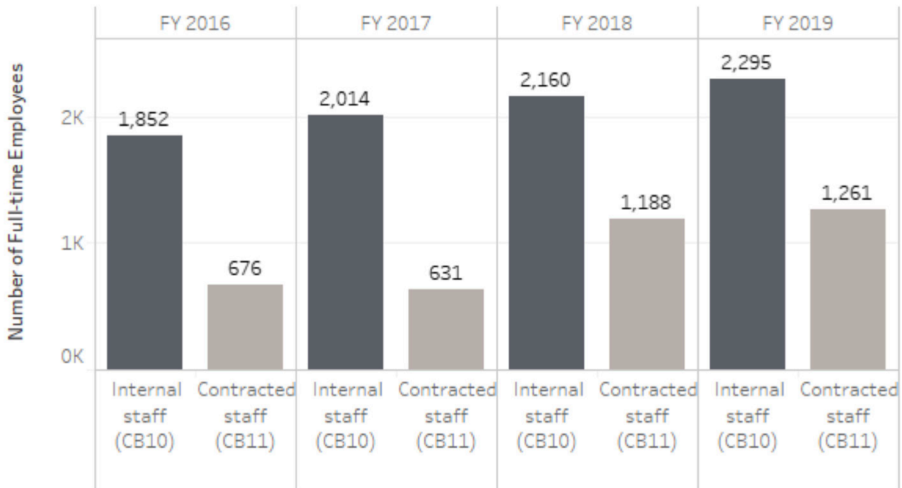
Excluding contractor vacancies, 220 vacancies constituting nearly 10% of internal staff were reported. A further 273 staff, representing approximately 11% of the workforce, are set to retire within the coming five years (based on a retirement age of 65).

Table 1: Total number of staff, contractors, and vacancies

	Internal Staff (CB10)	Contracted Staff (CB11)	Staff Vacancies (CB10a)	Retiring Staff (CB10b)
Total numbers	2,590	1,551	220	273
Median staff per 1,000 water and wastewater properties serviced[2]	0.759	0.001	0.04	0.09

The number of staff working in organisations who have repeatedly participated in the NPR has steadily increased since reporting on this metric began in 2016.[3] Figure 2 shows the number of internal staff and contractors employed by participants throughout this period.

Figure 2: Number of internal staff and contractors employed by repeat participants



2 Auckland Council data has been normalised by the number of stormwater properties serviced.

3 Staffing metrics have been the focus of external audits to address the following issues:

- Contractor staff (CB11): refinements have been made to the definition of contractors to ensure all staff are accounted for.
- Internal staff (CB10): includes staff providing 'overhead' functions who spend more than 50% of their time supporting water service delivery (such as finance and administration roles). These should be included in this metric, but are not always accounted for.

These factors may have contributed to, but are unlikely to wholly account for, some of the increases in staffing levels.

2.2 Training

2.2.1 Continuing professional development

On average, staff received 30 hours of training per year. Average hours spent annually in training per staff member for the 29 participants providing data on this metric is provided in Figure 3.

Figure 3: Average staff training hours per year

The number of staff listed as being enrolled in continuing professional development programmes is 901.[4] Six participants provided further information on the professional development schemes staff were enrolled in. Four listed the Engineering New Zealand scheme. Tasman noted it also had staff enrolled in schemes by the Institute of Civil Engineering and Electrical Workers Registration Board. Kapiti's scheme was internal, and Ruapehu cited the continuing professional development scheme of Veolia (their principal contractor).

2.2.2 Qualifications

The number of qualifications listed is 940, which covers 64% of internal staff of the organisations reporting on this metric (however some participants had one staff member holding qualifications in more than one category). The total number of qualifications held by staff is shown in Table 2.[5] Thirty-seven entities provided responses to one or more of these questions.[6]

Table 2: Qualifications held by participants

	Staff with a Bachelor's degree (CB10)	Staff with a New Zealand Certificate (CB15b)	Staff with a New Zealand Diploma (CB15c)	Staff with completed apprenticeships (CB15d)	Total staff covered by participants responding to qualification question (FTE)
Total numbers	364	318	185	72	1,451

2.3 Health and safety

A summary of the near-miss and lost-time injuries recorded since 2016 is shown in Table 3. Values relate to both internal staff and contractors working exclusively on 3 Waters. A comparison of individual participants' values is available via the data portal link below.

Data portal link 2: Number of lost-time injuries and health and safety incidents per participant
https://www.waternz.org.nz/ohs

Table 3: Total number of lost-time injuries and near-miss reports

Year	Days of lost-time injuries	Number of near misses	Number of participants reporting lost-time injuries	Number of participants reporting near misses
FY2019	488	1,478	40	39
FY 2018	275	2,109	43	44
FY 2017	250	1,344	40	41
FY 2016	156	1,330	47	47

4 Data collection on continuing professional development enrolments was introduced in 2019, and definitions failed to specify whether this should or should not include contractor staff. Accordingly, it is likely that some contractors have been included and some have not.

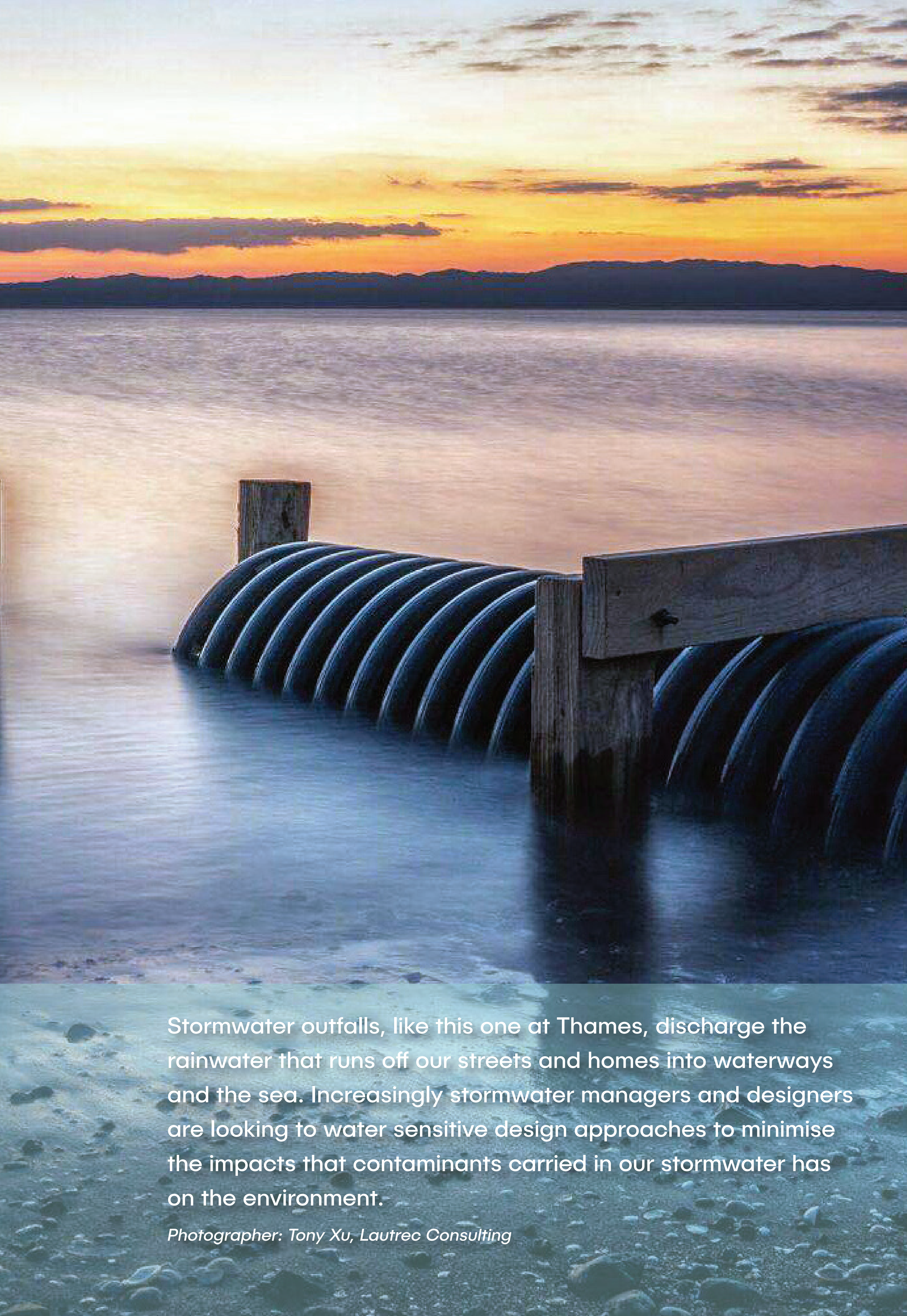
5 Data definitions did not specify whether the qualifications listed should be related to internal or contracted staff. In general, the number of qualifications held by internal staff was listed, however it is likely that some contractor qualifications have been included in the overall figure.

6 Several respondents noted that there were often no formal records of this information. It is possible that the number of qualified professionals may be somewhat higher.

Supporting guidance and additional measures for performance reporting in health and safety are included in the *Good Practice Guide for Occupational Health and Safety in the New Zealand Water Industry* (BECA, 2016).

For the first time since reporting began, the number of participants reporting near misses was lower than the number of participants reporting lost-time injuries. There were also fewer near misses reported overall.

Lost-time injury days were at a record high, largely attributable to two long-term injuries affecting staff at Waipa which resulted in 157 days off work.



Stormwater outfalls, like this one at Thames, discharge the rainwater that runs off our streets and homes into waterways and the sea. Increasingly stormwater managers and designers are looking to water sensitive design approaches to minimise the impacts that contaminants carried in our stormwater has on the environment.

Photographer: Tony Xu, Lautrec Consulting

3 PUBLIC HEALTH AND ENVIRONMENTAL PROTECTION

3.1 Asset overview

3.1.1 Assets under management

Public health and the environment are safeguarded by an extensive (and expensive) network of drinking water, wastewater, and stormwater assets. Table 4 provides a summary of those assets included in this report.

Combined wastewater and stormwater pipes are relatively uncommon. The length of combined pipes reported comprised 198km in Auckland, 53km in Gore, 17km in Grey District, and 10km in Whanganui.

Table 4: Number and value of assets covered by this report

Assets	Covered by this report	Value
Water treatment plants	351	$2,581,741,168
Length of water supply pipes (km)	44,472	$10,015,345,511 [7]
Water pump stations	792	
Water supply system total asset value		*$12,597,086,679*
Wastewater treatment plants	240	$3,356,619,803
Length of wastewater pipes (km)	28,082	$12,974,575,837 [7]
Length of combined wastewater and stormwater pipes (km)	452	
Wastewater pump stations	3,158	
Wastewater system total asset value		*$16,331,195,640*
Length of stormwater pipes (km)	17,719	$11,040,934,106 [7]
Stormwater pump stations	246	
Stormwater asset value		*$11,040,934,106*
Total asset value		***$39,969,216,425***

3.1.2 Connections to drinking water and wastewater systems

Participants in the NPR have responsibility for jurisdictions covering 4,536,520 New Zealanders (approximately 93% of the population). Table 5 shows the proportion of this population receiving reticulated water and wastewater services.

Table 5: Water and wastewater coverage statistics

	Water Supply		Wastewater	
Population serviced	3,559,296	(73%)	3,871,580	(79%)
Population not serviced	1,325,554	(27%)	1,013,270	(21%)
Total properties serviced	1,466,511		1,409,932	

7 Value also includes "other" water, wastewater, and stormwater assets not explicitly listed in this table.

For the purposes of this report, a stormwater-serviced property is defined as a property that is billed for stormwater services. This reflects that several properties do not have direct connection to the stormwater system (many instead employ soakage pits) but receive the benefits of stormwater infrastructure in public areas such as roads. However, given the varying nature of billing for stormwater services, not all participants were able to identify data for this measure. For this reason, statistics on stormwater have been excluded from this section of the report.

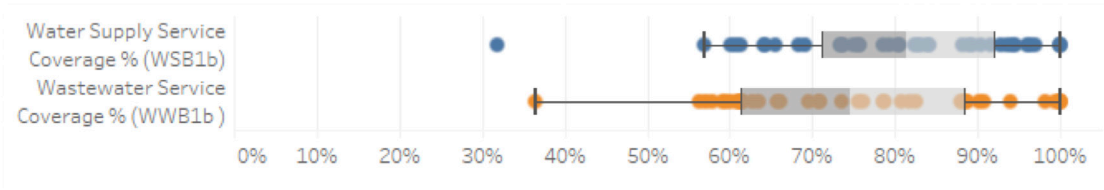
3.1.3 Service coverage

The proportion of the population connected to water and wastewater services varies from around one third of properties in the Far North to all properties in most major centres. The median numbers of properties in participants' jurisdictions receiving services are 81% for water supply, and 75% for wastewater.

A comparison of the proportion of the population serviced by participants' water and wastewater systems is available via the data portal link below, and summarised in Figure 4.

Data portal link 3: Proportion of properties connected to the reticulated water and wastewater system
https://www.waternz.org.nz/servicecoverage

Figure 4: The proportion of the population connected to water and wastewater services

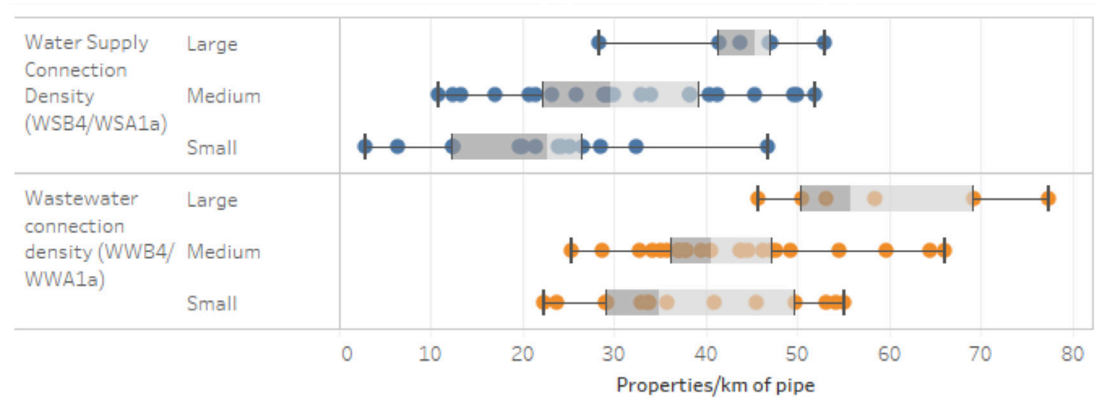


3.1.4 Connection density

The density of properties per kilometre is generally lower in rural areas. These areas are serviced by small and medium sized councils (defined by number of properties serviced). A summary of the density of property connections per kilometre of pipe, broken down by size of participant, is shown in Figure 9. Data for individual participants is available via the data portal link below.

Data portal link 4: Water and wastewater serviced properties per kilometre of pipe
https://www.waternz.org.nz/connectiondensity

Figure 5: Water and wastewater connection density by entity size



3.2 Drinking water quality

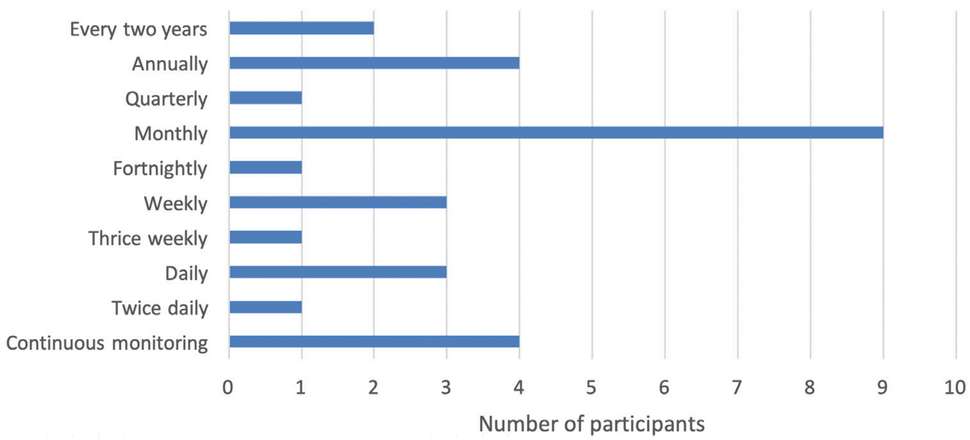
The *Annual Report of Drinking Water Quality* (Ministry of Health, 2019) is the authoritative source for drinking water quality reporting. This report contains supplementary information.

3.2.1 Source water management

The Havelock North enquiry noted that "[p]rotection of the source of drinking water provides the first, and most significant, barrier against drinking water contamination and illness." The management of source water is primarily a function of regional councils, and not covered by this report. The inquiry also noted, however, gaps in the resource management regime of this first barrier of protection *(Government Inquiry into Havelock North Drinking Water, 2017)*. Accordingly, reporting on source water management has been introduced to the NPR, given its critical impact on the provision of safe drinking water, which is a primary function of participants in the Review.

Responses were provided by 29 of the Review participants (67% of participants with water supply responsibility). The sampling frequency with which source water is monitored is shown in Figure 6. Participants were also asked for source water sample parameters, and the management approach applied. A full summary of responses is provided in *Appendix II: Source water management.*

Figure 6: Source water sampling frequency



Monthly sampling of E.coli, nitrate, pH, and total coliforms was common. Testing for cyanobacteria was commonly performed seasonally, and the full range of determinants listed in the drinking water standards was commonly perfomed annually or bi-annually. Regular tests commonly included alkalinity, colour, turbidity, conductivity, Dissolved Organic Carbon, Total Dissolved Solids, and Free Available Chlorine.

The number of participants identifying source water zones feeding their water treatment plants is shown in Figure 7. Participants identifying source water zones were also asked whether they had management plans in place. Fifteen of those 43 participants responded. Some simply noted that this is the responsibility of the regional council, and some mentioned that the regional council has either an active monitoring programme, a plan in place, or a plan under development. Stratford noted that Taranaki Regional Council notifies the District Council when there are any new resource consents sought in the catchment.

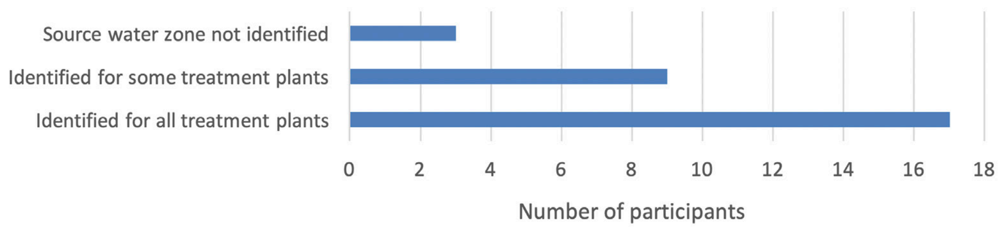
Hastings District Council provided the most comprehensive response:

"Most sources have defined SPZs, remainder being implemented. HDC have submitted SPZs to be adopted during HBRC TANK plan change. Catchment risk assessments in progress. GIS risk tool being developed. Consent applications for activities in SPZs monitored and assessed where risk to water supplies."

Two participants pointed to variation in the extent to which different catchments were managed. Wellington Water commented that "Te Marua Water Treatment Plant and Wainuiomata Water Treatment Plant catchments are protected and managed as pest controlled regional parks with restricted access by the Regional Council. The aquifer supplying the Waterloo Water Treatment Plant and Gear Island Water Treatment Plant is more challenging as it lies beneath a developed city (Lower Hutt). The source protection zone for the aquifer has been assessed, a catchment GIS risk tool is being developed, and revision of the catchment risk assessment is in progress." Waitaki noted that "Environment Canterbury has identified source water zones for water supplied in Canterbury, but Otago Regional Council has not."

Others highlighted inadequacies in plans. Ashburton noted: "All water sources have been assigned Community Drinking Water Protection Zones by Environment Canterbury. These are for the most part generic and not based on any detailed understanding." Tasman noted that "basic catchments recorded in WSP [Water Safety Plans], but [there are] limited actions to prevent contamination in these areas".

Figure 7: Source water zone identification



3.2.2 Water safety planning

The Drinking Water Standards (Ministry of Health, 2018) require water suppliers to have in place Water Safety Plans for each of their drinking water distribution networks. Water safety plans note risks to the water supply, controls in place to manage risks, and additional actions that can be taken to further minimise risk.

There were 29 respondents in this category. The number of actions identified in water safety plans, and the proportion of those that have already been implemented, are shown in Figure 8 and Figure 9 respectively. Information for each participant can be viewed via the data portal link below.

> Data portal link 5: Water safety plan actions identified and implemented
> https://www.waternz.org.nz/watersafetyplans

Figure 8: Total number of water safety plan actions identified per participant

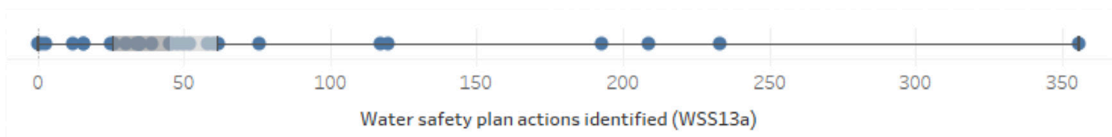
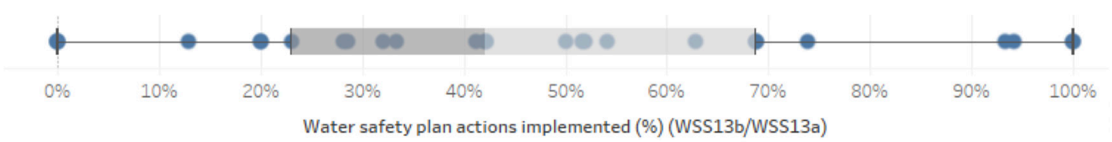


Figure 9: Proportion of water safety plan actions identified that have been implemented



3.2.3 Boil water notices

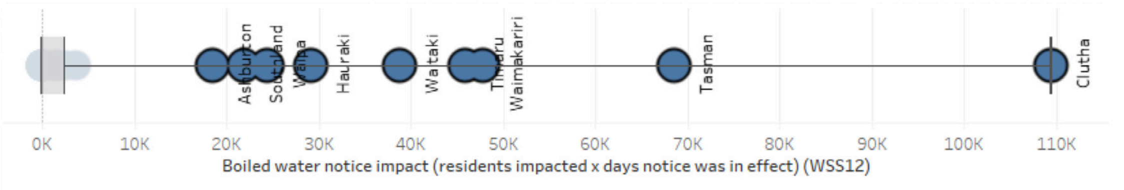
Boil water notices are reported as the number of affected residents multiplied by the number of days restrictions were in place (resident days).

Seventeen participants had issued boil water notices at some point during the year. Collectively, boil water notices were in effect for 415,409 resident days. The majority of these related to nine events in the jurisdictions shown in Figure 10.

The number of boil water notices issued by individual participants can be viewed via the data portal link below. Performance comparisons based on boil water notices should be applied with caution, as the threshold at which participants apply a boil water notice varies.

Data portal link 6: Boil water impacts (affected population x days affected) per participant
https://www.waternz.org.nz/boiledwater

Figure 10: Number of resident days affected by boil water notices per participant



3.3 Wastewater overflows

Wastewater overflows occur when sewage spills from gully traps, manholes, engineered overflow points, or pump stations, and flows into public or private property, waterways, or the sea.

Overflows are commonly categorised as either dry or wet, depending on the cause of the overflow. Dry-weather overflows can occur due to either blockages or system failures. Wet-weather overflows occur during rainfall events when stormwater makes its way into wastewater pipes. Table 7 shows the total number of network-related overflows reported by all participants, categorised by cause[8]. A comparison of overflows per participant is available via the data portal link below.

Table 6: Total number of overflows

Dry-Weather Wastewater Overflows[8]	**1,628**
Overflows caused by blockages	1,444
Overflows caused by mechanical failures	114
Wet-Weather Wastewater Overflows	**1,218**
Overflows from combined stormwater and wastewater networks	350
Overflows from wastewater networks	868
Total wastewater network overflows	***2,846***

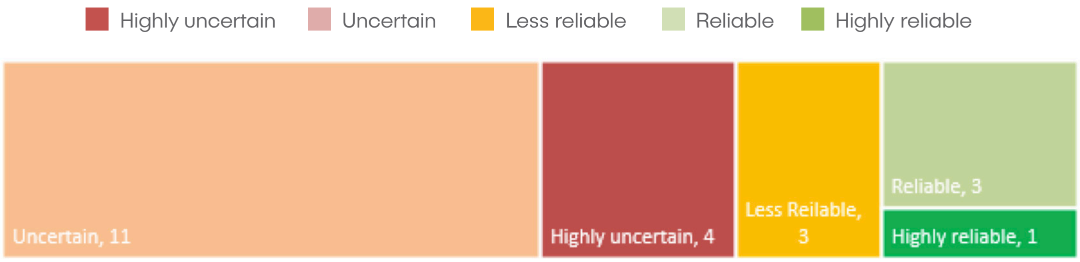
Data portal link 7: Wastewater overflows per participant
https://www.waternz.org.nz/wastewateroverflows

8 Rotorua, Palmerston North, and Southland were unable to distinguish dry-weather overflows by cause, so are included in overall dry-weather overflow figures, but not blockage or mechanical failure figures.

3.3.1 Overflows on private properties

Wastewater overflows occurring on private properties were reported for the first time this year. In general, such overflows are the responsibility of private property owners. The 22 participants (just over half) able to supply data on this metric reported 220 private property overflows. Most expressed low confidence in the data as illustrated in Figure 11. Only four participants thought their data on this metric was either reliable or highly reliable. Given the gaps in data, and the low confidence in its accuracy, a comparative breakdown of overflows in private properties has not been supplied

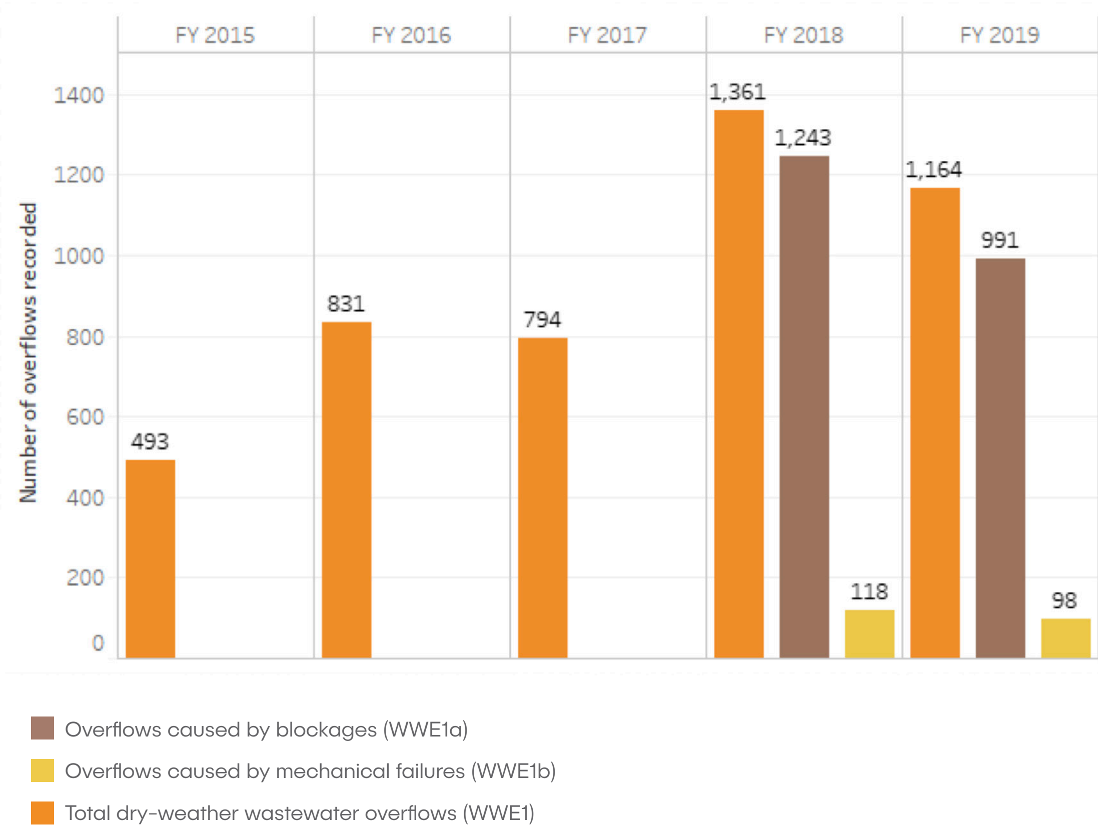
Figure 11: Confidence in wastewater overflow on private property data



3.3.2 Dry-weather overflows

The total number of dry weather overflows reported across repeat participants decreased in 2019, as illustrated in Figure 12. This was a result of fewer blockage-related overflows, largely attributable to a reduction in overflows in Hamilton (157 dry-weather overflows, down from 482 the previous year), though this change appears to be related to the way Hamilton classifies overflows for reporting, rather than any operational changes. Blockages remain the leading cause of dry-weather wastewater overflows.

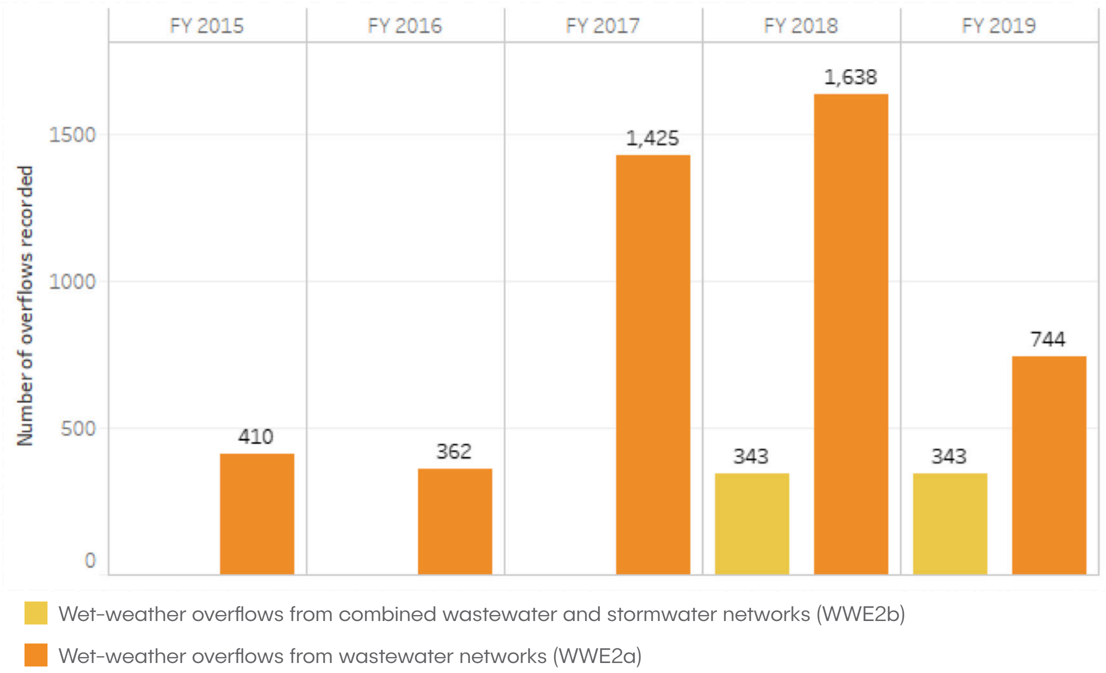
Figure 12: Trend of total dry weather overflows by type



3.3.3 Wet-weather overflows

There were fewer wet-weather overflows in 2018-19 than in the previous two years, as shown in Figure 13. This may reflect wetter than normal years in 2016-17 and 2017-18, while 2018-19 was generally a year of normal or below normal rainfall (NIWA, n.d.).

Figure 13: Trend of total wet-weather overflows by overflow type

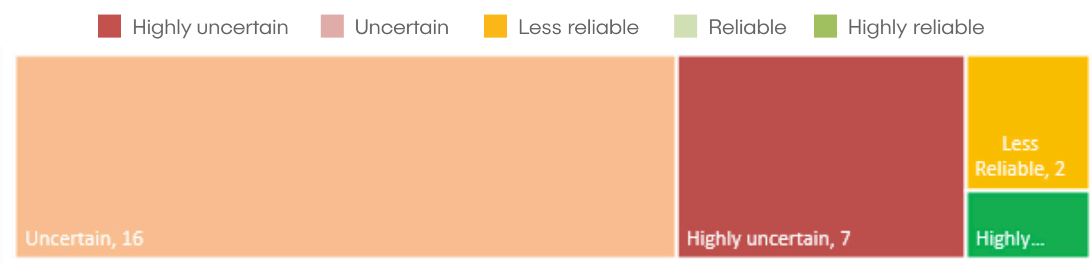


Interpretations of wet-weather overflow data should be made with caution, as participants' confidence in reported data is generally low. Participants' confidence in wet-weather overflow data is shown in Figure 14.

In reporting on wastewater overflow data quality, the auditor commented that:

"We believe that the industry in general has poor information/knowledge of the performance of the wastewater and combined sewer networks during wet weather, which causes problems in getting good quality, consistent answers to questions on wet weather overflows from the wastewater network, wet weather overflows from combined stormwater and wastewater networks, sewage design standards and average calculated wet weather overflow frequency". (AECOM, 2020)

Figure 14: Confidence ratings assigned to wet-weather overflow data



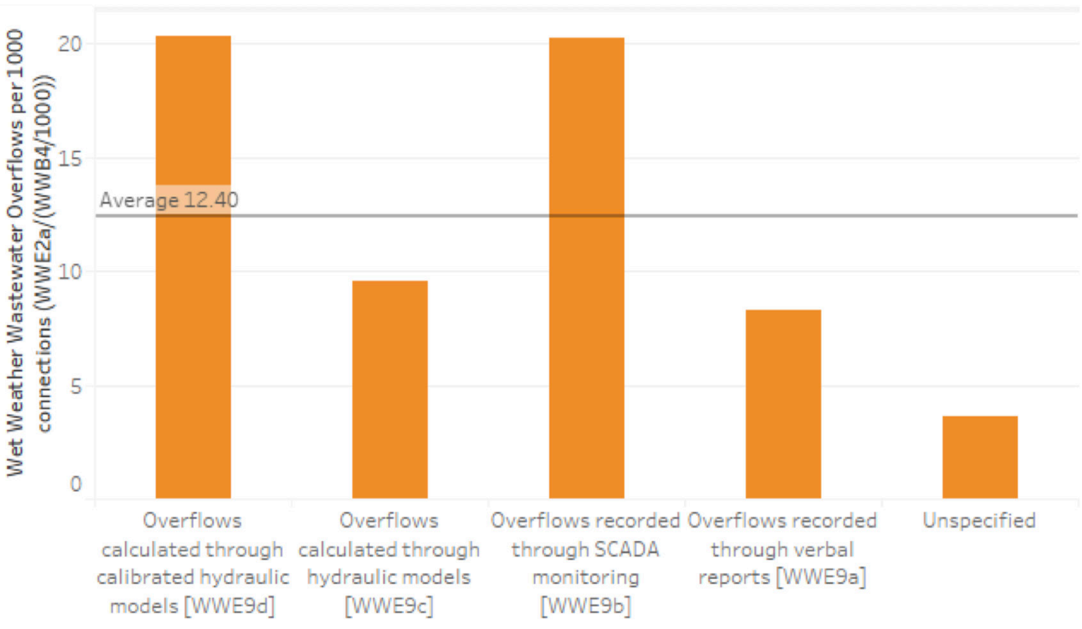
Low data confidence is partially explained by participants' mechanisms for recording overflows. Verbal reports were the only method of recording wet-weather overflows for eleven of the participants. A further three did not indicate how they determined wet-weather overflows. The number of participants employing various approaches for recording overflows is listed in Table 7. If participants employed multiple methods they are counted in multiple categories.

There is a strong correlation between the sophistication of overflow recording methods and the number of wet-weather overflows reported. Figure 15 shows that participants who have SCADA monitoring in place record twice the number of overflows as those relying on verbal reports. With a quarter of participants relying on verbal reports this indicates wet-weather overflows will have occurred more frequently than reported.

Table 7: The number of participants employing various approaches to overflow recording

Overflow recording approach	Number of participants
Overflows recorded through verbal reports [WWE9a]	37
Overflows recorded through SCADA monitoring [WWE9b]	24
Overflows calculated through hydraulic models [WWE9c]	15
Overflows calculated through calibrated hydraulic models [WWE9d]	11
Unspecified	3

Figure 15: Wet-weather overflows recorded by recording approach



3.3.4 Sewage capacity design standards and models

Reporting on sewage containment design standards (WWE8a) and average calculated wet-weather overflow frequency (WWE8b) was unable to be answered by most participants and produced varied responses among those who did respond. Responses to this question are listed in Table 8.

Auditors noted "a reasonable amount of prompting was required to get data values on sewage design standards (WWE8a). Very few initial responses were compliant with the definition guidelines, and organisations had to be pressed to provide something useful." The responses provided included average dry-weather to wet-weather flow peaking factors, inflow per property figures, and annual exceedance probabilities. Inconsistencies in the units provided has prevented meaningful presentation of this data.

The auditors also commented that

> "[average calculated wet-weather overflow frequency] was one of the more problematic measures as only two organisations provided data and both values were in different units. While most organisations had models, they haven't been in use long enough to reliably calculate wet weather overflow frequencies. It should be possible to compare this measure with WWE2a [wet weather overflows] and WWE2b [wet weather overflows from combined stormwater and wastewater networks]. The fact that this cannot be done may demonstrate the lack of good industry information on the whole subject of overflows from the public network."

Table 8: Average calculated wet-weather overflow frequency

Participant	Average calculated wet-weather overflow frequency
Auckland	1.21 Average number of wet-weather overflows per discharge location
Christchurch	1.8 based on actual frequency of overflows over 15 years of data
Dunedin	20.00% annual recurrence interval. Noted they found the definition unclear
Hamilton	1.1. averaged resultant overflow frequency of sites (including manholes and pump stations) where a result of overflow frequency greater than zero was returned (i.e. only a small % of the network would be predicted to overflow once per year).
Invercargill	Frequency results for 18-year simulation carried out is 1 in 2-6 year ARI
Kapiti Coast	20.00% annual recurrence interval
Marlborough	50.00% annual recurrence interval
Masterton	0.05 annual exceedance probability
Nelson	2.00 annual recurrence interval
Queenstown Lakes	20% annual exceedance probability Modelling indicates that localised overflows occur at 1/5-year storms or greater
Timaru	20.00% annual recurrence interval
Waimakariri	50% annual recurrence interval. Pre-2000 has a 2 year LOS and 2000 onwards has a 5 year LOS.
Whanganui	200% annual recurrence interval

3.4 Wastewater treatment

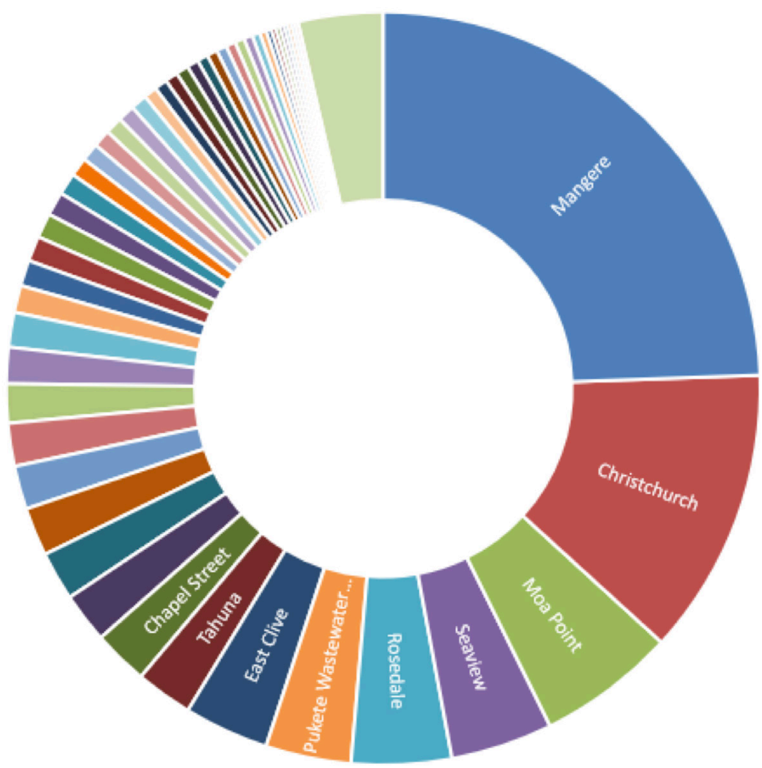
Information was provided on 215 wastewater treatment plants treating over 470 million cubic meters of wastewater.

The treatment plants covered in this report represent nearly two thirds of 326 known municipal wastewater treatment plants. Information provided to the Review is used to update data on New Zealand's wastewater treatment plant inventory, available at https://www.waternz.org.nz/WWTPInventory .The inventory includes the following treatment plant data:

- Managing organisation
- Treatment plant location and receiving environment
- Treatment level
- Volume of wastewater treated
- Proportion of trade waste treated
- Consent status and expiry date
- Sludge production and disposal routes
- Backup generation
- Peak wet- to average dry-weather flow ratios
- Discharge flow rate
- Population serviced
- Last year desludged (for pond-based systems)

A large majority of this wastewater is treated at a small number of the treatment plants, as illustrated in Figure 16. New Zealand's largest treatment plant, Mangere, treats nearly a quarter of all wastewater reported in the Review, while the 10 largest treatment plants are responsible for treating 65% of the country's wastewater, and the twenty largest are responsible for treating over 80%.

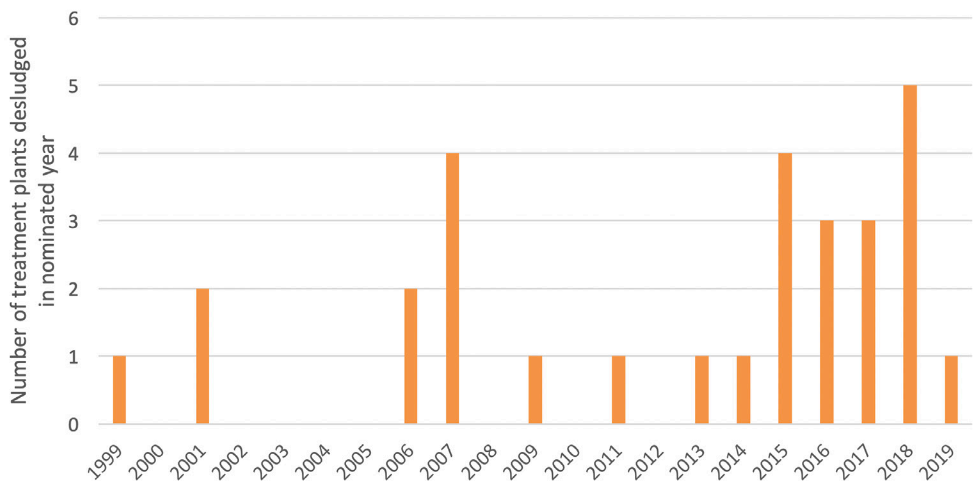
Figure 16: Proportion of wastewater treated at New Zealand's largest wastewater treatment plants



Smaller treatment plants often utilise pond-based systems which require regular desludging to operate effectively. Participants were asked to supply information about the last year their wastewater treatment ponds were desludged, and 29 provided responses, shown in Figure 17.

The *Good Practice Guide for Waste Stabilisation Pond Design and Operation* (Water New Zealand, 2017) recommends that sludge levels be measured regularly (5-yearly initially, and 2-yearly after 15 years' operation) to understand the rate of deposition and any irregularities formed (e.g. shoals of sludge), and when it is necessary to desludge. The guide recommends councils and plant operators reserve funds for desludging in long term plans, and then in annual plans approaching the time for desludging.

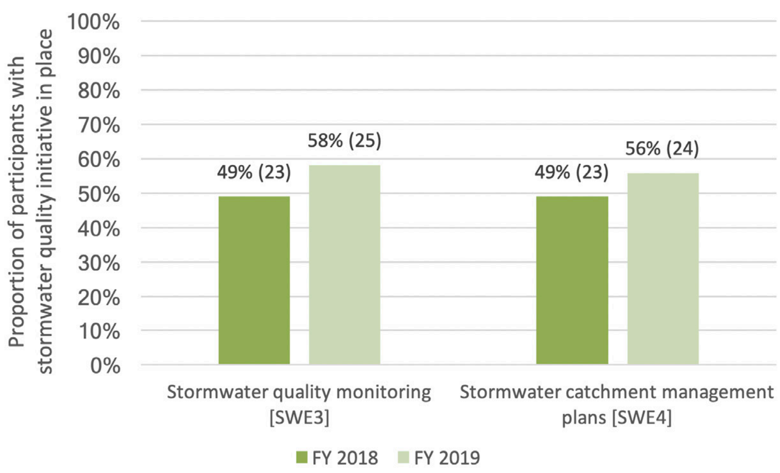
Figure 17: Last year of desludging for pond-based wastewater treatment plants



3.5 Stormwater quality management

Just over half the Review's participants have in place stormwater quality monitoring programmes and/or catchment management plans, as illustrated in Figure 18. The number of repeat participants with such plans in place has increased by one since last year, with Christchurch having recently implemented both. Information on which individual participants have stormwater quality and stormwater catchment plans is available via the data portal link below.

Figure 18: Stormwater quality monitoring and catchment management plans in place



Data portal link 8: Stormwater quality initiatives and consents
https://www.waternz.org.nz/stormwaterdischarges

3.6 Discharge consents

3.6.1 Wastewater treatment plant consents

Wastewater treatment plants require effluent discharge consents from their regional councils to discharge treated wastewater into receiving environments.

Several treatment plants operate on expired effluent discharge consents. This year, of the 214 treatment plants providing data to this year's Review, 24 had consents that had passed their expiry date, and had new consents lodged with their regional councils.

627 non-conformances in relation to wastewater treatment plants were reported. A summary of the number reported by individual participants is shown in Figure 19.

Non-conformances reported (Figure 19) significantly exceeded the number of actions taken in relation to consent non-compliances, with only eleven reported: six abatement notices (one each at Kaipara and Taupo and two each at Waipa and New Plymouth), one enforcement order (Far North), two infringement notices (Far North and Manawatu), and two prosecutions (Queenstown Lakes and Wellington Water).

Figure 19: Wastewater treatment plant discharge consent non-conformances per participant

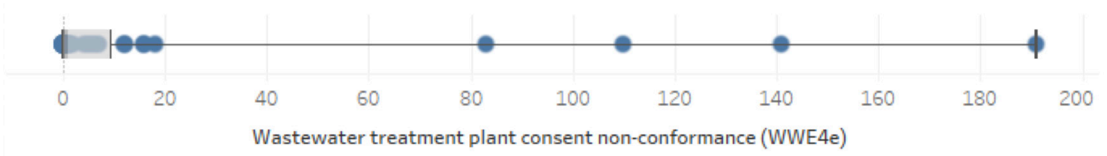


Table 9: Actions taken as a result of wastewater consent non-compliance over the last five years

Wastewater consent non-conformance action	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Abatement notices (WWE4a)	2	7	1	6	6
Enforcement orders (WWE4c)	0	0	0	0	1
Infringement notices (WWE4b)	2	2	7	4	2
Successful prosecutions (WWE4d)	1	0	0	3	2

3.6.2 Wastewater network (overflow) consents

Stormwater and groundwater makes its way into wastewater pipes during periods of heavy rain. The complete containment of sewage in wet weather is not always possible, and in heavy rainfall events the capacity of sewerage infrastructure can be exceeded, causing wastewater overflows.

Under the Resource Management Act, wet-weather overflows constitute a discharge of contaminants to the environment and all participants recorded some level of either wet- or dry-weather wastewater overflows.[9] Yet only seven participants held consents for discharges from sewerage networks (Auckland, Christchurch, Dunedin, Grey, Nelson, Tauranga, and Whangarei).

In general, participants holding network discharge consents held a single consent covering multiple engineered overflow points. Exceptions were Dunedin, which held five consents for constructed overflow points; Auckland, which held nine consents (five related to pump stations, and four comprehensive network consents); and Whangarei, which held three related to separate pump stations.

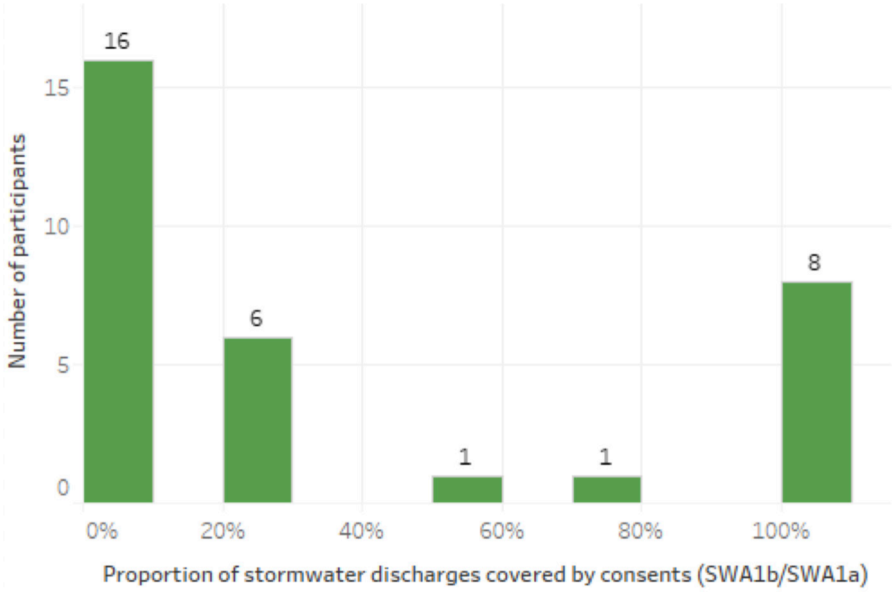
Two participants held discharge consents for sewerage networks that were not related to wastewater overflows: Queenstown Lakes held a discharge-to-air consent for an isolated portion of its network; and Selwyn held a consent related to network air-valves.

9 The only participant with no overflows recorded was Manawatu, whose reporting was limited.

3.6.3 Stormwater discharge consents

The percentage of participants' stormwater discharges covered by resource consents is summarised in Figure 20. A minority of participants (8 of 32 providing data) had all stormwater discharges consented. Most commonly, participants held consents for less than 10% of their networks, six of these had no stormwater discharge consents whatsoever. The nature of discharges covered by these consents is reported on in further detail in the 2017/18 NPR (Water New Zealand, 2019).

Figure 20: Proportion of stormwater discharges covered by resource consents



Data portal link 9: Stormwater discharges and consents
https://www.waternz.org.nz/stormwaterdischarges

There were only three abatement notices related to stormwater discharge consents (one in the Far North and two in Hamilton), and only one infringement notice, and one enforcement order (both in Invercargill). The low number of compliance actions taken as a result of consent non-conformance continues a trend from previous years, shown in Table 10. This can partly be explained by the low proportion of the network covered by discharge consents.

Table 10: Actions taken as a result of stormwater consent non-compliance over the last five years

Stormwater consent non-conformance action	FY 2015	FY 2016	FY 2017	FY 2018	FY 2019
Abatement notices (SWE2a)	3	0	0	5	3
Infringement notices (SWE2b)	0	0	0	4	0
Enforcement orders (SWE2c)	0	0	0	0	1
Successful prosecutions (SWE2d)	5	0	0	0	1

Improving customer experience has become an increasing focus for water and wastewater suppliers in recent years. Here a group of scouts visit Watercares new Hunua 4 watermain under construction in Auckland. Education is key to ensuring that our customers appreciate and value the critical services we provide.

Photograph supplied by McConnell Dowell Constructors Ltd

4 Customer focus

4.1 Complaints

Customer complaints follow categories in the *Non-Financial Performance Measure Rules* (the Rules) (Department of Internal Affairs, 2013). The NPR complaints definition departs from that in the Rules by defining complaints as instances where customers have expressed dissatisfaction. The NPR definition aligns with *AS/NZS 10002-2014 Guidelines for complaint management in organisations* (Standards New Zealand, 2014).

Comparatively high complaint volumes may reflect mature complaint-recording systems, rather than high levels of customer dissatisfaction. For this reason, comparisons between participants' complaint data is not reported in the NPR. Rather, the range of complaints per 1,000 properties serviced is shown in Figure 21, which represents the number of complaints per participant as a dot. The Figure illustrates clusters around values of 8.03, 8.06, and 3.71 complaints per 1,000 properties for drinking water, wastewater, and stormwater services respectively.

Table 11 shows complaints reported by all participants. Complaints related to wastewater blockages were the most reported, followed by complaints related water supply continuity.

Figure 21: Number of complaints per 1,000 properties serviced

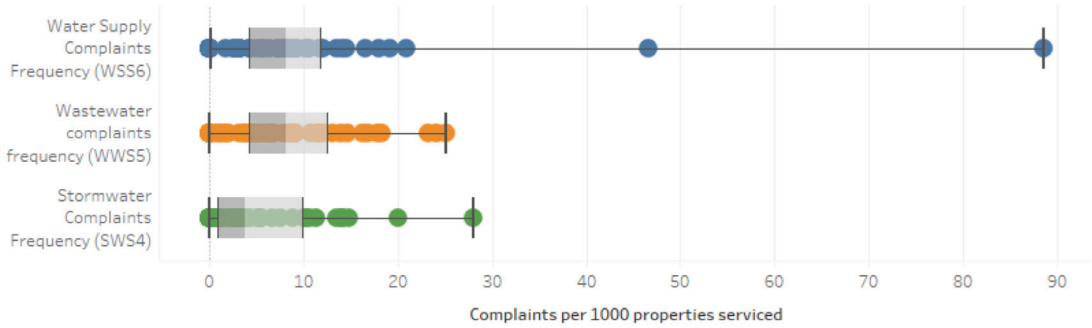


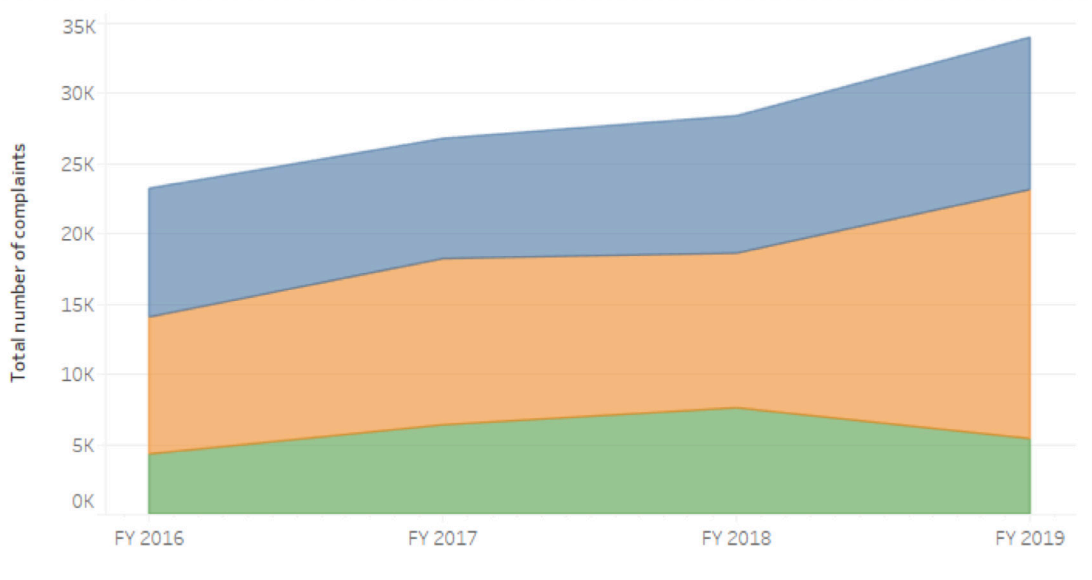
Table 11: Total number of complaints reported in the NPR by type[10]

Complaint type	Total number of complaints recorded
Drinking water clarity complaints (WSS5a)	2,923
Drinking water odour complaints (WSS5c)	210
Drinking water pressure or flow complaints (WSS5d)	2,914
Drinking water taste complaints (WSS5b)	640
Continuity of water supply complaints (WSS5e)	7,890
Water Quality Complaints (WSS5)	**14,578**
Wastewater odour complaints (WWS4a)	1,475
Wastewater blockage complaints (WWS4c)	12,013
Wastewater fault complaints (WWS4b)	6,715
Wastewater complaints (WWS4)	**20,267**
Stormwater blockage complaints (SWS3a)	3,139
Stormwater fault complaints (SWS3b)	3,215
Stormwater Complaints (SWS3)	**6,843**

10 Categorised complaints do not sum to the total complaints volume for each service, as not all participants were able to provide a breakdown of complaints by type.

The number of complaints being recorded for water supply systems is increasing over time, as illustrated in Figure 22. This may reflect a decrease in customer dissatisfaction but is more likely caused by a gradual maturation of complaint-recording systems. Widespread adoption of complaint recording first occurred in the 2016 fiscal year, when mandated by *Non-Financial Performance Measure Rules* 2013 (Department of Internal Affairs, 2013).

Figure 22: Trend in total number of complaints reported[11]



4.2 Fault response attendance and resolution

Water supply and wastewater fault attendance and resolution times, and flooding response times, are collected in line with the Non-Financial Performance Rules (Department of Internal Affairs, 2013). Median response times are summarised in Figure 23 and Figure 24 which represents each participant's median response time as a dot. Median, minimum, and maximum response times for the group are summarised in Table 12. Individual participants' responses and attendance times are available via the data portal link below.

Table 12: Fault attendance and resolution summary

	Median (hours)	Minimum (hours)	Maximum (hours)
Median attendance for non-urgent water supply fault callouts (WSS10c)	6.3	0.2	165.6
Median resolution for non-urgent water supply fault callouts (WSS10d)	20.2	0.6	172.1
Median attendance for urgent water supply fault callouts (WSS10a)	0.5	0.2	6.0
Median resolution for urgent water supply fault callouts (WSS10b)	2.4	0.2	22.0
Median wastewater fault attendance time (WWS6a)	0.5	0.2	5.2
Median wastewater fault resolution time (WWS6b)	2.8	0.8	51.1
Median flooding response time (SWS6)	0.1	0.0	3.1

11 Trend is shown only for complaints recorded by participants involved in the NPR for the last four years.

Figure 23: Median time taken to respond and attend to faults in the water supply, wastewater, and stormwater systems[12]

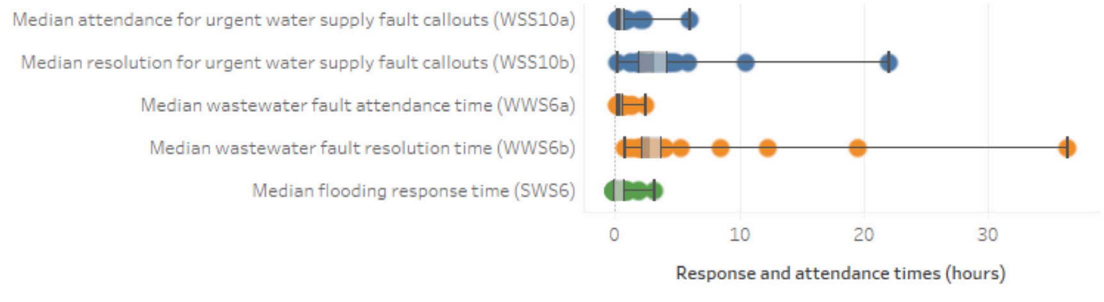
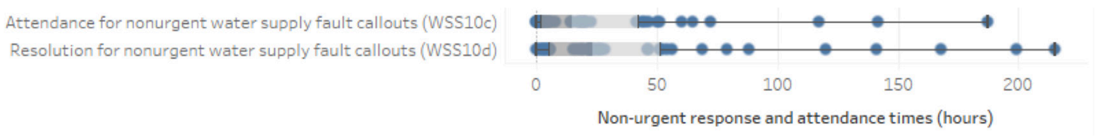


Figure 24: Median time taken to respond to non-urgent faults in the water supply system



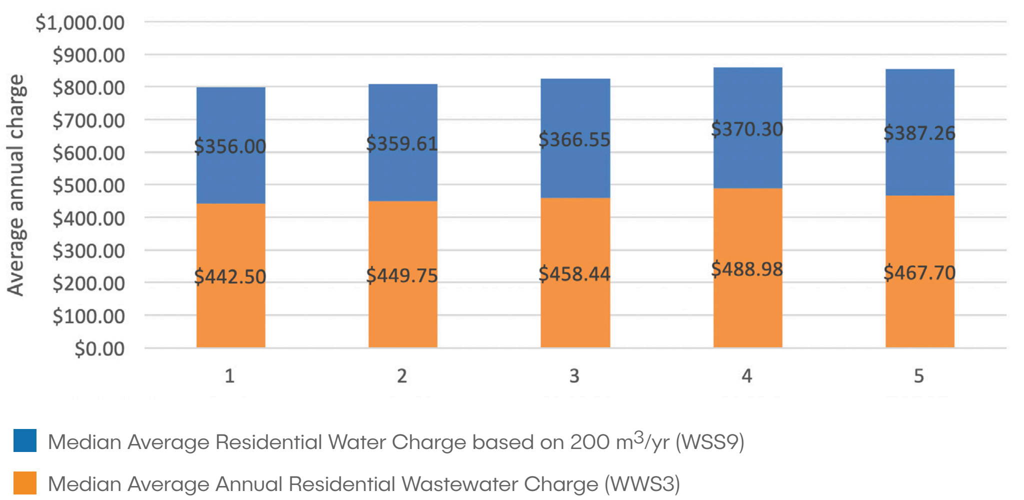
Data portal link 10: Attendance and resolution times for water supply, wastewater, and flooding
https://www.waternz.org.nz/responsetimes

4.3 Charges

4.3.1 Residential water, wastewater, and stormwater charges

On average, there has been little growth in residential water and wastewater charges over the last five years. Median charges over this time are shown in Figure 25. Average annual water and wastewater prices have risen by 0.54%, 1.90%, 3.99%, and -0.54% from 2016 to 2019, which is largely within the New Zealand Consumer Price Index inflation range of 0 to 2% over this period (Reserve Bank of New Zealand, 2020).

Figure 25: Average residential water and wastewater charges over the previous five years

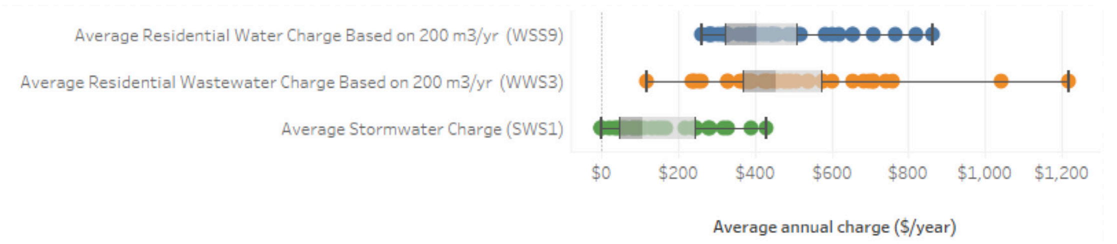


12 Significant outliers in water, wastewater, and flooding response times have been excluded from the data set. This includes data on water supply from Central Otago; flooding response times from the Far North, Kapiti Coast, and South Taranaki; and wastewater response time from Stratford.

Variation from average charges is, however, significant. The average annual charge for a resident consuming 200m3 of water is summarised in Figure 26, which shows that consumers in some areas are paying over three times as much as others for water ($863/year versus $262/year), and over ten times as much for wastewater ($1,217/year versus $116/year).

There was even higher variation in stormwater charges, which ranged by a factor of over 20, from $18 to $427 per year. The approach for charging for stormwater is also highly variable. Only 27 participants (62%) were able to specify the charge for stormwater. For many, stormwater charges were included in roading or amenity rates, and not able to be extracted from other components of the rates bill.

Figure 26: Annual charges for residential water, wastewater, and stormwater



Residential water charges comprise either a single fixed charge or a combination of fixed and volumetric charges. This is except for Auckland, whose entire charge is based on a volumetric rate. Residential water charges with a volumetric component are summarised in Table 13. A comparison of charges and average charge for a residential customer using 200m3 of water per year where a volumetric charge is applied is available via the data portal link below.

Table 13: Residential volumetric charges (including GST)

Council	Fixed charge ($/year)	Volumetric: applies only above the following volume (m^3/year)	Flat volumetric rate ($/$m^3$)	Ascending volumetric rate	Descending volumetric rate
Auckland			1.517		
Central Otago	323.46		0.6		
Far North	302.97		2.80		
Hastings					
Hauraki	120.61				0-200m^3 = $1.95 200-400$m^3$ = $1.64 >400$m^3$ = $1.48
Horowhenua	401.1	364	2.07	Foxton beach only: 0-50m^3 = $0.64 51-100$m^3$ = $1.28 >101$m^3$ = $1.92	
Kapiti	215		1.14		
Marlborough	450-976		0.9-2.58 (for selected properties with meters)		
Napier	221		0.9		
Nelson	197.68		2.10		
Selwyn	235		0.46		
Tararua	94.40-466.68	320	1.48		
Tasman	332.74		2.17		
Tauranga	31		1.99		
Timaru	315	500	0.64		
Waipa	106.95		1.49		
Western Bay of Plenty	448.24		1.30		
Whakatane	169.78		0.56		
Whangarei	34.5		2.26		

Some participants levy multiple charges for their different schemes, covered in further detail in the 2017-18 NPR (Water New Zealand, 2019). Where this is the case, benchmarked figures show either a weighted average charge or the most employed charge, depending on what best represents a participant's jurisdiction.

Both a single fixed annual charge levied as part of a uniform annual general charge, and a general charge are treated as fixed charges in this report. Other approaches to fixed charges include charging based on water allocation amount or land area (Ashburton).

All wastewater charges are based on a fixed rate. Auckland is the exception to this: the entire wastewater charge is based on a volumetric rate. For every 1,000 litres of water consumed at a residential property, Watercare will apply charges for 785 litres of wastewater. A comparison of wastewater charges is available via the data portal link below. Auckland's wastewater rate is based on a residential house using 200m^3 of water per year.

Data portal link 11: Drinking water and wastewater charges and affordability
https://www.waternz.org.nz/charges

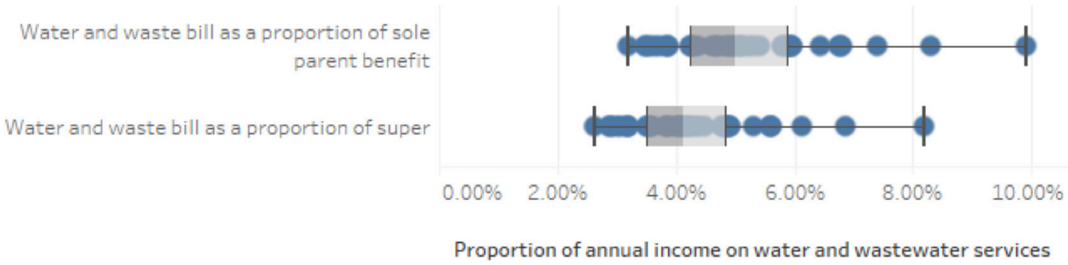
4.3.2 Affordability

On average, a worker on minimum wage would need to work for 58 hours to pay their annual water and wastewater bill. In some areas this figure could be as high as 115 hours (nearly three weeks' labour).[13] A summary of the number of hours required to be worked for each participant is shown in Figure 27, and a comparison between participants- is available via the data portal link provided in Section 4.3.1.

Figure 27: Affordability of water and wastewater charges plotted against scheme size

An alternative affordability metric considers the proportion of low-income earners' wages being spent on water and wastewater services. This is summarised in Figure 28 for two different benefit types, with each participant represented as a dot. Individuals receiving the single living alone superannuation payment ($21,372.00/year post tax) pay on average 4.13% of their income on water and wastewater services but, depending on where they live, can pay as much as 8.2%. Individuals receiving the sole parent support payment ($17,663.88/year post tax) pay on average 5% of their income on water and wastewater services but, depending on where they live, can pay more than 10%.

Figure 28: Water and wastewater charges as a proportion of government benefit payments



13 This is based on an hourly rate of $15.14, the post-tax hourly rate of a full-time worker on the New Zealand adult minimum wage of $17.70/hour.

4.3.3 Non-residential water and wastewater charges

Most participants applied separate charges for non-residential water and wastewater customers.

Water charges for non-residential customers most often involved the use of volumetric charging, and/or a higher fixed rate than for residential customers.

Differences between non-residential and residential wastewater charges were most often attributable to additional volumetric and/or contaminant-based charge components for non-residential customers, and/or variations in fixed rates, often dependent on connection size. Some participants applying volumetric wastewater charges for non-residential customers applied either no or lower fixed rates than for residential customers.

Figure 29: Number of participants with separate charges for non-residential customers

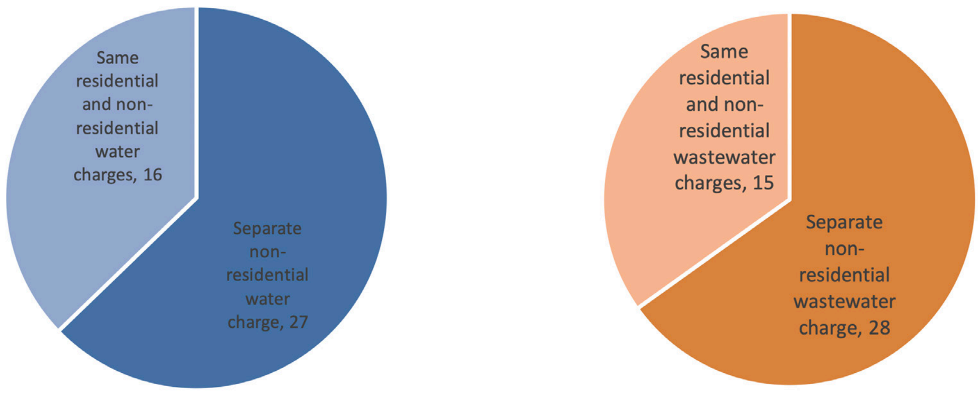
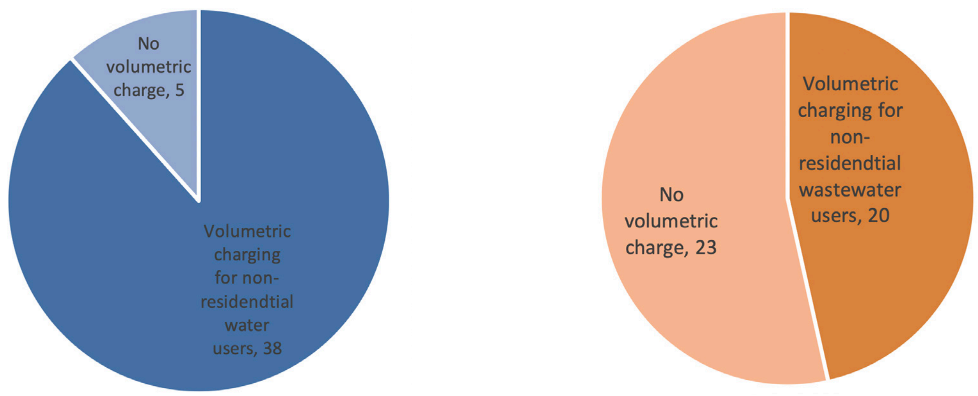


Figure 30: Number of participants with volumetric charges for non-residential customers



Data portal link 12: Non-residential water and wastewater charges
https://www.waternz.org.nz/nonresidentialcharges

4.4 Trade waste management

Most participants used a bylaw to manage trade waste discharges. In addition, it was more common than not to have in place charges for individual contaminants. Nelson and Hauraki were the only participants indicating they had contaminant-based charging, but not a formal trade waste management approach. A detailed compilation of contaminant-based charges is included in the 2017-18 NPR (Water New Zealand, 2019).

Figure 31: Trade-waste management approach

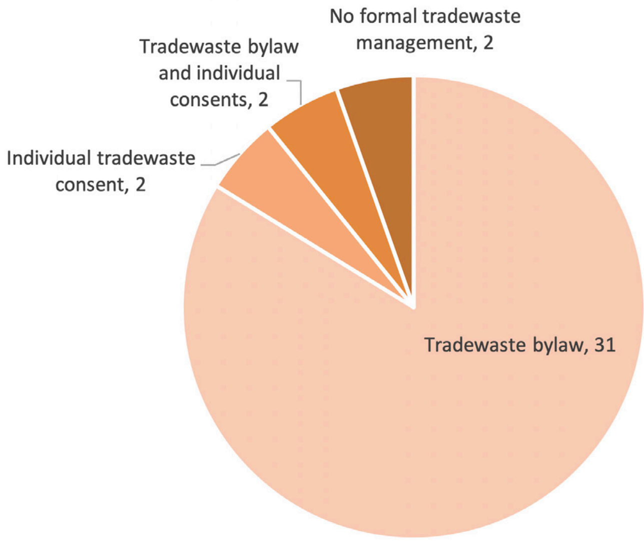
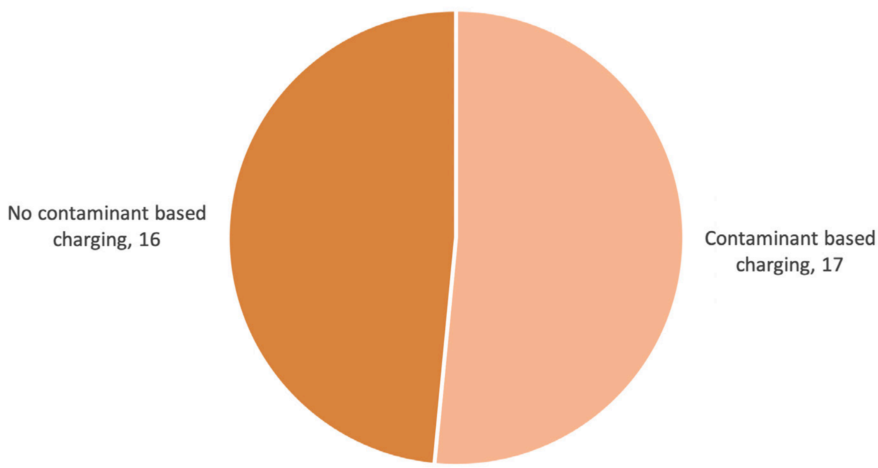
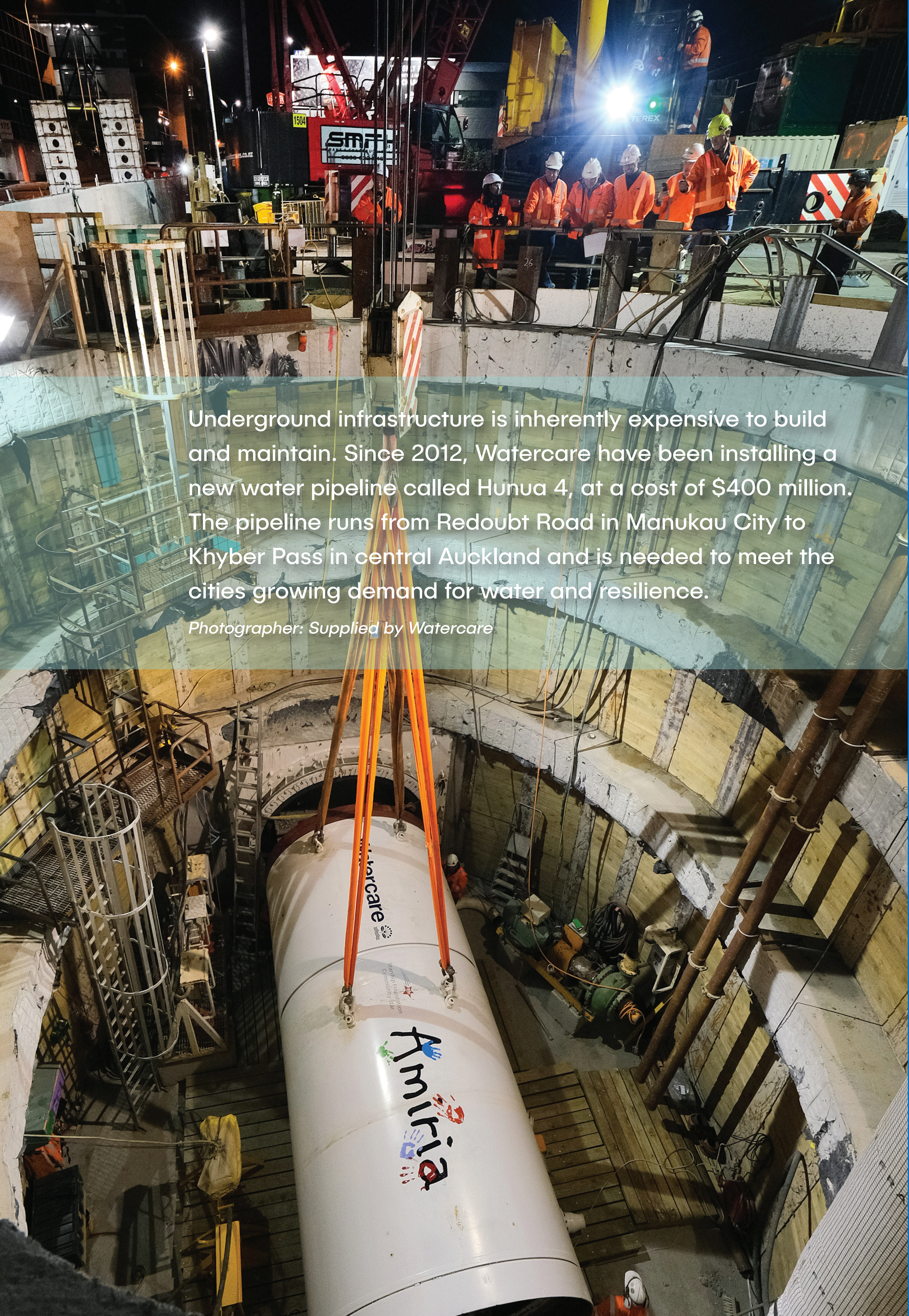


Figure 32: Contaminant-based charges in place





Underground infrastructure is inherently expensive to build and maintain. Since 2012, Watercare have been installing a new water pipeline called Hunua 4, at a cost of $400 million. The pipeline runs from Redoubt Road in Manukau City to Khyber Pass in central Auckland and is needed to meet the cities growing demand for water and resilience.

Photographer: Supplied by Watercare

5 Economic sustainability

5.1 Water and wastewater transfers

A number of participants had in place arrangements to treat water or wastewater on behalf of neighbouring jurisdictions. These are listed in Table 14 and Table 15.

Water transfers from Nelson to Tasman occurred in response to drought. Both Nelson and Tasman transfer their wastewater to the Nelson Regional Sewerage Business Unit, which is jointly owned by both councils.

Transfer of wastewater in the Ruapehu district is to the military base in Waiouru.

Table 14: Transfers of water across district council boundaries

Transferred from	Transferred to	Volume (m^3/year) [14]
Auckland	Waikato and Pokeno	8,380,921
Christchurch	Selwyn	38,019
Hamilton	Waikato and Waipa	840,978
Nelson	Tasman	61,148

Table 15: Transfers of wastewater across district council boundaries

Transferred to	Transferred from	Volume (m^3/year) [14]
Auckland	Waikato and Pokeno	960,920
Christchurch	Selwyn	65,879
Masterton	-	17,700
Nelson	Nelson Regional Sewerage Business Unit	2,596,605
Waiouru Military Camp	Ruapehu	-
Tasman	Nelson Regional Sewerage Business Unit	2,122,971
Tauranga	Western Bay of Plenty	283,196

5.2 Revenue

Participants collected around $2.2 billion in revenue for the provision of water, wastewater, and stormwater services in the 2019 fiscal year. Most revenue collected was operational, obtained from fixed charges (usually administered through rates), volumetric charges, special levies, lease of land or space reserved for assets, revenue from asset sales, or interest.

A comparison of the average revenue collected per property for each participant is available via the data portal link below.

Data portal link 13: Revenue per property for water supply, wastewater, and stormwater services
https://www.waternz.org.nz/revenue

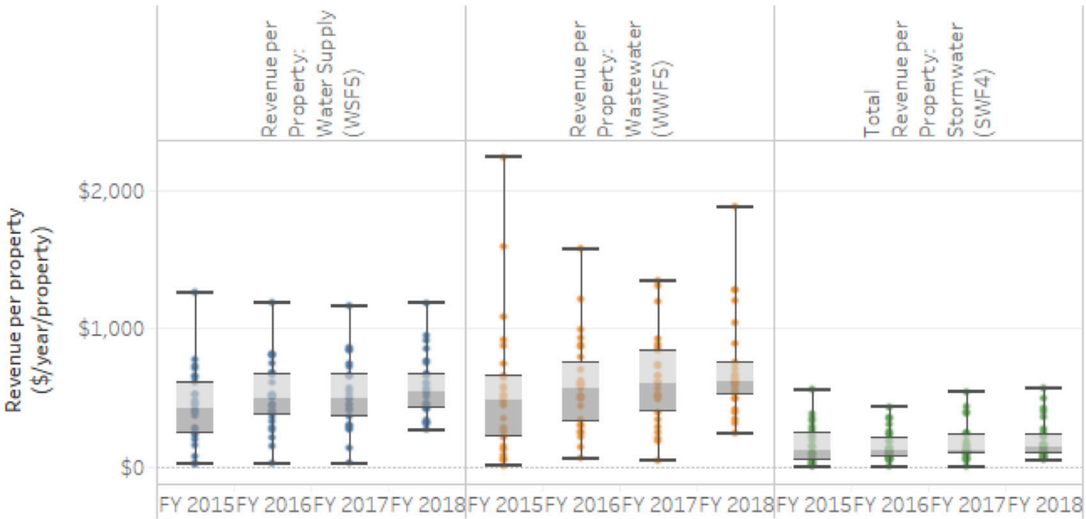
Table 16: Total 3 Waters revenue

	Water Supply	Wastewater	Stormwater
Operating revenue	$712,307,875	$984,809,519	$334,545,558
Developer contribution revenue	$39,379,483	$71,772,261	$48,160,797
Revenue from the supply of services to other authorities	$6,437,849	$13,342,234	
TOTAL	$758,125,207	$1,056,581,779	$382,706,354

14 In some instances, the participant importing water reported a volume that differed slightly from the value reported by those exporting water or wastewater. In these instances, an average of the two values reported was taken.

Figure 33 shows revenue collected per property from fiscal years 2015 to 2019. Each participant supplying data across this period is represented as a dot. Median revenues have continued to increase over this time, except for stormwater which decreased slightly from a median of $144 to $141 per year per property.

Figure 33: Trend in revenue per property

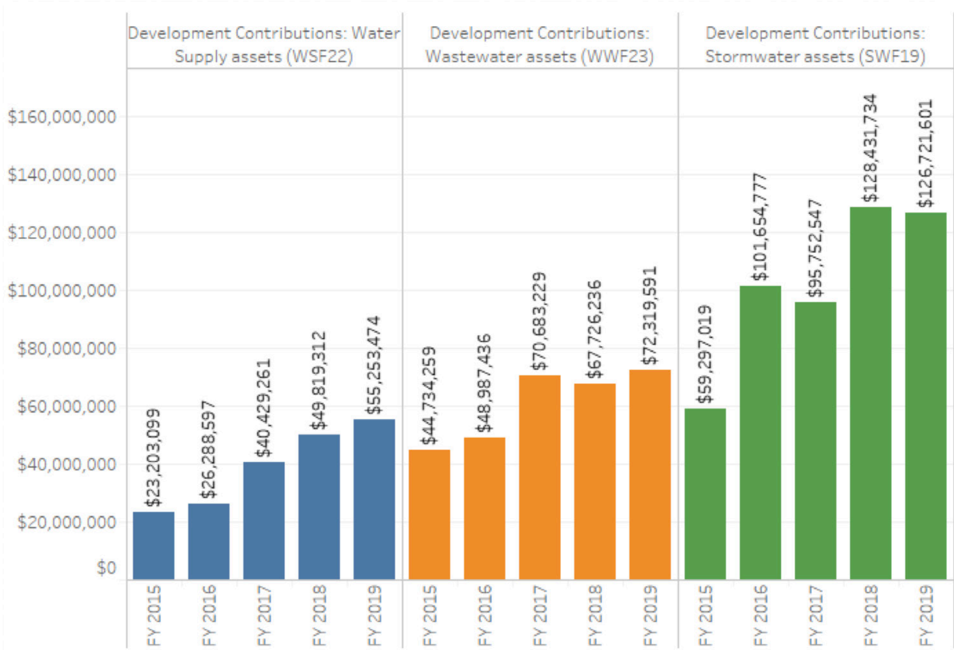


5.3 Developer contributions

In addition to cash contributions made by developers, councils and council-controlled organisations are commonly vested with the water and wastewater assets developers build. Figure 34 shows the total values of vested assets over the last five years, which have been gradually increasing.

Developer contributions are the only area reported on in the National Performance Review where spending associated with stormwater exceeds that of spending on water and wastewater.

Figure 34: Developer asset contributions



5.4 Expenditure

Expenditure across all participants was nearly $2 billion. A breakdown is provided in Table 17.

Table 17: Total expenditure across all participant systems

	Water Supply	Wastewater	Stormwater
Capital Expenditure (WSF20, WWF21, SWF17)	$347,628,663	$521,868,313	$220,094,824
Interest (WSF15a, WWF16a, SWF12a)	$42,190,115	$104,815,004	$34,809,744
Operating Cost (WSF12, WWF13, SWF9)	$275,026,937	$343,202,693	$100,943,429
TOTAL	$664,845,714	$969,886,010	$355,847,998

5.4.1 Operational expenditure

Total operational expenditure for the 2019 fiscal year was $858 million, composed of $338 million on water supply, $404 million on wastewater, and $114 million on stormwater systems. Different components of operational expenditure aggregated across all participants are shown in Figure 35. A comparison of individual participant operational expenditure is provided via the data portal link below. Where possible, the portal also shows the how much each participant spends of routine versus reactive maintenance.

Each participants operational expenditure per property over the last five years is summarised in Figure 36, with each repeat participant represented as a dot. This data exhibits no discernible trends.

Data portal link 14: Operational expenditure per property
https://www.waternz.org.nz/opex

Figure 35: Total operational expenditure by type for each of the 3 Waters

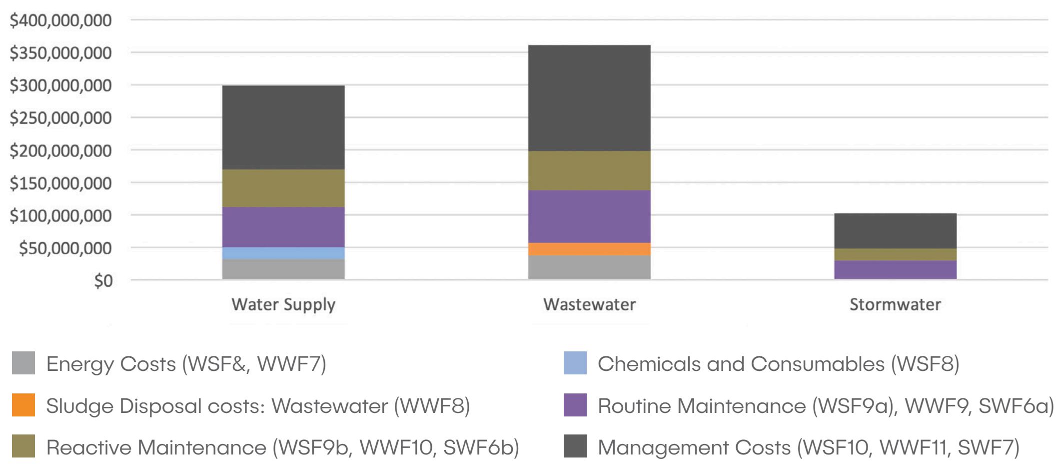
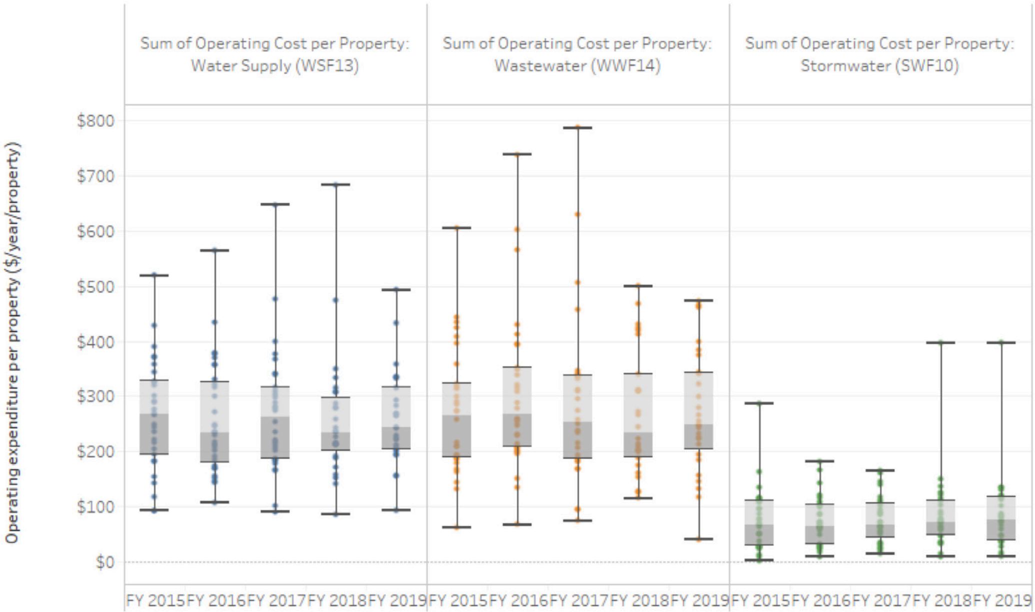


Figure 36: Trend in operational expenditure per property



5.4.2 Actual expenditure

Participants' actual capital expenditure totalled slightly over $1.25 billion in the 2019 fiscal year. A comparison of capital expenditure per participant is available via the data portal link below. A breakdown of expenditure by purpose is shown in Figure 37.

Capital expenditure for participants supplying data to the Review over the past five years is shown in Figure 38. Spikes in capital expenditure on wastewater systems and stormwater systems in 2017 are largely attributable to earthquake recovery in Christchurch.

Data portal link 15: Capital expenditure per property for water, wastewater and stormwater
https://www.waternz.org.nz/capex

Figure 37: Total 3 Waters capital expenditure by purpose

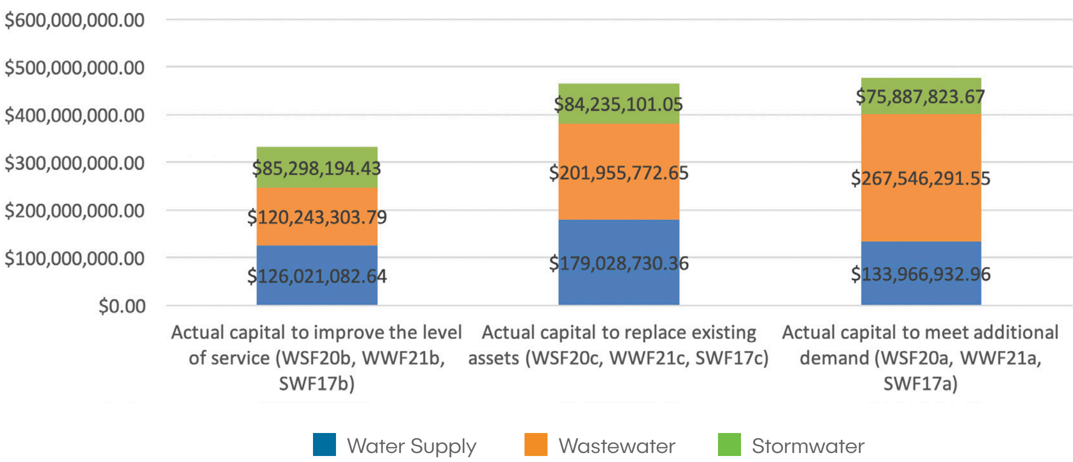
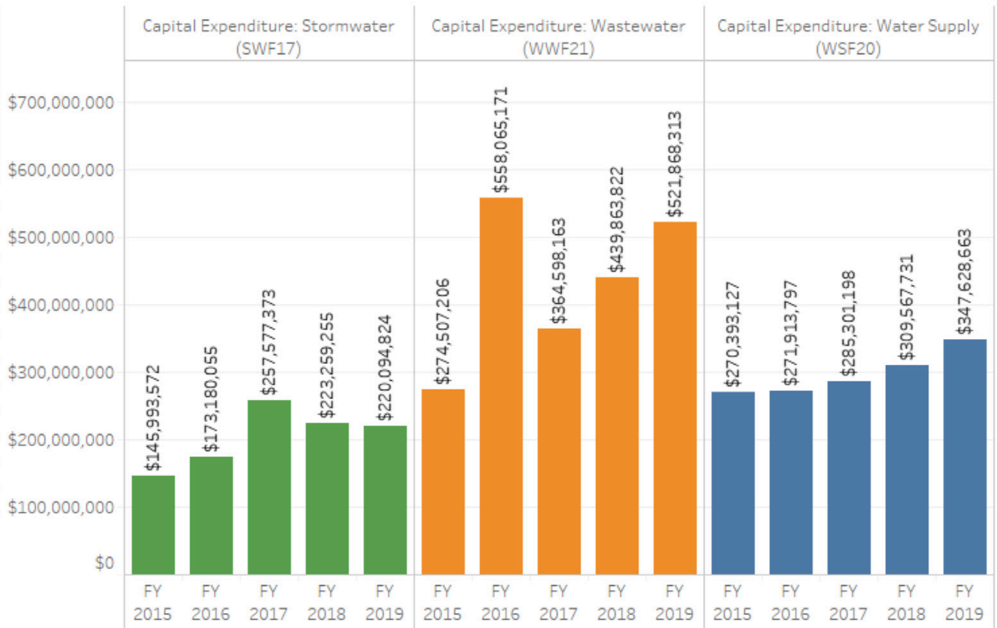


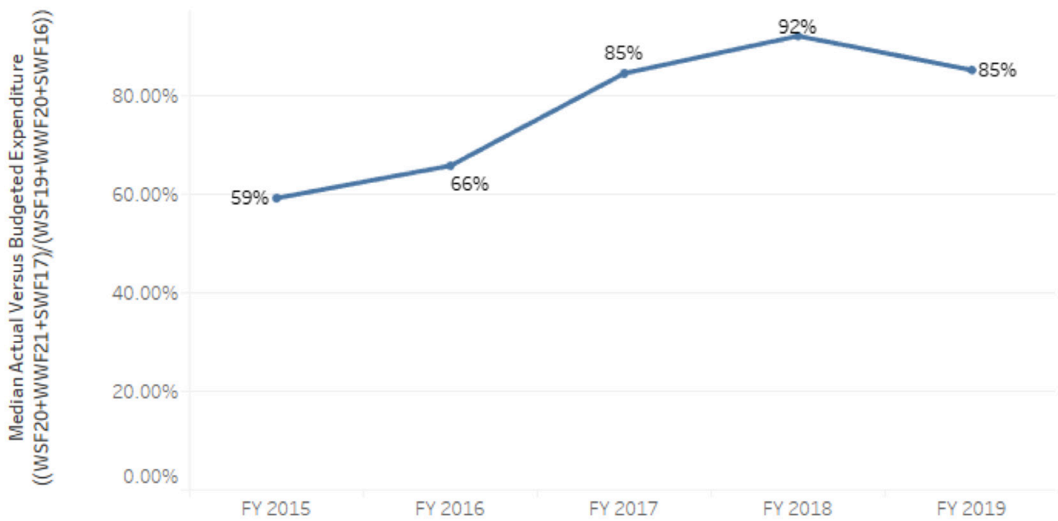
Figure 38: Trend in capital expenditure over the last five years



In general, participants spent less capital than they budgeted for. The median percentage of capital spent versus that budgeted across all participants is shown in Figure 39. The gap between actual and budgeted expenditure has gradually been closing; however, this year it regressed slightly from gains made the previous year. Individual participants actual capital spent versus budgeted capital can be viewed via the data portal link below.

Data portal link 16: Actual capital expenditure as a proportion of budgeted capital expenditure
https://www.waternz.org.nz/balancedbudget

Figure 39: Trend in actual versus budgeted expenditure



5.5 Depreciation

The monetary value of an asset decreases over time due to use, wear and tear, or obsolescence. This decrease is measured as depreciation. In theory, for assets to maintain their original intended levels of service, spending on assets should match depreciation.

Local government categorises capital expenditure on water assets as either expenditure on asset replacement, level of service improvements, or new growth. The first two categories relate to spending on existing assets. The total expenditure on existing assets for all NPR participants is shown alongside depreciation in Table 18. The data suggests that, if improvements to levels of service are considered, then spending is occurring on water and stormwater assets to maintain service levels, with a slight underspending on wastewater. If only expenditure on replacing existing assets is considered, however, then asset condition would be expected to be deteriorating.

The collation of expenditure masks outliers at individual councils. In addition, capital expenditure, by its nature, occurs in chunks, requiring that trends be considered over time, rather than by individual years. A comparison of individual participants showing capital expenditure on asset replacements as a proportion of depreciation over the past three years is available via the data portal link below.

Data portal link 17: Capital expenditure versus depreciation over the last three years for water, wastewater, and stormwater https://www.waternz.org.nz/depreciation

Table 18: Depreciation and capital expenditure on existing assets

	Water		Wastewater		Stormwater	
	Total	Asset improvement as a proportion of depreciation	Total	Asset improvement as a proportion of depreciation	Total	Asset improvement as a proportion of depreciation
Annual Depreciation: Wastewater (WSF14, WWF15, SWF11)	$306,705,843		$363,955,618		$149,544,258	
Capital to replace existing assets (WSF20c, WWF21c, SWF17c)	$179,028,730	58%	$201,955,773	55%	$84,235,101	56%
Capital to replace existing assets and improve the level of service (WSF20b+WSF20c, WWF21b+WWF21c, SWF17b+SWF17c)	$305,049,813	99%	$322,199,076	89%	$169,533,295	113%

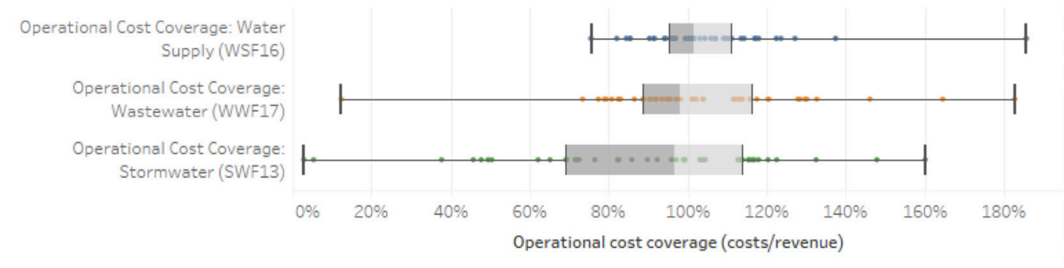
5.6 Cost coverage

5.6.1. Costs as a proportion of revenue

This metric shows operational costs, asset depreciation, and interest as a proportion of revenue (excluding developer contributions) for 3 Waters networks. In order to have a balanced budget, revenue should match costs. The cost coverage figure includes depreciation (as capital is generally not spent evenly over three years). Depreciation is often not fully funded which limits the accuracy of cost coverage represented by this metric.

Cost coverage using this approach was achieved for around half the participants, with median cost coverage rates of 101%, 98%, and 96% for water, wastewater, and stormwater systems respectively. However, there is a large spread in cost coverage rates, with some participants collecting enough revenue to cover as little as 3% of the cost of the stormwater network, and others raising nearly twice as much revenue as was spent on the water supply network. A comparison of individual participants' cost coverage is available via the data portal link below, and is summarised in Figure 40.

Figure 40: Operational cost coverage for water, wastewater, and stormwater



Data portal link 18: Operational cost coverage for water, wastewater, and stormwater systems per participant
https://www.waternz.org.nz/costcoverage

5.6.2 Debt servicing

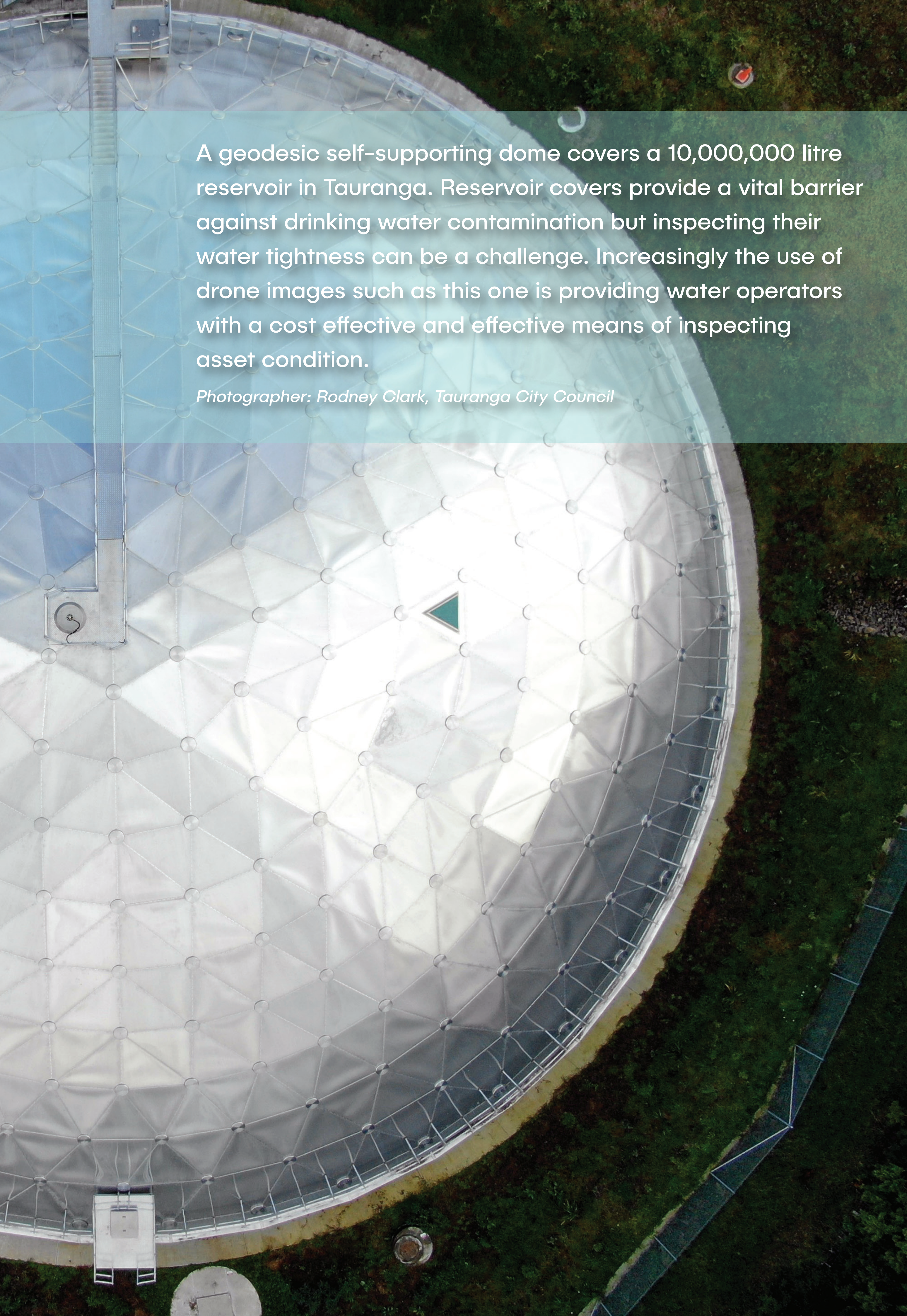
The proportion of revenue (excluding developer contributions) spent on interest for water, wastewater, and stormwater networks is summarised in Figure 41, and participant comparisons are available via the data portal link below.

Data portal link 19: Interest as a proportion of revenue for water, wastewater, and stormwater per participant
https://www.waternz.org.nz/debtservicing

This metric aligns with the *Debt Servicing Benchmark in the Local Government* (Financial Reporting and Prudence) Regulations 2014 (New Zealand Government, 2015), which applies to whole-of-council operations. It is met if borrowing costs are less than 10% of a local authority's revenue per year (or 15% for a high-growth council). The 10% benchmark was exceeded by 12 participants for water supply systems, 17 for wastewater, and 16 for stormwater.

The financial prudence measures apply to all council operations. The fact that 3 Waters assets carry higher levels of debt may be attributable to the long life of water assets, meaning capital used to finance them is commonly funded through debt in adherence with principles of intergenerational equity. Nonetheless, debt is a significant portion of revenue for many water operations.

Figure 41: Interest as a proportion of revenue for water, wastewater, and stormwater



A geodesic self-supporting dome covers a 10,000,000 litre reservoir in Tauranga. Reservoir covers provide a vital barrier against drinking water contamination but inspecting their water tightness can be a challenge. Increasingly the use of drone images such as this one is providing water operators with a cost effective and effective means of inspecting asset condition.

Photographer: Rodney Clark, Tauranga City Council

6 Reliability

6.1 System interruptions

Unplanned interruptions to water supply are the most common form of service disruption. The total number of interruptions recorded across all participants is shown in Table 19. The data for interruptions to water and wastewater systems per 1,000 properties serviced, shown in Figure 42 with each participant listed as a dot, reveals a significant spread across participants. A comparison of individual participant interruptions (normalised by the number of properties serviced) is available via the data portal link below.

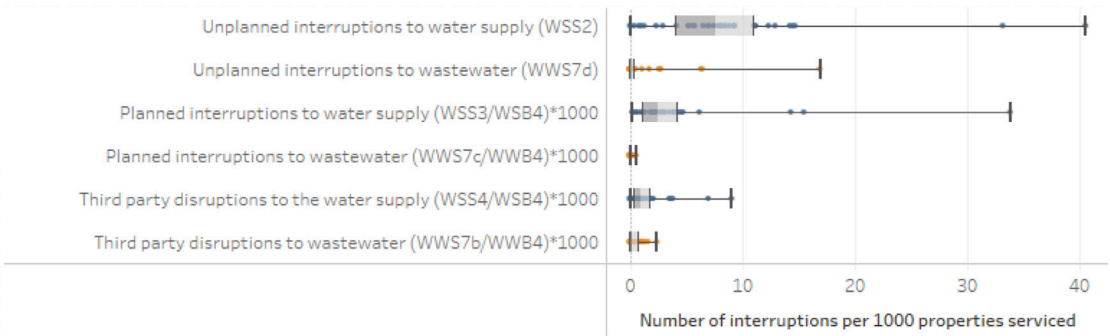
Reporting on planned interruptions to the wastewater system was introduced for the first time this year. Most participants reported no such interruptions. The auditor noted that, unless there is an immediate blockage on private property, it is very rare, if ever, that a customer cannot flush their toilet. Most repairs are done live, with measures in place to bypass problems so the customer is not inconvenienced.

Table 19: Total number of water and wastewater service disruptions

	Water supply	Wastewater
Planned Interruptions (WSS3, WWS7c)	3,299	8
Third Party Incidents (WSS4, WWS7b)	2,828	367
Unplanned Total Interruptions (WSS2, WWS7a)	12,055	820

Data portal link 20: Third party interruptions affecting the water and wastewater systems, planned and unplanned interruptions to the water supply, and failure of pipes affecting the wastewater system https://www.waternz.org.nz/interruptions

Figure 42: Interruptions to water and wastewater systems per 1000 properties serviced[15]



6.2 Condition assessment

Participants commonly assign a 1 to 5 grading to indicate the condition of their assets (with 5 indicating assets are in very poor condition, and 1 indicating very good).

Such condition assessment offers a glimpse into the state of assets, however variation in assessment methodologies makes it difficult to make meaningful comparisons. Table 20 shows the range and frequency of condition grading approaches in use at the time of reporting.

15 Whakatane and Ashburton have been excluded from the unplanned interruptions to the water supply (WSS2) data, as they were significant outliers with 124 and 132 unplanned interruptions per 1,000 properties respectively.

Throughout 2019, a suite of new industry publications was released, superseding many of the documents listed here. Further information is available https://www.waternz.org.nz/PipeGuidance.

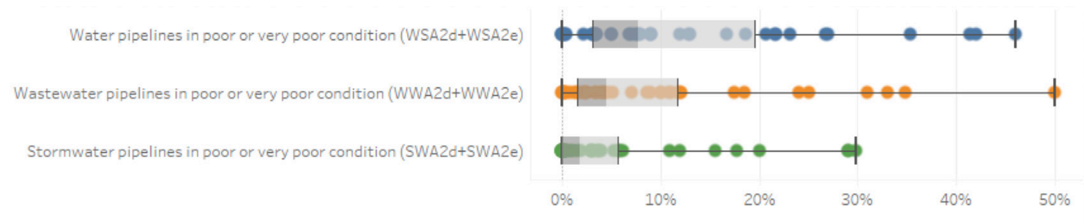
Table 20: Condition grading approaches in use

Condition grading approach	Water		Wastewater		Stormwater	
	Pipelines	Above-ground assets	Pipelines	Above-ground assets	Pipelines	Above-ground assets
Informal	5	3	9	3	8	5
In-house	10	6	7	6	4	7
New Zealand Infrastructure Asset Grading Guidelines	3	2	4	2	3	0
NAMS International Infrastructure Management Manual	7	6	10	6	7	8
IPWEA Condition Assessment and Asset Performance Guidelines	2	1	3	1	3	1
Visual Assessment Manual for Utility Assets	0	0	1	0	1	0
New Zealand Pipe Inspection Manual	4	12	0	12	0	11
IPWEA Practice Note 7: Water Supply and Sewerage	1	1	0	1	0	0
Other	4	2	2	2	5	2
Not specified	7	10	7	10	12	9

6.2.1 Pipeline condition assessment

A comparison of the proportion of pipelines assessed as being in poor or very poor condition is available via the data portal link below, and summarised in Figure 43.

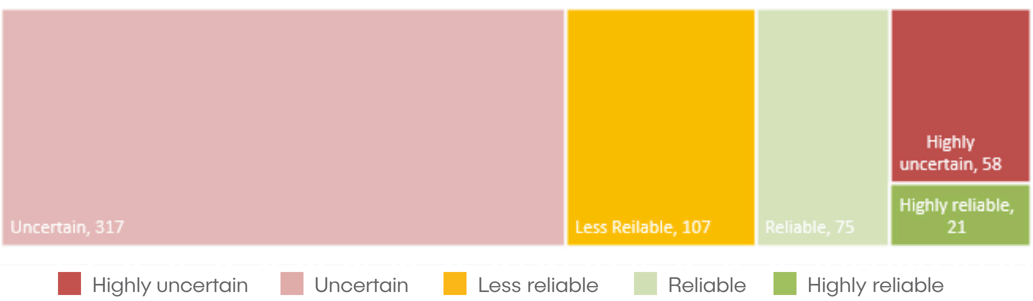
Figure 43: Proportion of pipelines in poor or very poor condition



Data portal link 21: Proportion of water, wastewater, and stormwater pipelines assessed as being in a poor or very poor condition https://www.waternz.org.nz/Pipecondition

Information on confidence ratings for pipeline condition data is also available via this data portal link and summarised in Figure 44. Only a small proportion of participants considered their condition data to be reliable.

Figure 44: Data confidence ratings assigned to pipeline condition data



Comparability of data is also limited by variations in condition assessment approaches and the comprehensiveness of network assessments. The proportion of participants' pipelines that have not yet received a condition grading is also available via this data portal link, and summarised in Figure 46, Figure 47, and Figure 48.

CCTV (Closed Circuit Television) is commonly used to assess pipeline condition. The proportion of participants' networks assessed using CCTV in wastewater and stormwater networks is shown in Figure 45 (CCTV is not commonly applied to water networks due to water pressure in the networks).

Figure 45: Proportion of networks assessed using CCTV

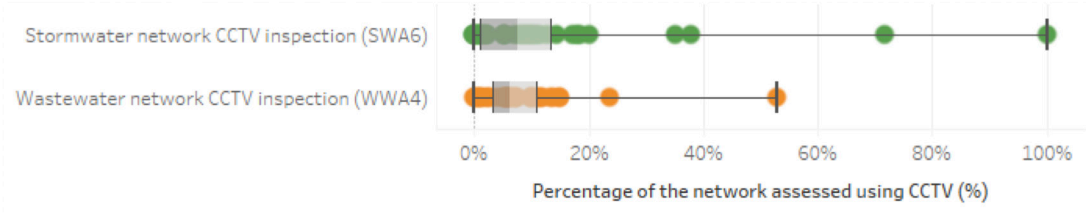


Figure 46: Proportion of water pipelines that had not yet been assigned a condition grading

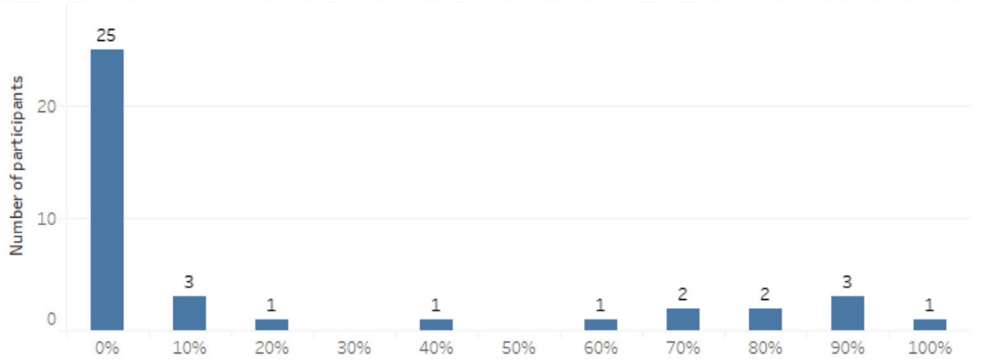


Figure 47: Proportion of wastewater pipelines that had not yet been assigned a condition grading

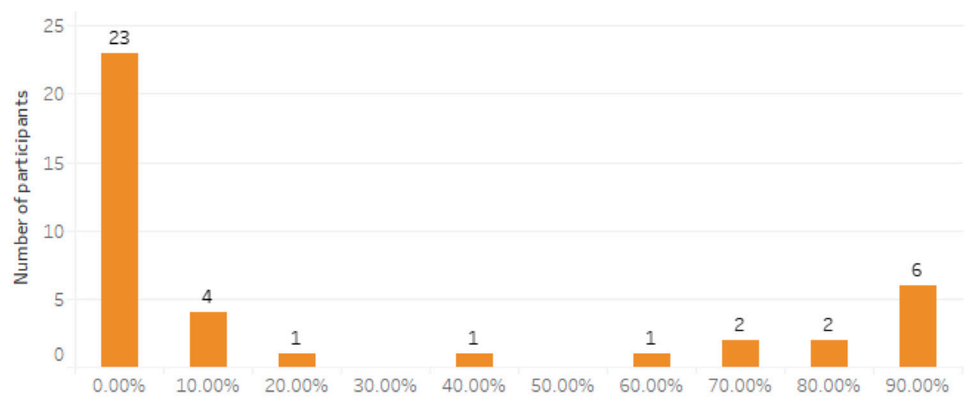
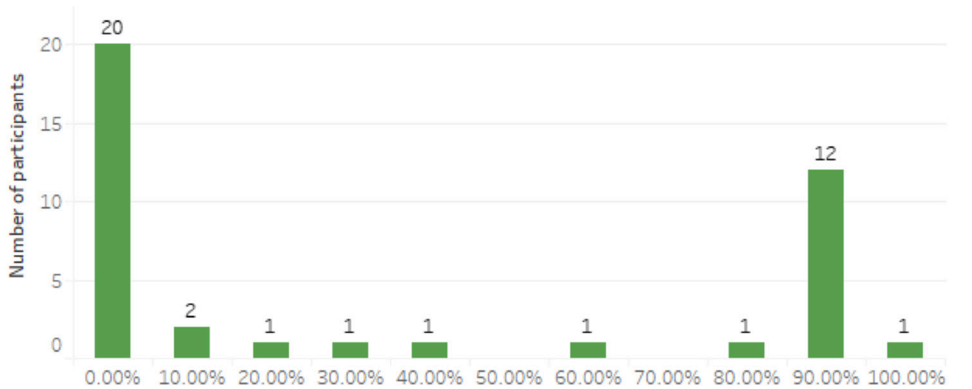


Figure 48: Proportion of stormwater pipelines that had not yet been assigned a condition grading



6.2.2 Above-ground asset assessment

Most participants have in place a regular condition assessment programme for above-ground assets. The proportion of network assessed in a three-yearly asset management cycle is shown in Figure 49, Figure 50, and Figure 51.

Figure 49: Proportion of above-grounds assets assigned a condition grading for water

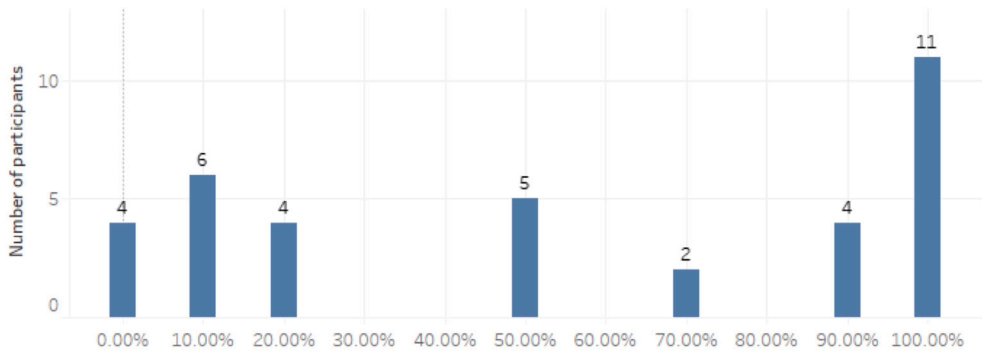


Figure 50: Proportion of above-ground assets assigned a condition grading for wastewater

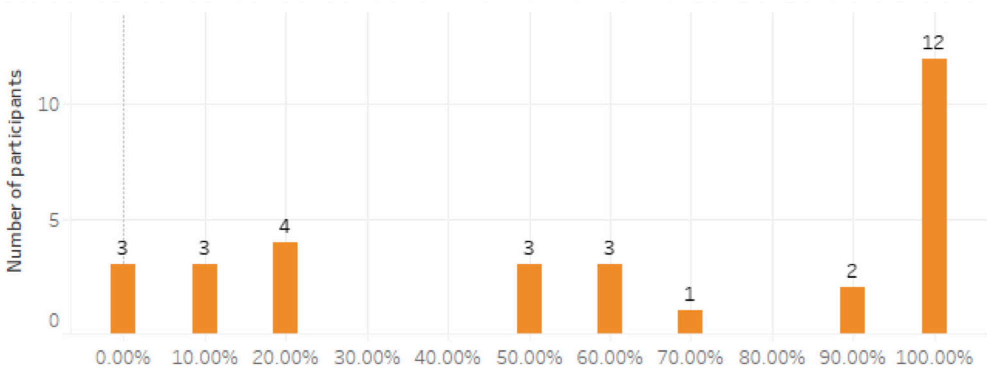
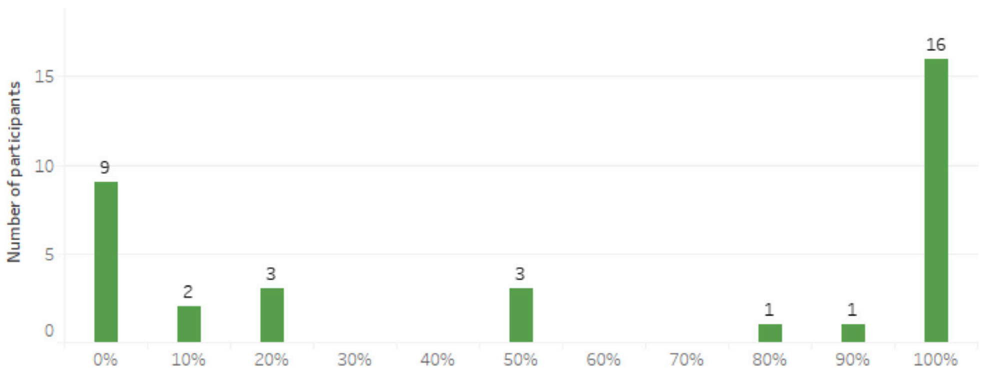


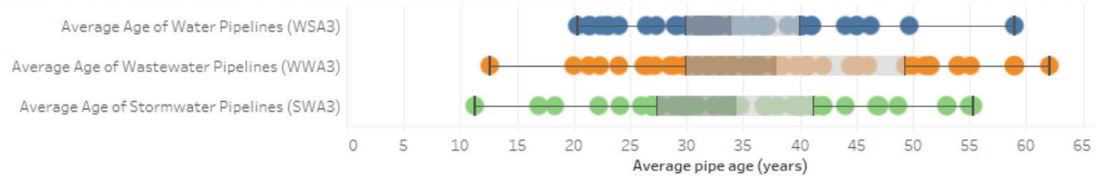
Figure 51: Proportion of above-ground assets assigned a condition grading for stormwater



6.3 Pipeline age

Water supply pipes have the lowest median weighted age of 34 years, followed by wastewater and stormwater pipes at 37 years. A comparison of participants' average weighted age is available via the data portal link below, and summarised in Figure 52 with each participant represented as a dot.

Figure 52: Average pipeline age for water, wastewater, and stormwater



Data portal link 22: Average water, wastewater, and stormwater pipeline age per participant
https://www.waternz.org.nz/Pipeage

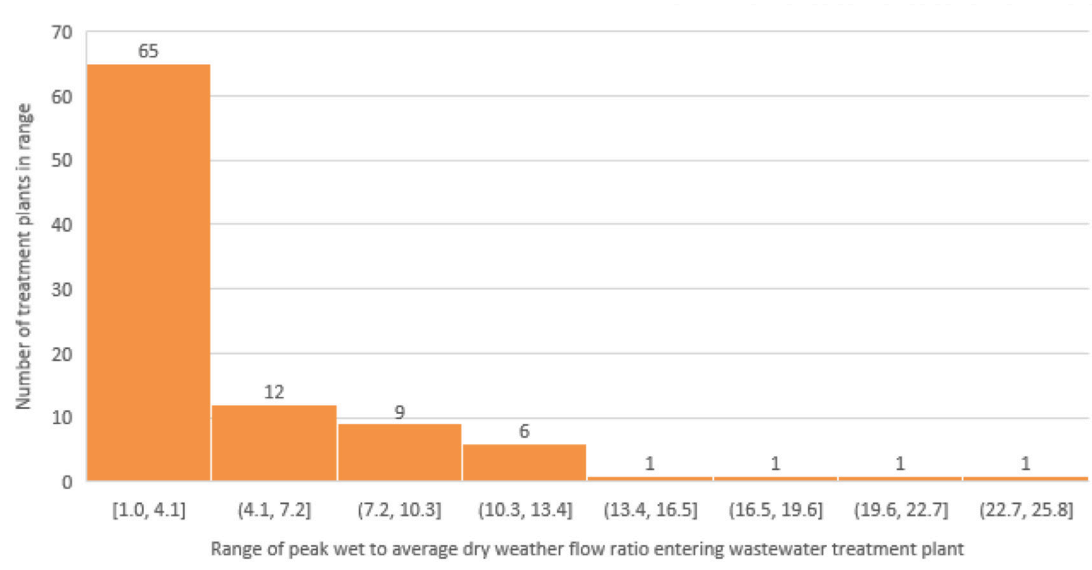
6.4 Inflow and infiltration

Inflow and infiltration (I&I) are mechanisms by which stormwater and groundwater make their way into the wastewater network, commonly caused by cross connections or damaged pipes. High volumes of I&I put additional load on wastewater treatment plants, which can result in wastewater overflows to the environment in wet weather.

Participants have provided information on the peak wet to average dry-weather flow ratios entering their treatment plants to provide an indication of I&I. Information was provided for 96 different treatment plants. Individual treatment plant flow ratios are available from the wastewater treatment plant inventory https://www.waternz.org.nz/WWTPInventory. A summary of values is shown in Figure 53.

Data portal link 23: Inflow and infiltration range per participant
https://www.waternz.org.nz/inflowandinfiltration

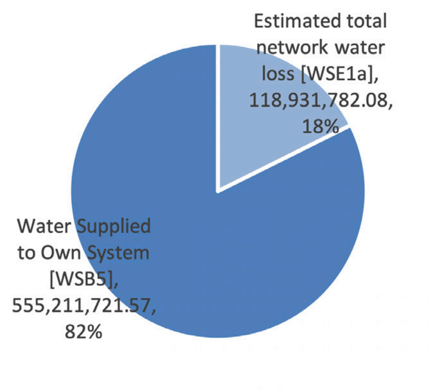
Figure 53: Peak wet to average dry weather flow ratios for treatment plants



6.5 Water loss

In the 2019 fiscal year, participants lost 119 million cubic meters of water through their water supply systems, equivalent to over 47,000 Olympic-sized swimming pools. This constituted 18% of the 555 million cubic meters of water supplied to systems with known water loss.[16]

Figure 54: Total water losses as a proportion of water supplied (m^3/year)

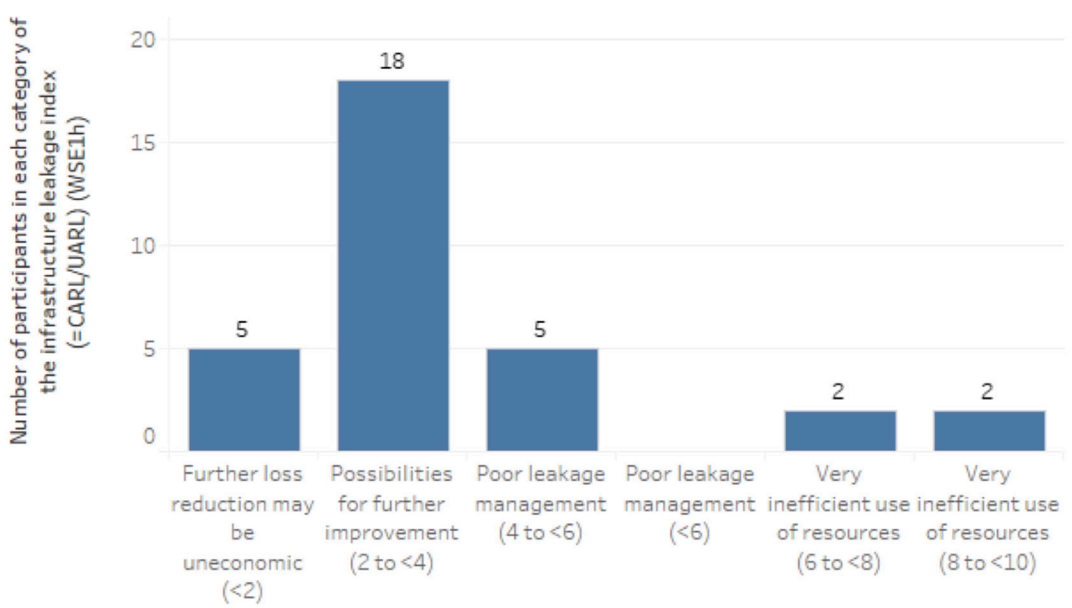


International experts recommend the Infrastructure Leakage Index (ILI) is used to compare water losses across different systems. ILI is determined by dividing current annual real water loss levels (CARL) by unavoidable annual real losses (UARL). The number of participants achieving each of the ILI performance bands contained in Water New Zealand's Water Loss Guidelines (Lambert & Taylor, 2010) is shown in Figure 55. Only five participants (Kapiti Coast, New Plymouth, Selwyn, Tauranga, and Western Bay of Plenty) achieved water loss levels low enough that further reduction of losses would be considered uneconomic. ILI performance for these and other participants is available via the data portal link below.

Data portal link 24: Water losses using current annual real losses over time and the Infrastructure Leakage Index https://www.waternz.org.nz/waterloss

There are inherent inaccuracies in water loss estimates for water supplies without universal metering in place. For this reason the percentage of residential connections with meters is indicated in the data portal.

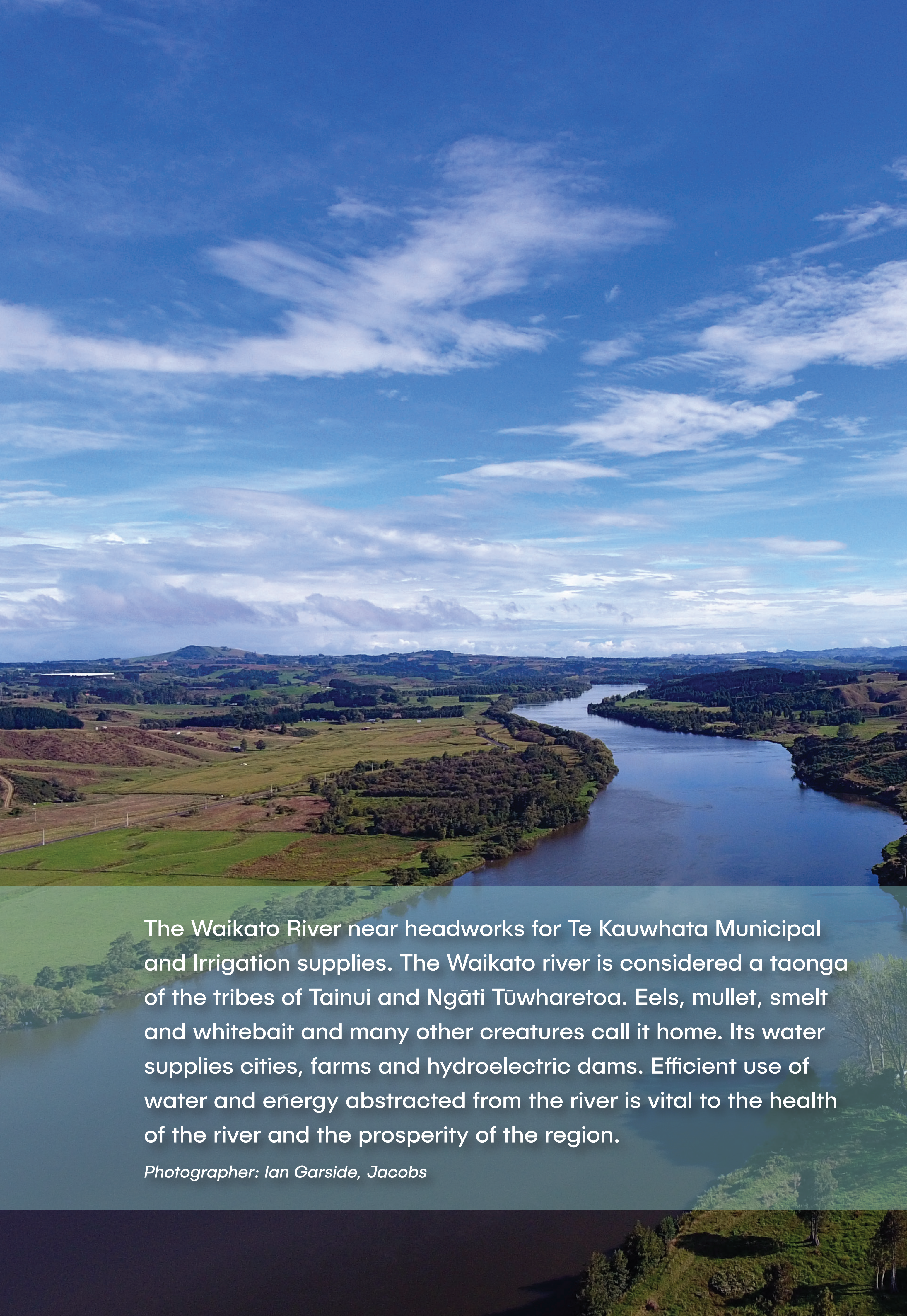
Figure 55: Water loss performance summary using the Infrastructure Leakage Index



Changes in water loss over time can be compared by looking at changes in current annual real loss levels (CARL). Median CARL levels for participants continuously supplying data to the NPR is shown in Figure 56. Individual participant trends are available via the data portal link below.

16 Grey, Manawatu, Tararua, Taupo, and Whanganui did not supply data on the volumes of water lost through their systems, so the water supply value in this section differs from the total water supply volume of all participants.

Figure 56: Changes in median, and number of entities reporting, current annual real loss of water in litres/property/day



The Waikato River near headworks for Te Kauwhata Municipal and Irrigation supplies. The Waikato river is considered a taonga of the tribes of Tainui and Ngāti Tūwharetoa. Eels, mullet, smelt and whitebait and many other creatures call it home. Its water supplies cities, farms and hydroelectric dams. Efficient use of water and energy abstracted from the river is vital to the health of the river and the prosperity of the region.

Photographer: Ian Garside, Jacobs

7 Resource efficiency

7.1 Water abstractions

Participants supplied 563 million cubic meters of water in 2018-19, roughly equal to the volume of 225,000 Olympic-sized swimming pools. A breakdown of water supplied by individual participants over the last five years is available at the data portal link below. A map indicating volumes abstracted around New Zealand is shown in Figure 58. Major end use categories are estimated in Table 21.

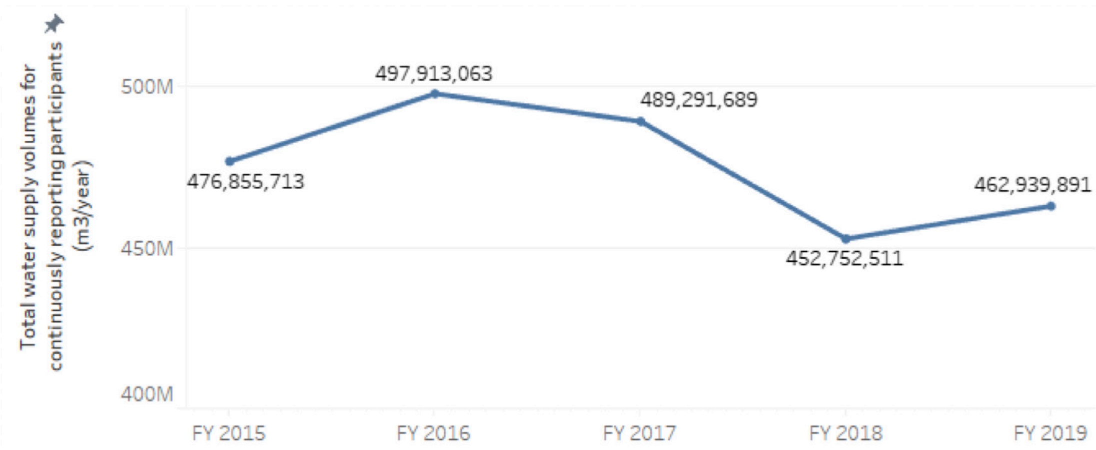
Data portal link 25: Annual water supply volumes for participants systems.
https://www.waternz.org.nz/waterabstractions

Table 21: Total water supply volumes by end use (m^3/year)[17]

Water end use	Total volume supplied (m^3/year)
Non-residential water consumption (WSB7)	127,184,998
Residential consumption estimate (WSB5-WSB7-WSE1a)	316,963,581
Total network water loss (WSE1a)	119,010,271
Water supplied to own system (WSB5)	**563,158,850**

Total water supplied for participants providing data over the last five years[18] is shown in Figure 57. The return from lower consumption in the 2017-18 fiscal years is likely reflecting a return to generally more normal rainfall patterns, after the wetter than normal conditions which affected much of New Zealand in 2017-18 (NIWA, n.d.).

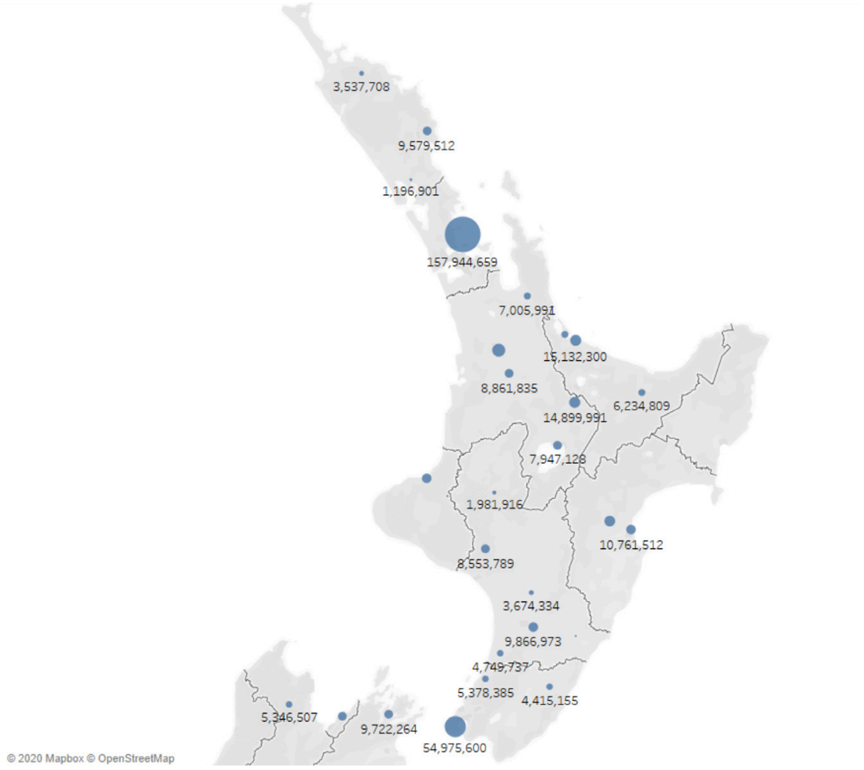
Figure 57: Trends in total volumes of water supplied to participant systems

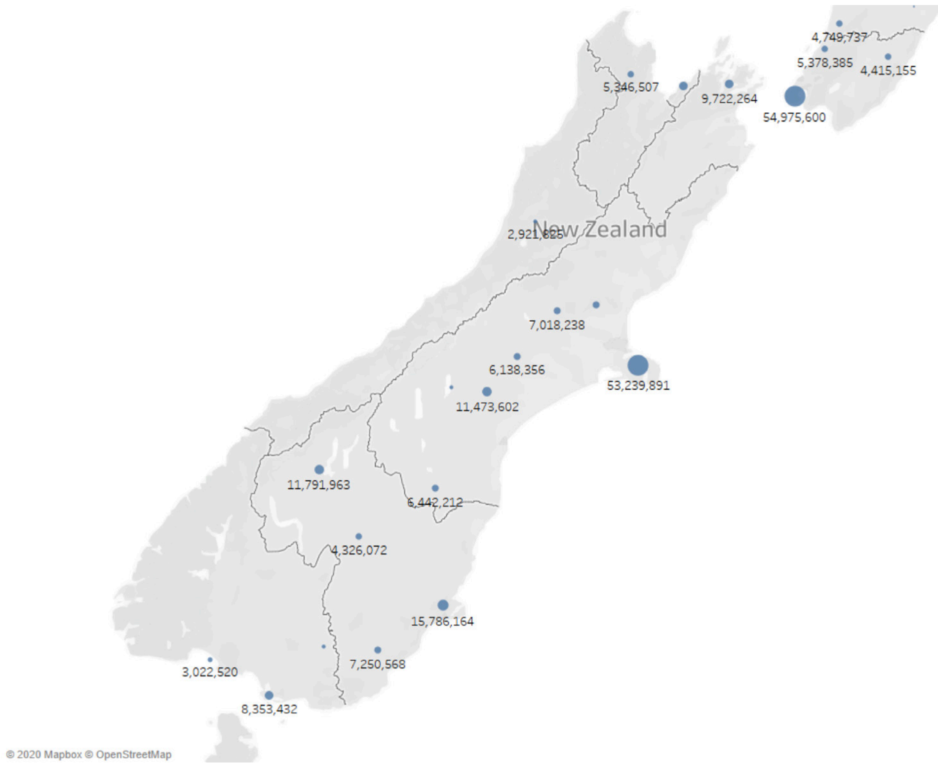


17 The total volume of non-residential water use is under-represented, and residential consumption overestimated, as Kaipara, Hauraki, Napier, Selwyn, Southland, Tararua and Waimakariri did not provide volumes of non-residential water use.

18 Excluding Kaipara, which did not provide total water supply volumes in 2015.

Figure 58: Water abstractions for drinking water per participant (m^3/year)





7.2 Water demand management

7.2.1 Water restrictions

21 of 47 participants used water restrictions in 2018-19. They were used most extensively in Wellington, with 28,739,580 resident days affected. The number of repeat participants who have put water restrictions in place over the last five years is shown in Figure 59. A scaled map of resident-affected days is shown in Figure 60.

Figure 59: Number of participants with water restrictions in place

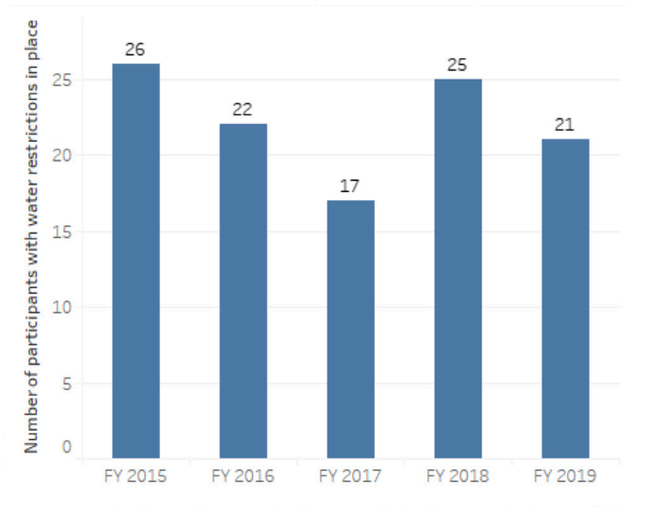
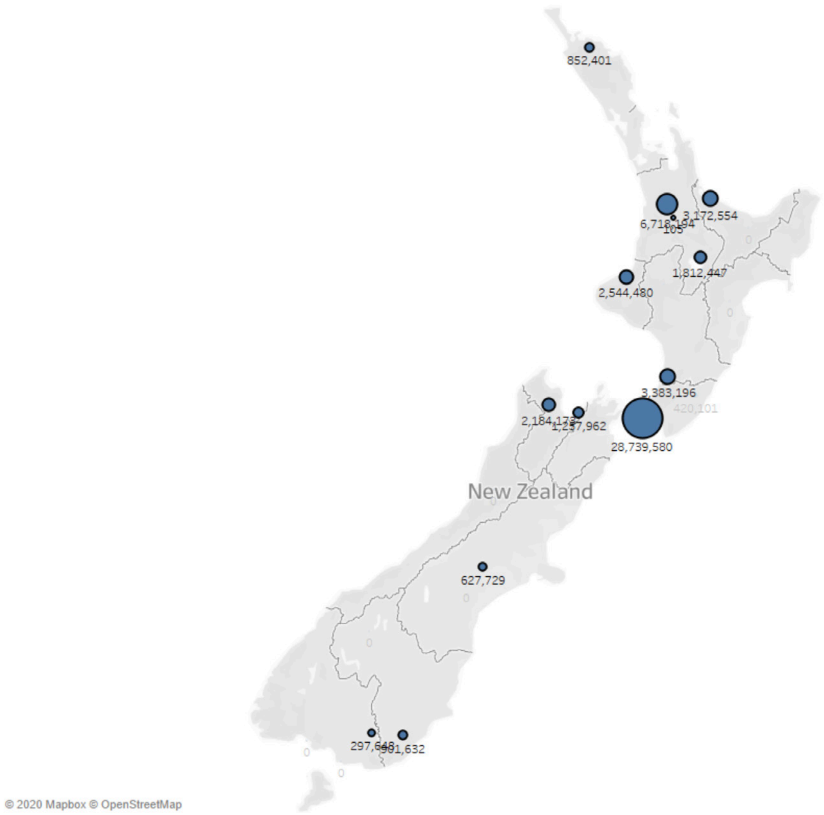


Figure 60: Population days of water restrictions per participant



7.2.2 Water metering and restrictors

104,842 non-residential and 746,410 residential water meters were in place to measure participants customers water use in 2018-19. This covered 83% of non-residential properties and 58% of residential properties.

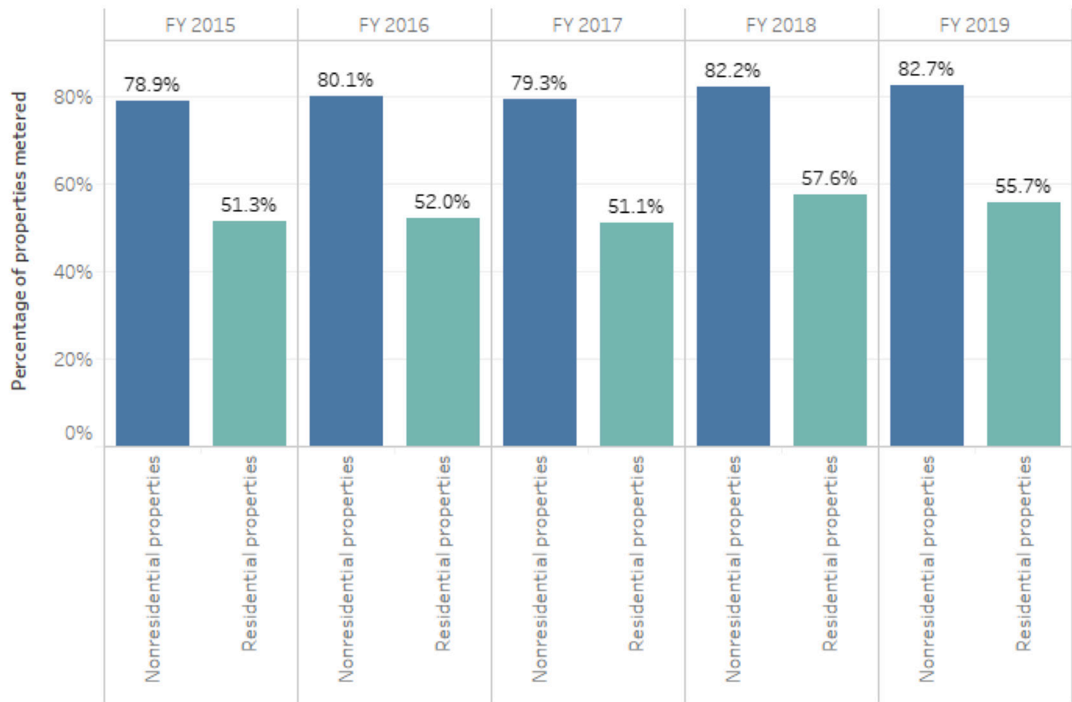
Over half of residential properties have a water meter reflecting near-total metering coverage in many of New Zealand's large centres. Auckland, Christchurch, Central Otago, Far North, Hauraki, Nelson, Tauranga, Western Bay of Plenty and Whangarei have 100% residential water metering coverage, and Kapiti, Selwyn, Tasman, Whakatane and Waipa all meter the majority of residential properties with coverage levels of greater than 80%.

There are several districts where water metering is still not widely used. Twenty-three participants had residential meters on less than 5% of their network. A comparison of metering levels at individual participant sites are available at the data portal link below.

Data portal link 26: Percentage of residential properties with water meters for residential and non-residential properties https://www.waternz.org.nz/metering

Over the previous four years, the proportion of meters had gradually increased, levelling off this year. While some regions had increased metering coverage this was offset by growth in the number of properties serviced in other unmetered areas. The proportion of metered properties for participants supplying five years' continuous data is shown in Figure 61.

Figure 61: Changes in the proportion of properties with water metering for repeat participants



7.2.3 Residential water efficiency

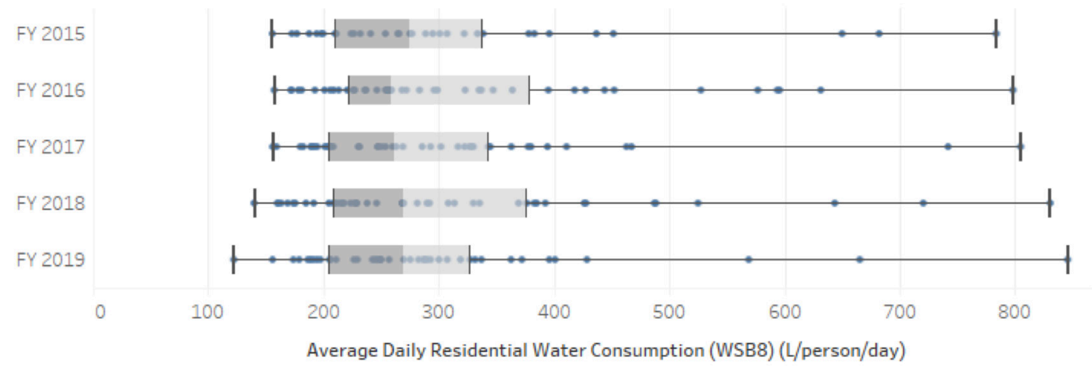
263 litres per person per day is the median of the average daily water consumption across participants districts. There is a large spread in residential water efficiency in different areas. This is illustrated by the summary of participants reported average daily per capita water consumption for the last five years shown in Figure 62.

In the 2019 fiscal year Western Bay of Plenty achieved record low average residential water use, with residents consuming on average 122L/person/day. A comparison of results for all participants are available at the data portal link below.

Participants recording exceptionally high residential water consumption did not have in place mechanisms to track either water loss or non-residential water consumption. The absence of this data means that residential water consumption levels are overrepresented.

Data portal link 27: Average daily residential water use (litres/person/day)
https://www.waternz.org.nz/residentialefficiency

Figure 62: Average daily residential water efficiency



7.3 Sewerage sludge

Sewerage sludge is the solid fraction of wastewater treatment. Measurement and monitoring of sludge volumes is not widespread. Sludge volumes were reported for only 49 treatment plants, and no information on sludge was provided for 124. 88,000 tonnes of dry solids was the total volume of sludge reported by those supplying data. More accurate estimates of sludge volumes treatment at New Zealand's largest wastewater treatment plants is provided in the paper *The Value of Biosolids in New Zealand – An Industry Assessment* (Tinholt, 2019).

Treated sewerage sludges, known as biosolids, can be beneficially reused as a fertiliser or an energy source. Currently however a large proportion of wastewater sludges are sent to landfill. Participants were asked to provide information about the end route of their sludges. The number of times different disposal routes were employed is summarised in Table 22.

Table 22: Sewage sludge disposal routes in use

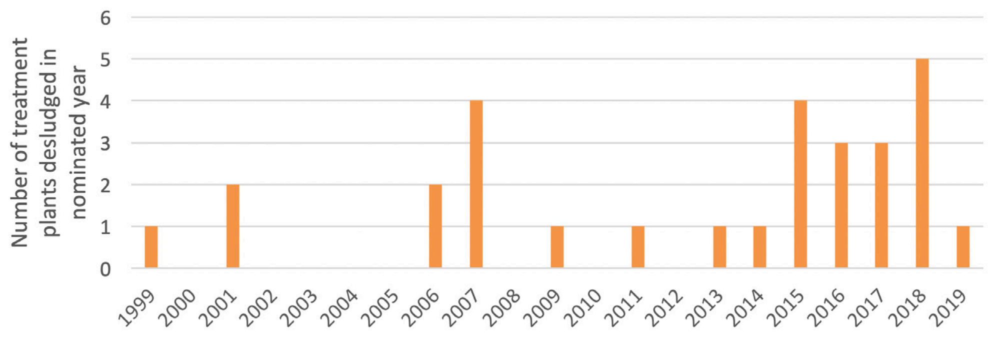
Sludge disposal routes	Number of wastewater treatment plants employing disposal route
Stockpile	7
Landfill	42
Composting and reuse	15
Other	5
Unknown	**109**

Wastewater treatment plants where sludge was disposed of to "other" routes included Auckland's Mangere Treatment plant, Tauranga's Te Maunga Treatment Plant, Ashburton's Rakaia plant and the Nelson North Wastewater Treatment Plant. Mangere's sewage sludges are being used to rehabilitate a former quarry into a nature reserve, and Nelson Norths wastewater treatment plant which uses biosolids as a fertiliser for pine forest on Bell Island.

Many of New Zealand's smaller wastewater treatment plants are oxidation pond systems, which only produce sludge periodically when desludging occurs. Participants were asked to supply information about the last year their wastewater treatment ponds were de-sludged. 29 participants provided responses which are summarised in Figure 63.

The *Good Practice Guide for Waste Stabilisation Pond Design and Operation* (Water New Zealand, 2017) recommends that sludge levels are measured regularly (5 yearly initially and 2 yearly after 15 years operation), to understand when it is necessary to de-sludge.

Figure 63: Last year of desludging for pond-based wastewater treatment plants



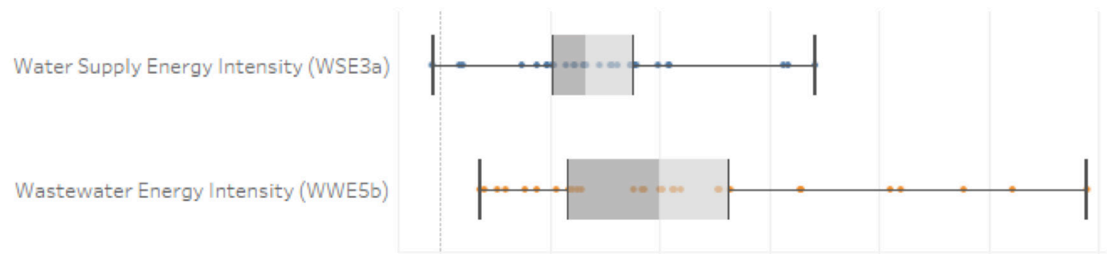
7.4 Energy use

Participants used 653,617 GJ and 1,063,572 GJ in the treatment and conveyance of water and wastewater respectively. A comparison of energy use per participant is available at the data portal link below and summarised in Figure 64 with each participant represented as a dot.

Data portal link 28: Energy intensity for water and wastewater systems
https://www.waternz.org.nz/energyuse

Most energy used by water supply and wastewater systems is sourced from the grid however this is not always the case. For example, in Palmerston North the wastewater treatment plant is run on biogas, sourced from both the wastewater treatment process and a nearby closed landfill. This process produced energy surplus to the treatment plant's needs.

Figure 64: Energy intensity for water and wastewater systems



This photo was taken while inspecting a valve in a chamber near Silverdale. A lot of our vital water infrastructure is hidden, either buried or confined to subsurface chambers that only on occasion gets to see the light of day. Valves like this one control the crisscross of water and wastewater pipelines that run beneath our feet. Being able to redirect water is essential for maintaining a continuous and resilient water supply in the event of natural disasters or maintenance disruptions.

Photographer: Charley Miles, Guaranteed Flow Systems

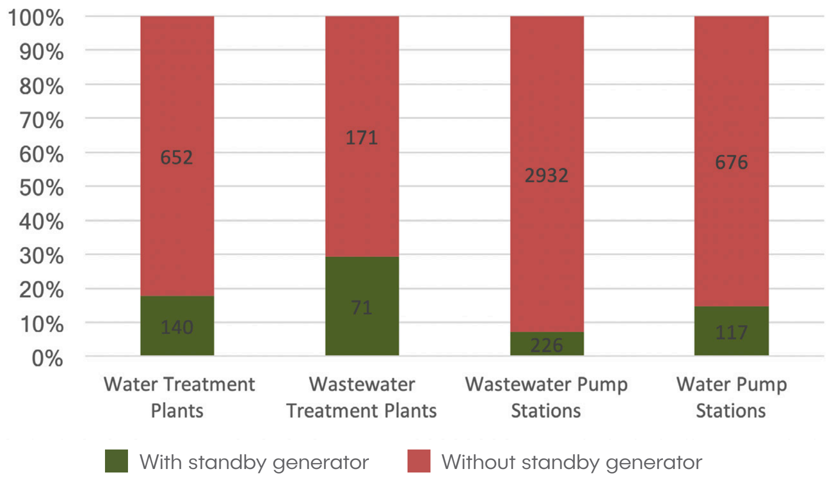
8 Resilience

8.1 Back-up power supplies

Over one third of wastewater treatment plants have back-up electricity generators, however this figure is lower for water treatment plants and pump stations. The number of backup generators in place for pump stations and treatment plants is shown in Figure 65. This figure includes both fixed and mobile generators.

The number of plants and pump stations with and without back-up generation for individual participants is shown at the data portal link below.

Figure 65: Proportion of sites with back-up generation



Data portal link 29: Number of water treatment plants, wastewater treatment plants, water pump stations, and wastewater pump stations with and without backup generation https://www.waternz.org.nz/backupgeneration

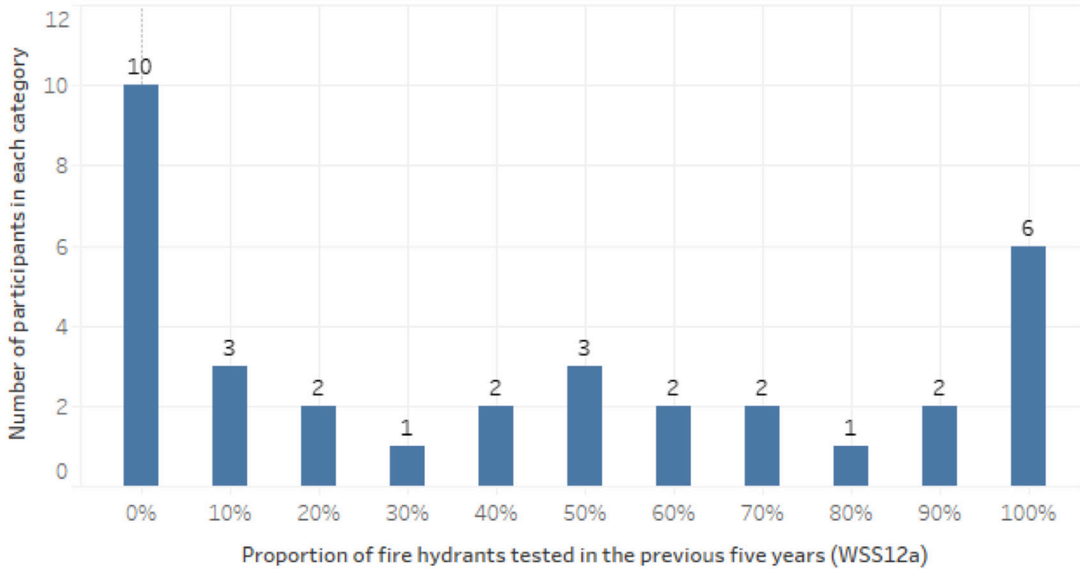
8.2 Firefighting water supplies

The *New Zealand Fire Service Firefighting Water Supplies Code of Practice* (Standards New Zealand, 2008) provides direction on what constitutes enough supply of water for firefighting in urban fire districts.

The Code specifies that all fire hydrants must be inspected and flushed every five years by an approved tester. Assessing hydrants compliance with the code has technical challenges for water suppliers and assessment against the code is not widespread. Only six participants (Tauranga, Christchurch, Waimakariri, Selwyn, Western Bay of Plenty and Masterton) had assessed all hydrants against the code. Ten participants had not assessed any. Assessment levels for each authority vary for each participant.

Data portal link 30: Proportion of fire hydrants tested in the previous five years per participant
https://www.waternz.org.nz/hydrants

Figure 66: Proportion of fire hydrants tested every five years, by number of participants



8.3 Water storage

Reservoirs are generally kept close to full and have storage capacity ranging from 2 hours to nearly 4 days' worth of average day water demand. Figure 69 summarises how full storage reservoirs are. Figure 70 summarises the average number of days treated water stored in reservoirs. A comparison of participants reservoir level and average hours of water storage is available at the data portal link below.

Data portal link 31: Reservoir average days storage and storage levels
https://www.waternz.org.nz/reservoirLevel

Figure 67: Average reservoir storage levels

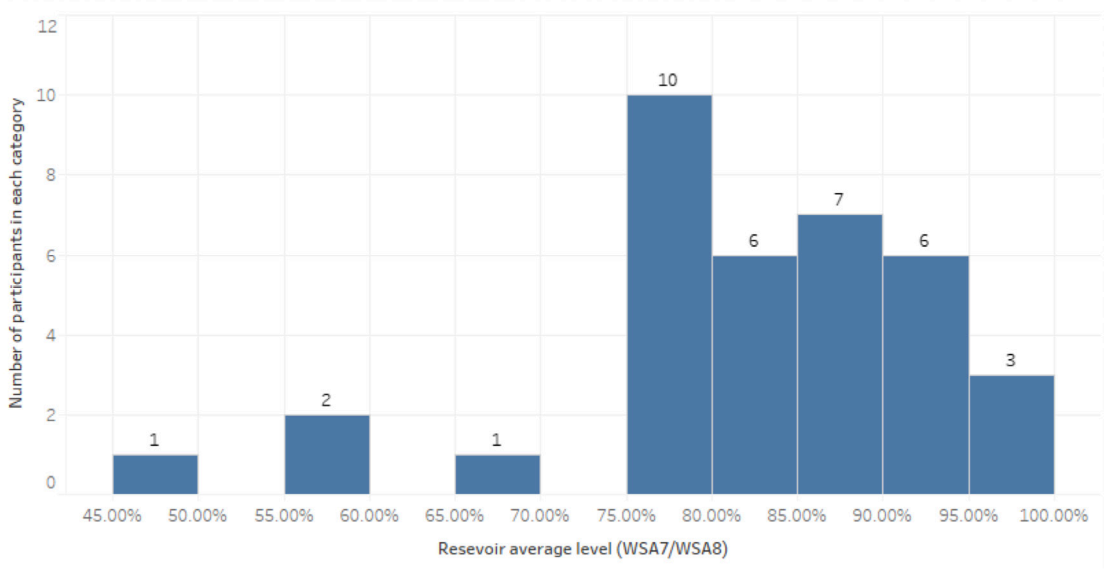
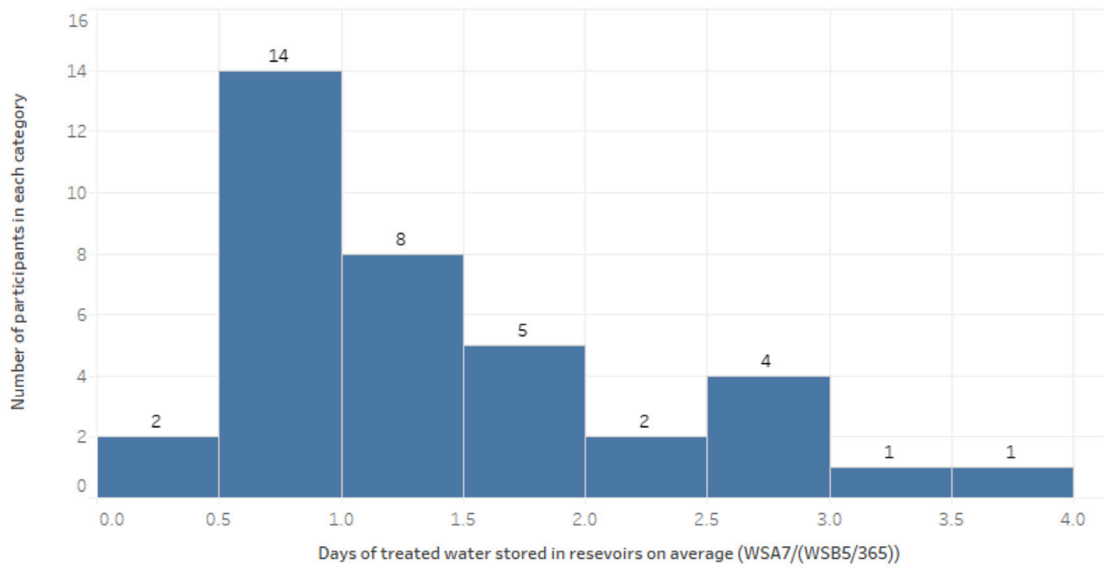


Figure 68: Days of treated water stored in reservoirs on average



8.4 Flooding

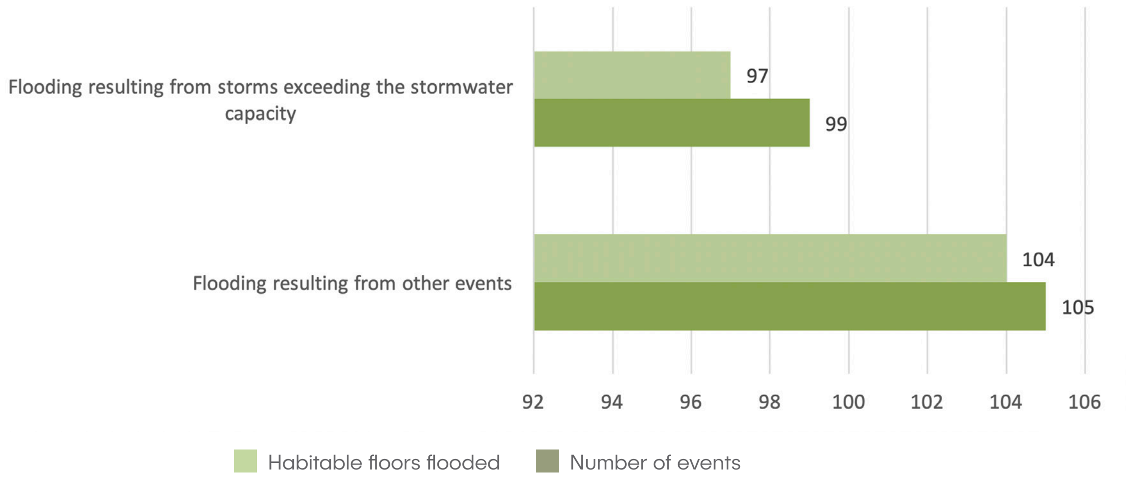
8.4.1 Flooding events

Flooding has been categorised into events caused by storms exceeding the stormwater capacity or other causes (such as floods related to tidal inundation or rivers bursting flood banks). The number of both types of flood event and the habitable floors impacted for each participant are available at the data portal link below and summarised in Figure 69.

Data portal link 32: Number of flooding events recorded, and the number of habitable floors impacted
https://www.waternz.org.nz/floodingevents

Eleven participants reported having floods resulting from stormwater events that overwhelmed the stormwater system, with most occurring in Auckland (57) and Nelson (21). Only two areas reported flooding resulting from other causes were reported, 104 in Auckland and two in Invercargill.

Figure 69: Number of flooding events and habitable floors impacted by cause



Data definitions specify that only floods affecting habitable floors should be included in the measure however definitions don't appear to have been adhered to in this regard as five participants reported flooding events but no flooding of habitable floors.

8.4.2 Flood design standards

The levels of service targeted when designing stormwater networks is available for individual participants at the data portal link below and summarised in Figure 70 and Figure 71. The figures show the annual exceedance probability ((i.e. the chance or probability of a flooding event occurring in any given year) for primary and secondary networks.

The primary stormwater network typically consists of pipes, culverts, and soak holes designed to minimise nuisance flooding. The secondary network refers to the stormwater flow path designed to convey excess stormwater with a minimum of damage when the primary system is overloaded.

Data portal link 33: Annual Exceedance Probability of events designed to be contained by primary and secondary stormwater networks https://www.waternz.org.nz/stormwaterstandards

Figure 70: The annual exceedance probability targeted during the design of the primary stormwater network

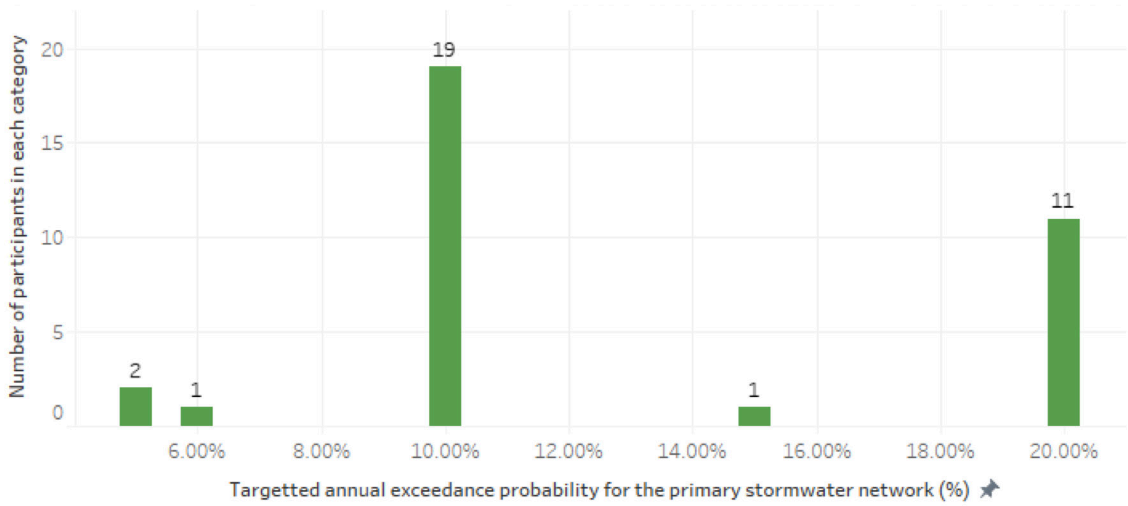
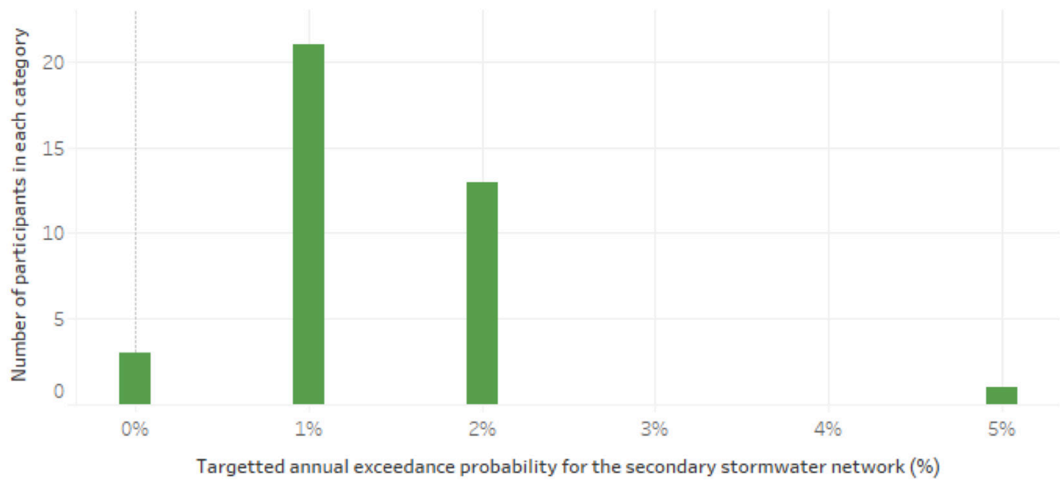


Figure 71: The annual exceedance probability targeted during the design of the secondary stormwater network



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Appendix I: Review participants

Organisations participating in the 2018/19 National Performance Review

Participant name	Report reference	Size category	Data confidence	Data completeness	Audit status
Ashburton District Council	Ashburton	Small		Most available	Audit
Watercare	Auckland	Large		Most available	Onsite audit
Auckland City Council	Auckland Council	Large		Most available	Audit
Central Otago District Council	Central Otago	Small		Some gaps	Audit
Christchurch City Council	Christchurch	Large		Most available	Audit
Clutha District Council	Clutha	Small		Some gaps	Audit
Dunedin City Council	Dunedin	Large		Most available	
Far North District Council	Far North	Medium		Some gaps	Audit
Gore District Council	Gore	Small		Some gaps	Phone audit
Grey District Council	Grey	Small		Some gaps	Audit
Hamilton City Council	Hamilton	Large		Most available	Audit
Hastings District Council	Hastings	Medium		Most available	Audit
Hauraki District Council	Hauraki	Medium		Major gaps	Audit
Horowhenua District Council	Horowhenua	Medium		Some gaps	Phone audit
Invercargill City Council	Invercargill	Medium		Most available	
Kaipara District Council	Kaipara	Small		Limited	Phone audit
Kapiti Coast District Council	Kapiti Coast	Medium		Most available	Audit
Mackenzie District Council	Mackenzie	Small		Some gaps	Phone audit
Manawatu District Council	Manawatu	Small		Major gaps	Audit
Marlborough District Council	Marlborough	Medium		Most available	Audit
Masterton District Council	Masterton	Small		Most available	Phone audit
Napier City Council	Napier	Medium		Some gaps	Audit
Nelson City Council	Nelson	Medium		Most available	Audit
New Plymouth District Council	New Plymouth	Medium		Most available	Phone audit
Palmerston North City Council	Palmerston North	Medium		Some gaps	Onsite audit
Queenstown Lakes District Council	Queenstown Lakes	Medium		Some gaps	
Rotorua District Council	Rotorua	Medium		Some gaps	Audit
Ruapehu District Council	Ruapehu	Small		Most available	Audit
Selwyn District Council	Selwyn	Medium		Some gaps	Phone audit
Southland District Council	Southland	Small		Major gaps	Phone audit
Stratford District Council	Stratford	Small		Most available	
Tararua District Council	Tararua	Small		Limited	Audit
Tasman District Council	Tasman	Medium		Most available	Phone audit
Taupo District Council	Taupo	Medium		Some gaps	Audit
Tauranga City Council	Tauranga	Large		Most available	Audit
Timaru District Council	Timaru	Medium		Most available	
Waimakariri District Council	Waimakariri	Medium		Most available	
Waipa District Council	Waipa	Medium		Some gaps	Phone audit
Waitaki District Council	Waitaki	Medium		Most available	Phone audit
Wellington Water	Wellington Water	Large		Most available	Audit
Western Bay of Plenty District Council	Western Bay of Plenty	Medium		Some gaps	Phone audit
Whakatane District Council	Whakatane	Medium		Most available	Audit
Whanganui District Council	Whanganui	Medium		Most available	Audit
Whangarei District Council	Whangarei	Medium		Most available	

Organisation with water, wastewater and stormwater service responsibilities not participating in the 2018/19 National Performance Review

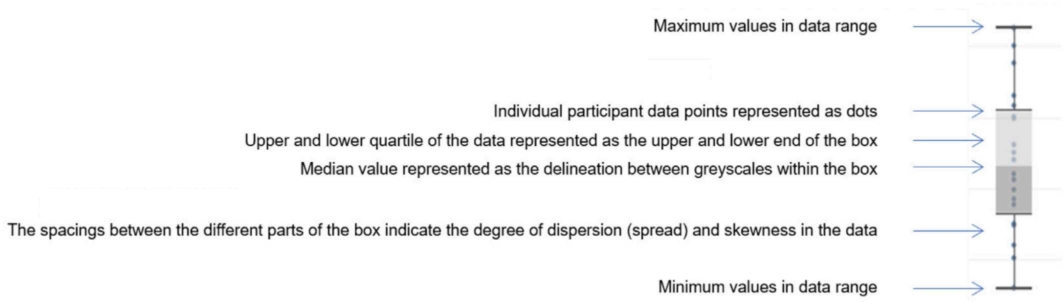
Council	Size categorisation
Buller District Council	Small
Carterton District Council	Small
Central Hawkes Bay District Council	Small
Gisborne District Council	Medium
Hurunui District Council	Medium
Kaikoura District Council	Small
Kawerau District Council	Small
Matamata-Piako District Council	Medium
Opotiki District Council	Small
Otorohanga District Council	Small
Rangitikei District Council	Small
South Taranaki District Council	Small
South Waikato District Council	Small
South Wairarapa District Council	Small
Thames - Coromandel District Council	Medium
Waikato District Council	Small
Waimate District Council	Small
Wairoa District Council	Small
Waitomo District Council	Small
Westland District Council	Small

Appendix II: Reporting exceptions

Entity	Reporting exception
Auckland Council	Provides stormwater services only.
Southland	Provides water services to seven urban water schemes, five combined water schemes with high stock water supply, and nine rural water schemes for stock water only. Only the seven urban water schemes (covering 84% of the population) have been included, in order to make for more meaningful performance comparisons with other councils: • Edendale Wyndham • Manapouri • Otautau • Riverton • Te Anau • Tuatapere • Winton In order to maintain consistency of reporting, wastewater and stormwater data is reported for the same schemes. The Council manages 19 sewer schemes and 23 stormwater schemes.
Watercare	Provides water and wastewater services only. Other deviations from the data definitions, consistent throughout Watercare data, are as follows: Water- and wastewater-serviced properties: this is the number of domestic accounts for connection to the Watercare network, which differs from the number of dwellings serviced. For example, an apartment building or terrace complex may have one body-corporate connection servicing many residential dwellings. Water- and wastewater-serviced non-residential properties: this is the number of non-domestic accounts for connection to the Watercare network. It differs from the number of properties and/or connections, the major differences being: • most office buildings may have only one connection to the network, but may have numerous tenants; • large businesses may have several accounts for the same property: and • one property may have many connections and accounts.

Appendix III: Box and whisker plots

Box and whisker plots have been included throughout the report. Box and whisker plots show the following information:



Appendix IV: Source water management

Participant	Source water zone identified	Source water zone management plans	Source water zone monitoring
Ashburton	Identified for some treatment plants	All water sources have been assigned Community Drinking Water Protection Zones by Environment Canterbury. These are for the most part generic and not based on any detailed understanding. One of our sources has recently had study done of hydrology of its shallow bore source. We have one surface water source. There are no source/catchment management plans for any supply at present.	Monthly E. coli samples are taken from all deep secure groundwater bores. All sources are sampled annually for basic determinands.
Christchurch	Identified for all treatment plants	Drinking-water protection zones are visible in the Canterbury Maps viewer.	• Urban water supplies (groundwater source): sample frequency dependent on population but at least twice per week, in some zones daily. • Rural water supplies (mainly surface water): source water sampled weekly for E. coli, Total Coliforms and Turbidity. Comprehensive chemistry suite done every 5-years (done in 2019).
Clutha	Identified for all treatment plants		Thrice weekly, taken at the same time as other sampling. Tested for pH, alkalinity, colour, and turbidity.
Dunedin	Identified for all treatment plants	Catchment management plans in place for all source waters	Quarterly - includes pH, alkalinity, hardness, conductivity, nutrients, herbicides and 1080.
Gore	Identified for some treatment plants	Cyanobacteria Monitoring, Raw Water Sampling	Monthly; Nitrate, Iron, pH, Alkalinity, Dissolved Organic Carbon, Total Dissolved Solids
Hamilton	Unknown	Management zone not specifically identified. Waikato River catchment upstream of intake. Waikato Regional Council manage the river.	Continuous monitoring (colour, DOC,TOC, turbidity); weekly E.coli/TC; monthly alkalinity and arsenic; quarterly, six-monthly and annual comprehensive chemical monitoring (e.g. metals, pesticides THMs, hydrocarbons etc etc); cyanobacteria (cell count and biovolume) and algae(cell count) monitored fortnightly in summer, monthly winter and in response to elevated levels or upstream notification of blooms as per Cyanobacteria monitoring plan - cyanotoxins monitored in event of a bloom.
Hastings	Identified for all treatment plants	Most sources have defined SPZs, remainder being implemented. HDC have submitted SPZs to be adopted during HBRC TANK plan change. Catchment risk assessments in progress. GIS risk tool being developed. Consent applications for activities in SPZs monitored and assessed where risk to water supplies.	Online monitoring - conductivity, UVT and turbidity at most sources – to be implemented for all. Daily/Weekly - Hastings urban supply sources monitored for E. coli, T.C, TDS, pH daily and small community supplies approx. weekly. Monthly – T.O.C Quarterly - chemistry suite including: Fluoride, Total Ammoniacal –N, NO2, DRP, Total P, Reactive silica, pH, Total Alkalinity, Free CO2, Total Hardness, Conductivity (uS/cm), TDS (approx.- calculated from EC), NO3, SO4, TOC, carbonate, Chloride, Bi-carbonate, Total metals: As, B, Ca, Cr, Cu ,Fe, Mg, Mn, K, Na, Zn, Bromate, Bromide Annually - age testing, pesticides suite (for selected sites). 5 yearly - Radiological sampling
Hauraki	Identified for all treatment plants		Annually
Invercargill	Unknown	source water is river fed; don't manage source zone or quality; controlled by regional council	Daily
Mackenzie	Identified for all treatment plants		Every two years
Manawatu	Identified for some treatment plants		Monthly in general. Weekly for new bores
Marlborough	Identified for all treatment plants		Varies depending on treatment plant and source.
Masterton	Identified for all treatment plants		Annually
Napier	Identified for all treatment plants	Preparing management plans underway	Secure source water. Monthly E. coli sampling. Turbidity, conductivity, pH and temperature every other day.
Nelson	Identified for all treatment plants		Daily

New Plymouth			Weekly
Queenstown Lakes	Identified for some treatment plants		Sampling once every two years for the full suite of determinands in the DWSNZ
Ruapehu	Identified for all treatment plants		Monthly
Selwyn	Identified for all treatment plants	Water safety plans identify the catchment management zones	Rolleston sampled daily.
Southland	Identified for all treatment plants		Weekly
Stratford	Identified for all treatment plants	TRC Monitors activities and notifies us with any new resource consents sought after in catchments	Annually
Tasman	Identified for some treatment plants	Basic catchments recorded in WSPs, but limited actions to prevent contamination in these areas	Fortnightly for E. coli and Total Coliforms for 6 plants
Taupo	Identified for some treatment plants		Monthly E. coli and Total Coliforms monthly for supplies with pop>500 Seasonal cyanobacteria bacteria for lake sources Annual water chemistry for all supplies