Watercare climate change summary 2023

We are a lifeline utility providing water and wastewater services to 1.7 million people in Auckland. Our services are vital for life, keep people safe and help communities to flourish. We supply reliable, high-quality drinking water to homes and businesses in the Auckland region and collect, treat and discharge their wastewater in environmentally responsible ways. We manage water and wastewater assets worth over $14 billion and plan and build infrastructure to ensure we support growth today and into the future. This year's Auckland Anniversary flood and Cyclone Gabrielle were stark reminders that we are feeling the impacts of climate change and must do our part to ensure a more resilient future.

Our commitment to climate action has continued as strong as ever throughout 2022/23 and our targets remain unchanged:

- Net zero emissions by 2050
- Reduce operational greenhouse gas emissions (GHG) by 50 per cent by the year 2030
- Reduce built carbon from infrastructure by 40 per cent by 2025.

These targets are ambitious but necessary and aligned with international science to reduce global warming. They will require significant focus to be achieved. This supplement highlights the impacts, opportunities and challenges of climate change for us and the services we provide to the communities of Tāmaki Makaurau.

Watercare

History and big changes

We have been improving and refining the way we measure and manage greenhouse gas emissions. This journey started with significant upgrades to the Māngere Wastewater Treatment Plant, replacing the open-air oxidation ponds and sludge lagoons with land-based treatment operations in the early 2000s. This enabled us to capture the methane from the solids stream of the wastewater and turn that into biogas, which is turned into electricity to help run the plant. This approach resulted in a decrease of greenhouse gas emissions by approximately 80 per cent from a 1990 baseline.

In recent times we have focused on the measurement process itself. We improved the reporting framework in 2013/14 to include additional scope 3 emissions and again in 2019/20 to update emission factors, adding in new areas of the organisation (e.g. our contract for services in the Waikato District Council) and improving data capture.

The most significant change occurred in 2021, when we updated the approach for reporting emissions associated with our wastewater treatment processes to align with the 2019 Refinement to the 2006 IPCC Guidelines on National Greenhouse Gas Inventories (2019 Refinement) which has a focus on methane and nitrous oxide, two potent greenhouse gases.

This guidance has also had additional refinement and adoption in New Zealand through the Carbon Accounting Guidelines for Wastewater Treatment: CH_4 and N_20 in 2021. We have adopted 'Level 2 plant specific assessments' which require plant influent and effluent load, as well as sludge removal information.

The impact of applying these methodology updates was major, resulting in an increase in our reported GHG footprint from 45,980 to 103,106 tCO_2e in the FY21 reporting year. This methodology has now been backdated to our 2018 baseline year and is used going forward in our reporting.

The next major change to our reported emission profile is associated with the disposal of biosolids at Puketutu Island in Auckland. Biosolids are the solid component of treated wastewater. We have recently completed research into the quantification of greenhouse gas emission from this single point source, the outcome of which is a further increase in reported emissions of approximately 23,800 tCO_2e (Scope 1) per annum.

Greenhouse gas monitoring and analysis equipment – floating hood and Picarro unit. Rosedale wastewater treatment plant.

Investment in direct GHG monitoring of wastewater

Looking ahead, we know that we will need to keep improving our understanding of greenhouse gas emissions. We have made great strides in wastewater reporting, but we know there is a further necessary step to take.

The WaterNZ guidance highlights Level 3 direct measurement as the highest quality data possible. This approach requires installing a selection of direct gas measurement devices at key points of wastewater treatment plants. These collect and analyse the gases that are produced. After running pilot tests in our Innovation Centre and applying a pilot to an active plant (Rosedale WWTP), we are extending measurement equipment across four sites. This will be completed by the end of 2025. In future GHG reporting we aim to include this direct measurement approach in combination with the calculations that already exist.

2022/23 Operational GHG footprint

This year has seen a seven per cent reduction in total operational emissions compared to FY22, mainly due to updates to emissions factors and improvements to reporting. The extreme weather events this year were a challenge for the business and led to increases in costs and emissions drivers (e.g. wastewater flows at treatment plants).

By their nature, GHG emissions are subject to uncertainty. We use recognised frameworks for calculating our GHG inventory*.

Scope	GHG Protocol Category	Emission source	t CO_2e	% of total emissions
Scope 1	Stationary combustion	Natural gas use	4,797	3.81%
		Biogas combustion	129	0.10%
	Mobile combustion	Fuel use in corporate vehicles	1,639	1.30%
		On-site fuel use	650	0.52%
	Process emissions	Wastewater treatment	52,834	41.97%
		Effluent discharge to water and land	4,577	3.64%
	Fugitive emissions	Refrigerants	39	0.03%
		Overflows from network	485	0.38%
		Fugitive emissions from network	1,730	1.37%
		Puketutu Island	22,668	18.01%
		Beachlands and Pukekohe on-site sludge storage	4,930	3.92%
	Sub-total Scope 1		94,478	75.05%
Scope	**GHG Protocol Category**	**Emission source**	**t CO_2e**	**% of total emissions**
Scope 2	Purchased electricity	Electricity use	12,807	10.17%
	Sub-total – Scope 1 and 2		107,285	
Scope 3	1. Purchased goods and services	Lime	7,262	5.77%
		Maintenance contracts petrol and diesel	1,505	1.20%
	3. Fuel and energy-related activities not included in scope 1 and 2	T&D loss electricity	1,485	1.18%
		T&D loss natural gas	188	0.15%
	5. Waste generated in operations, subsidiary and WWT	Waste to landfill	5.24	0.00%
		Sludge and screenings to landfill	4,991	3.96%
		Composting of biosolids	197	0.16%
		Sludge transport	110	0.09%
	6. Business travel	Air travel	45	0.04%
		Taxi	2	0.00%
		Private mileage	11	0.01%
		Accommodation	5	0.00%
	11. Use of sold products	Electricity - Waikato contract	357	0.28%
		Petrol and diesel - Waikato contract	195	0.15%
		WWT - Waikato contract	2247.02	1.78%
	Sub-total Scope 3		18,606	14.78%
	Total Emissions		**125,891**	

** Reasonable assurance provided by Toitu Envirocare (Toitu) August 2023 in respect of Watercare's Scope 1 and 2 emissions (including Puketutu). Toitu provided limited assurance on Scope 3 emissions. An operational control approach was used to set the reporting boundary based on areas of direct influence for the organisation.*

Table 1 Watercare scope 1,2 and 3 greenhouse gas emissions FY23

Overview of wastewater process emissions

Wastewater process emissions are the most significant emission source for Watercare and are driven by methane and nitrous oxide, powerful greenhouse gases. This table provides more detail on where these emissions occur whilst we treat wastewater to meet quality and environmental standards. Biogenic CO_2 is also reported here though does not form part of our targets due to it being part of the Earth's 'short' carbon cycle whereby atmospheric CO_2 is incorporated into living cells, consumed, respired or combusted to be released back into the atmosphere to start the cycle again.

Treatment system	t CO_2e (non-biogenic CO_2)	tCO_2 biogenic	tCH_4	tN_2O
Overflows from network	485	-	15	0
Fugitive emissions from network	1,730	-	64	-
Discharge to water and land (nitrous oxide + methane)	4,577	-	32	14
Nutrient removal from reactor clarifiers	45,042	-	250	166
Anaerobic digestion of sludge – Biogas loss from digester roof	5,411	116	197	-
Burning of biogas - CH_4 and N_2O	129	33,931	4	0
Emissions from biosolid and grit/screening deposition (third party landfill)	4,991	-	176	-
Facultative lagoons	1,621	-	61	-
Septic tank, oxidation ponds, other treatment	759	-	23	0
Beneficial reuse of biosolids (Puketutu)	22,668	-	840	0
Pond 1 Pukekohe and Beachlands drying beds and composting	4,930	342	165	-
Total emissions	92,344	34,389	1,828	180

Table 2 Watercare wastewater process emissions FY23

FY23 Operational emissions pie chart

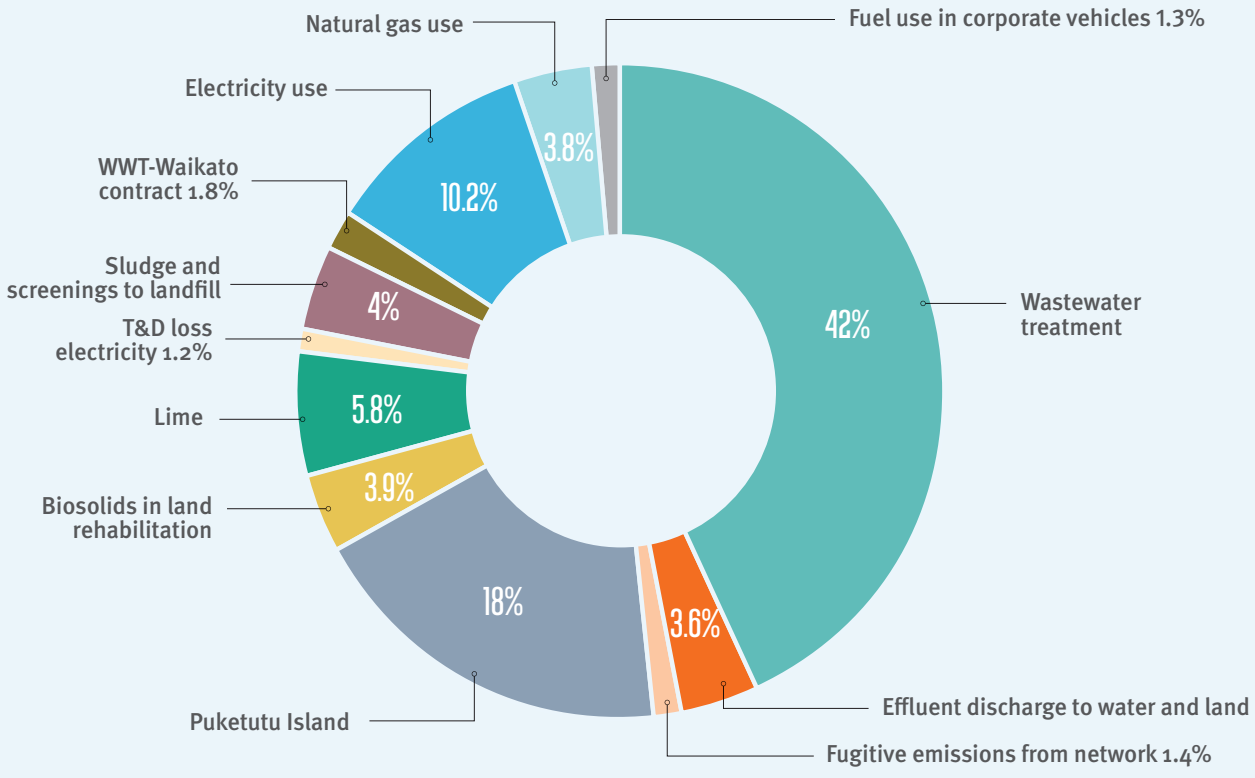

Figure 1 Watercare operational greenhouse gas emissions FY23 pie chart

We continue to improve our reporting approach and respond to changes in both the science and GHG reporting. For the FY23 figures, we have adopted the guidance from the IPCC AR6 report as well as emissions factors released by Ministry for Environment in July 2023, relating to the FY23 year.

These changes led to a decrease in emissions from electricity use because of abundant hydro generation impacting the New Zealand electricity market. Applying the latest emissions factors for the FY23 year and updating our 2015 network overflow modelling have been the key drivers in our emission reduction results this year. Without these changes, we would not have achieved reductions, demonstrating the impact of applying the latest emission factors and measurement approach in any given year.

This year, wastewater volumes increased due to extreme weather events. This led to an increase in the key parameters that drive wastewater process emissions and electricity consumption.

A change in energy production at the Māngere WWTP meant we spent less on electricity but used more natural gas, which influenced the emissions. We are reviewing the co-generation operating philosophy and the high inflows into the wastewater treatment plants to better understand the trade-offs between operating procedures, energy production, natural gas use, budget efficiency and meeting our long-term targets for GHG emissions.

The GHG intensity for delivering water and wastewater services in FY23 was:

- 0.71 $kgCO_2e$ per KL water produced
- 234 $kgCO_2e$ per connection

Trend/tracking since 2018

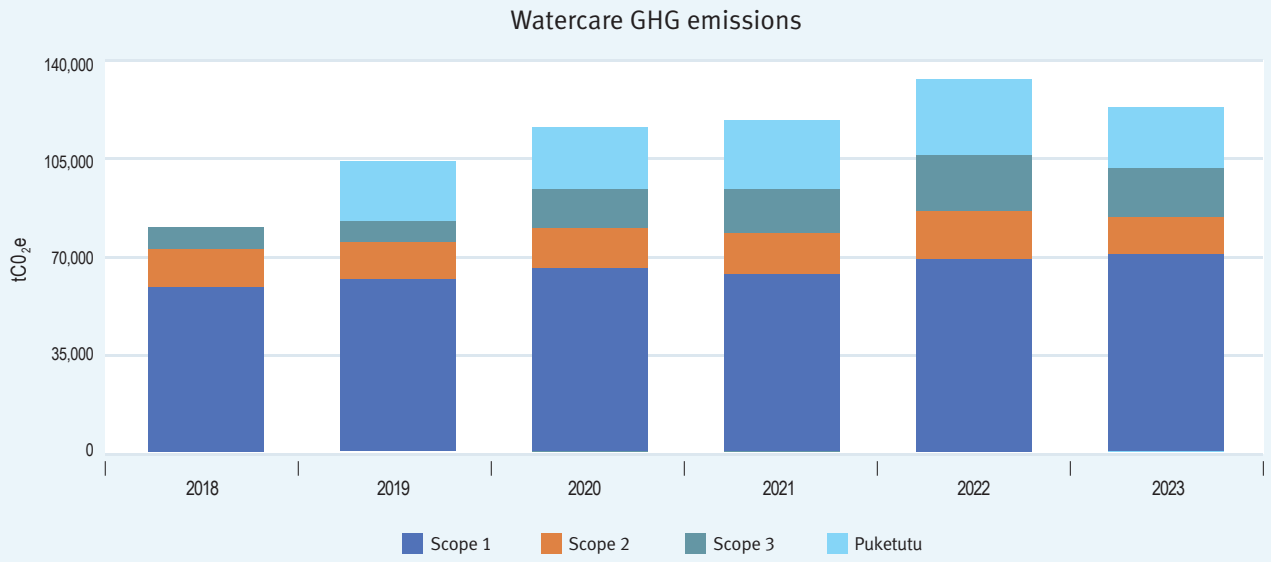

Figure 2 Operational greenhouse has tracking since FY18

Decarbonisation road map

To meet our target of 50 per cent reduction in operational emissions (scope 1 and 2) by 2030, a Decarbonisation Roadmap was established in June 2022. This comprises of a list of 39 projects, as well as enabling factors, and was developed through a combination of internal value streams and external support from consulting partners Beca. The roadmap will change as the feasibility of projects is further developed and new projects are identified. At present, the roadmap requires more projects, higher emissions reductions or a lower projection to meet the target and this is being actively worked on. The roadmap considered five potential reduction scenarios based on abatement potential, marginal abatement cost, resourcing, certainty and existing projects in planning or feasibility phase. Scenario 5 was selected to use as the Watercare roadmap as shown in Figure 3.

The roadmap acknowledges that emissions will grow without intervention. The primary drivers for this are population growth, leading to the delivery of more services, and more stringent environmental discharge requirements which lead to more intensive technology solutions that increase emissions.

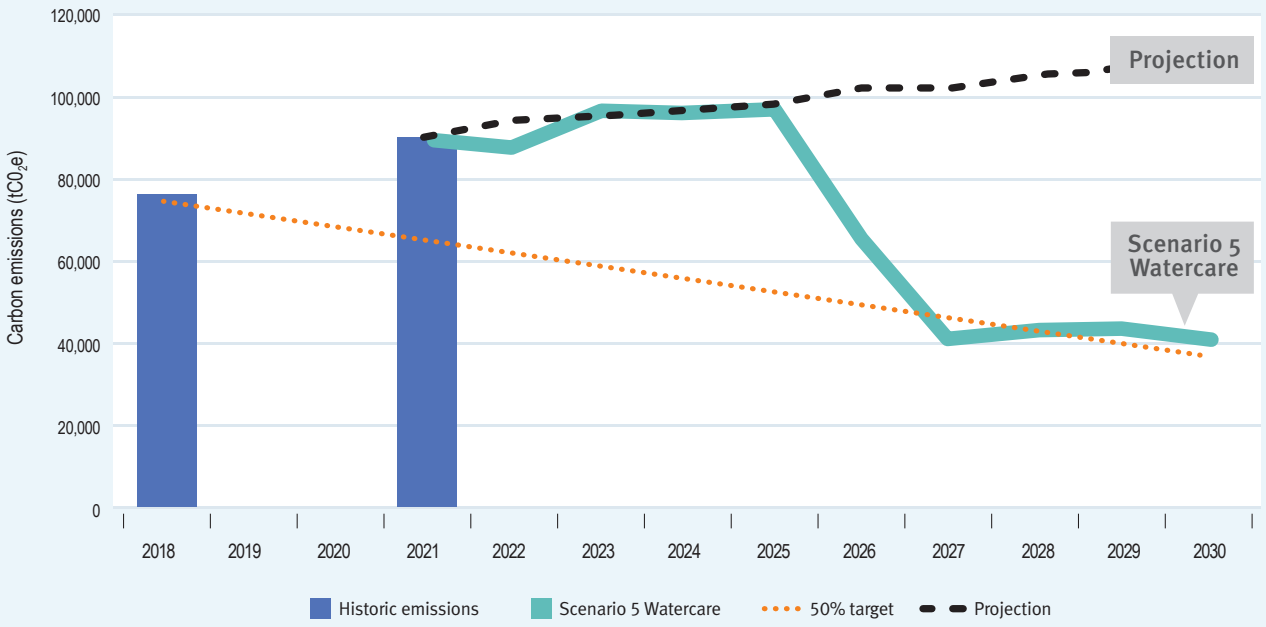

Figure 3 Decarbonisation roadmap projection and scenario

In FY23 there has been progress against four priority items:

- **Deliver wastewater emissions monitoring and optimisation strategy**

  trials and pilots for direct monitoring of nitrous oxide have provided us with the learnings to progress a business case for further capital expenditure to meet our objectives. This has been approved and will be rolled out over FY24 and FY25.

- **Feasibility into alternative uses for biogas at major wastewater treatment plants -**

  a study was commissioned with consulting firm Mott Macdonald to investigate whether there were ways to reduce emissions through using biogas beyond the current approach to generate electricity through combined heat and power engines.

- **Better understand the GHG impact of operations at Puketutu Island -**

  a study was commissioned with consulting firm Tonkin and Taylor to assess the methane emissions from our unique biosolids rehabilitation site. We updated our reporting from 2682 to 22,807 tCO_2e for FY20 based on this work and have back-cast previous reporting. We will continue to review and apply best practice reporting for this complex emission source.

- **Further develop our next solar array projects -**

  investigations and site preparation were completed and a business case prepared for our next solar array.

Our approach to action on infrastructure-related emissions

40:20:20 – Greater outcomes for infrastructure delivery

In 2020 we recognised an opportunity to achieve wider value from infrastructure delivery through a programme approach, as opposed to the traditional project-by-project approach. This led to the creation of a new vision termed “40:20:20 Build Better Infrastructure”. The vision outlines three complementary and equally important measures of value:

- 40 per cent reduction in carbon emissions from construction by 2025
- 20 per cent reduction in cost of construction by 2025
- 20 per cent year-on-year improvement in health, safety and wellbeing

Combining sustainability, cost and safety together in a vision provides an opportunity for innovation and collaboration. The scale of this investment, as well as industry influence, has the potential to create market shifts within the infrastructure industry and its supply chains. It also requires a step change in behaviour, not only in Watercare but within the supply chain.

The 40 per cent carbon target across an infrastructure programme has not been delivered in New Zealand’s water sector before. This target requires that by 2025, we have an on average a 40 per cent reduction in embodied emissions for all infrastructure projects from 2022 to 2032. It acknowledges that some projects will not meet the 40 per cent, especially those in the earlier years when we had less chance to influence carbon reduction opportunities in the planning and design phases.

The Enterprise Model was developed to enable the 40:20:20 vision and transform the delivery approach of construction projects. This wider system approach has been informed by the principles discussed in PAS 2080 Carbon Management in Infrastructure.

Watercare infrastructure carbon baseline

In line with the 40 per cent reduction in construction carbon, we have developed and implemented a capital carbon baseline and wider carbon management process alongside our delivery partners. In 2020, the carbon baseline estimated a capital carbon footprint of approximately 374,700 tCO_2e, and helped identify carbon hotspots, providing a focus on priority areas of carbon reduction across the programme.

The asset management programme has had a major update since 2018, requiring the realignment of the carbon baseline to the new programme, which will be completed by the end of 2023. We are also planning to implement a whole of life carbon lens to project delivery.

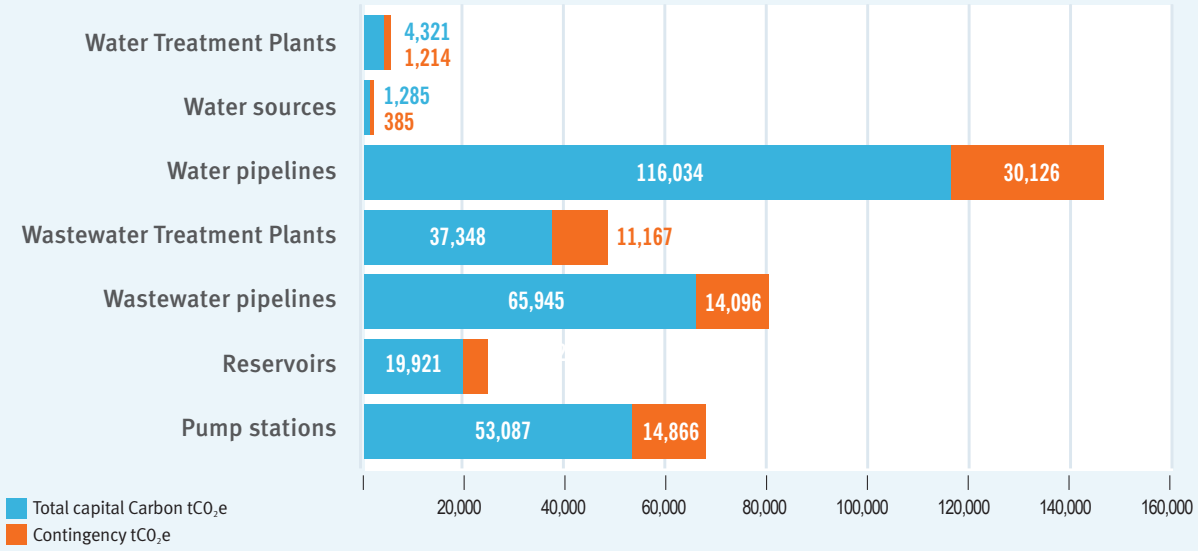

Figure 4: capital carbon baseline by project type for the enterprise model programme (2020)

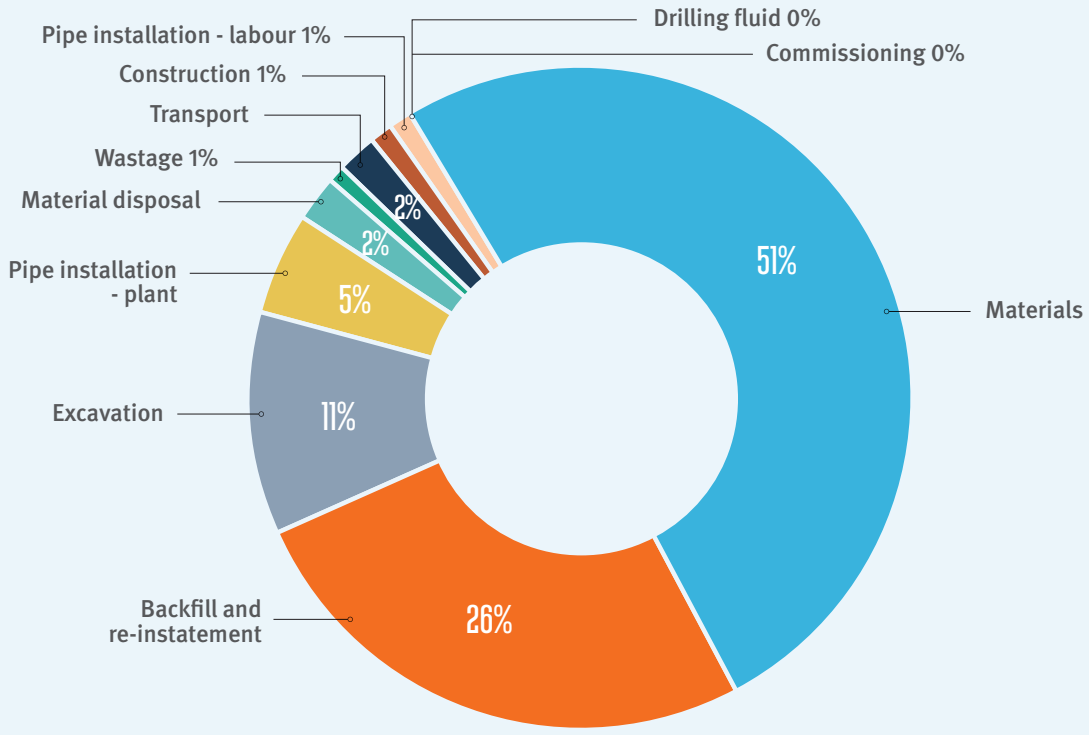

Figure 5: summary of capital carbon hotspots across enterprise model programme (2020)

Estimated 2022/23 infrastructure emissions

We have developed capital carbon intensity rates (tCO_2e/$) based on the data from the carbon baseline that was delivered in 2020. This has allowed us to apply these to the capital spend on infrastructure construction for FY23 to estimate the resulting carbon emissions.

We have equated the capital spend associated with asset construction to estimate a carbon footprint of 47,726 tCO_2e for FY23. This excludes the Central Interceptor, which will do its own reporting under the Infrastructure Sustainability rating.

	YTD cost $ (million)	tCO_2e
Wastewater networks	73.3	10,364
Water supply network	69.7	18.253
Pump station	17.8	1,814
Reservoirs	39.4	8854
Reservoir upgrade	0.8	0.1
Treatment plant - major upgrade	112.4	8,352
Treatment plant - minor upgrade	2.9	87
Total	316.2	47,726

Table 3: Carbon footprint estimated based on capital spend for project types

Notes to the table

- *This information has not been audited but follows the approach that has been described in the Capital Carbon Emissions guidance by Toitu.*
- *Dollar figures extracted from FY23 year end project financials report covering infrastructure and drought projects*
- *Exclusions include capital expenditure from digital, Kainga Ora, customer, operations, flood recovery and 'other'.*

Infrastructure project emission reductions

We have been using the PAS2080 hierarchy to consider carbon savings across various stages of project delivery. Examples of projects that have achieved significant carbon savings in FY23 are:

- Waikato Water Treatment Plant sludge treatment saved over 500 tCO_2e, through operational optimisation and avoiding the need to build additional sludge treatment.
- Takapuna pipeline relining and rehabilitation instead of replacement project saved 780 tCO_2e and significant community disruption.

Profile used to rehabilitate pipeline

- Māngere peak flow project reassessed and replaced with other existing projects on site to achieve the outcome, saving 1600 tCO_2e.
- Redoubt Rd reservoir utilising fly ash to replace approx. 25 per cent of cement and saving 200 tCO_2e.

Redoubt Road Reservoir roof pour

Climate change risk assessment

Climate change is one of the largest challenges we face as a business. We have identified our areas of vulnerability to climate change through preparing the Watercare Climate Change Strategy 2020 and are evolving that approach through 2022-2024.

We have completed a high-level risk identification which highlighted 89 risks across physical and transition scenarios. This will be refined further through a detailed risk assessment and quantification that will meet the Aotearoa New Zealand Climate Standards released by the External Reporting Board. A selection of identified risks are shared below and a more detailed response to these standards is included in the Auckland Council Volume 4 Climate Change Risk Report.

More immediately, as part of our long-term flood recovery plan, a flood response adaptation framework has been developed. This will ensure that we review and improve our resilience to extreme weather events through the recovery projects. The framework assesses the level of response that is both possible and necessary – ranging from relocating equipment and control panels above the flood line, to longer-term planning assessments on the location and need of certain assets.

Wairau Pump Station, Auckland Anniversary floods 2023

Northwest water networks impacted in Auckland Anniversary floods 2023

A snapshot of the climate change risk identification step is displayed in table 4. These have not been rated and are not in order of significance or impact.

	Hazard / Driver	Risk Element/ Domain	Risk statement	Physical or Transition
1	Changes in the variability of rainfall	Wastewater network	Risk to wastewater network due to changes in the variability of rainfall	Physical
2	Climate change (multiple)	Costs and revenue	Risk to the cost of service delivery due to climate-related disruption (increasing maintenance, capital expenditure to adapt, increasing operational costs, changing consumer profiles and complex customer interdependencies)	Physical
3	Drought	Source water availability	Risk to source water availability due to drought	Physical
4	Drought	Water supply conveyance	Risk to water supply conveyance due to drought	Physical
5	Extreme weather (wind and storm events)	Service delivery	Risk to service delivery due to extreme weather (wind and storm events)	Physical
6	Extreme weather (wind and storm events)	Water supply dams	Risk to water supply dams due to extreme weather (wind and storm events)	Physical
7	From 2035 greenfield development is curtailed	Economy	Risk to Watercare of stranded assets due to constraints on greenfield development.	Transition - Kahurangi
8	Groundwater rise and salinity stress	Source water quality	Risk to source water quality due to groundwater rise and salinity stress	Physical
9	Increased coastal inundation (sea level rise)	Assets	Risk to assets due to increased coastal inundation (sea level rise	Physical
10	Increased extreme rainfall and flooding	Staff health and safety	Risk to staff health and safety due to increased extreme rainfall and flooding	Physical
11	Increased landslide events	Source water quality	Risk to source water quality due to increased landslide events	Physical
12	Increased landslide events	Treatment plant operation	Risk to treatment plant operation due to increased landslide events	Physical
13	Increased temperature	Wastewater network	Risk to wastewater network due to increased temperature	Physical
14	Intensification Streamlined Planning Process is enacted.	Economy	Risk that response will require unplanned financial resourcing	Transition - Kakariki
15	The EU price on carbon in 2030 is approximately NZD $230. This results in exposure of NZ exports to EU and increased of EU goods coming into NZ	Economy	Risk that water treatment may become excessively expensive	Transition - Kakariki

Table 4: Climate change risk identification steps