Asset Management Plan Summary

Wastewater

Asset management plans

Together, our 14 asset management plans present a detailed description of all the things – roads, cycleways, footpaths, pipes, buildings, vehicles, parks and so on – that the Christchurch City Council owns, across all areas of work, and how these 'assets' are planned, managed, operated and funded.

All our assets, collectively worth $16.8 billion, belong to ratepayers and are managed and operated on their behalf. Ensuring our assets are appropriate for the city's needs enables us to deliver the services that make Christchurch and Banks Peninsula a great place to live, work and visit.

Asset management plans are technical documents. The summary documents give an overview of how we manage our assets through their lifecycles to ensure we deliver services in cost-effective ways.

For the first time, we have published these documents online as part of our commitment to transparency.

What we do

We are responsible for wastewater collection, treatment and disposal.

We collect wastewater from around 160,000 homes, businesses and industries, and maintain 945 kilometres of laterals, 2,000 kilometres of wastewater mains, 150 pump stations, 84 lift stations and 34 odour control sites.

Why we do it

Wastewater collection, treatment and disposal is an essential service that protects public health and the environment.

Christchurch City Council

Our assets

We own, plan and manage the city's wastewater network. We manage $5.1 billion of assets on behalf of the community (replacement value at 30 June 2020).

Asset class	Replacement value
Pipes	$4,215,414,020
Non-pipe assets	$275,352,157
Pump stations	$119,903,444
Odour control assets	$9,254, 349
Lift stations	$9,823,454
Vacuum stations	$12,345,242
Treatment plants	$465,879,378
Total	**$5,107,972,044**

Where we've come from

The Christchurch wastewater system has evolved from various community reticulations schemes, some dating back to 1875. The Bromley site was established as a sewage farm in 1882 and developed upstream treatment works in 1962. The wastewater network was further standardised in 1989, when five local bodies were merged into the new Christchurch City Council, with Banks Peninsula District Council also merging in 2006.

Our network and services were disrupted by the Canterbury earthquakes of 2010 and 2011. Significant assessment and rebuild work followed, under the Stronger Christchurch Infrastructure Recovery Team (SCIRT) alliance. This programme did not address all earthquake damage and many pipes with varying levels of defects remain.

New pipework has been installed to enable wastewater schemes at Governors Bay and Diamond Harbour to be pumped to Bromley and to allow Lyttelton's treatment plant to be decommissioned, ceasing the discharge of wastewater to the harbour.

Wastewater systems in Akaroa and Duvauchelle are due for replacement.

Our issues and risks

In this asset management plan we provide a snapshot of the greatest risks recorded for wastewater and summarise the main mitigations.

Our network is vulnerable to a wide range of risks, from issues such as climate change through to inherent operational risks, such as not complying with a resource consent. These are all outlined in the asset management plan, along with the mitigations we've planned.

What it costs

Our proposed budget for the activity that uses these assets in Year 1 of the LTP is $167.95 million (total activity net cost of service plus capital spend for 21/22), with the net operational expenditure projected at $111.02 million (net cost of service) and capital expenditure at $56.9 million (total capital spend). Tables for each area of spending are included in our activity plan.

**The proposed operational and capital programme is indicative only. It will be updated through the LTP 2021-31 capital prioritisation process.*

How we're funded

Council's Revenue and Financing Policy sets out how we are funded, based on who benefits. This policy was reviewed during the development of the Long Term Plan 2021-31.

- Operational expenditure is funded by rates (general, separate and differential) and through fees and charges.
- Capital expenditure is funded by borrowing and repaying over several years.
- Private developer vesting – wastewater assets created during subdivision development are vested with the Council.

How it's delivered

We work within the Council's Three Waters and Waste Unit across several teams, with other Council units and with external contractors.

Staff deliver

- Wastewater network operations, asset planning and management, project management
- Reactive renewals and major maintenance
- SCADA equipment maintenance
- The Christchurch Wastewater Treatment Plant operations at Bromley and laboratory services

Contractors deliver

- General operations, maintenance and construction
- Small treatment plant operations

Key delivery partners

- Technical Services Unit (Council)
- Transport Unit (Council)
- City Care Ltd
- Consultants Panel
- Land developers
- Selwyn District Council
- Environment Canterbury
- Ministry of Health/Government Regulator

Our functions and services

We apply engineering, financial and management practices to achieve the agreed level of service, for the most cost-effective expenditure. This means optimising investment and outcomes within the constraints of finance, service levels and resources.

Managing our assets involves spending considerable amounts of public money, so it's vital that staff ensure they are doing the right thing, at the right time and for the right price.

While managing our assets to meet agreed levels of service, financial prudence demands that we optimise asset lifecycle costs, so our management planning also aligns to the stages of an asset's lifecycle. Our renewals programme considers the condition of assets, not just their age.

The maturity assessment for our assets shows we are performing at an intermediate or advanced level in most areas. The average score rose from 82 percent to 85 percent in the past two years, with the target being 93 percent. More detailed information about this is included in our asset management plan.

Asset maturity assessment

The 2020 maturity assessment for our assets shows we are performing at an intermediate or advanced level.

That assessment showed we had made the greatest improvements in improvement planning and condition assessment.

No progress was made in asset register data, decision making, operational planning and reporting, financial strategies, information systems, service delivery models, quality management, or demand forecasting.

Improvements over the next three years will focus on the following areas:

- Asset inventory, condition assessment and failure data
- Financial tracking, forecasting and relationships
- Demand management
- Integrated master planning
- Climate change response
- Level of service and customer engagement

Our next maturity assessment is scheduled in the 2020-21 financial year.

Wastewater Asset Management Plan

February 2021

Christchurch City Council

Version Control and Approvals

Version	Date
Draft for internal review	21 May 2020
Revised draft following Council confirmation of draft budget	Under development

Version 1.0 – Draft for internal review

Role	Name	Title	Signature	Date
Author	James Thorne Michael Galambos Mayank Katira	Asset Engineer Asset Engineer Asset Engineer		
Reviewer	Mark Johnson	Team Leader – Asset Management		
Approver	Helen Beaumont	Head of 3 Waters & Waste		

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1 Summary of the Activity

1.1 Activity Description

1.1.1 What do we do?

This activity provides wastewater collection, treatment and disposal for the people of Christchurch in a way that protects public health and the environment. The Council collects wastewater from approximately 160,000 customers in Christchurch, Lyttelton, Diamond Harbour, Governors Bay, Akaroa, Duvauchelle, Tikao Bay and Wainui, through 1000 km of laterals, 1,900 km of wastewater mains, 150 pump stations, 84 lift stations, and 34 odour control sites.

1.1.2 Why do we do it?

Collection, treatment and disposal of wastwater is an essential service to the people of Christchurch.

The wastewater activity also supports the community outcomes below.

- Safe and healthy communities
- Healthy waterways
- Sustainable use of resources
- Modern and robust city infrastructure and facilities network

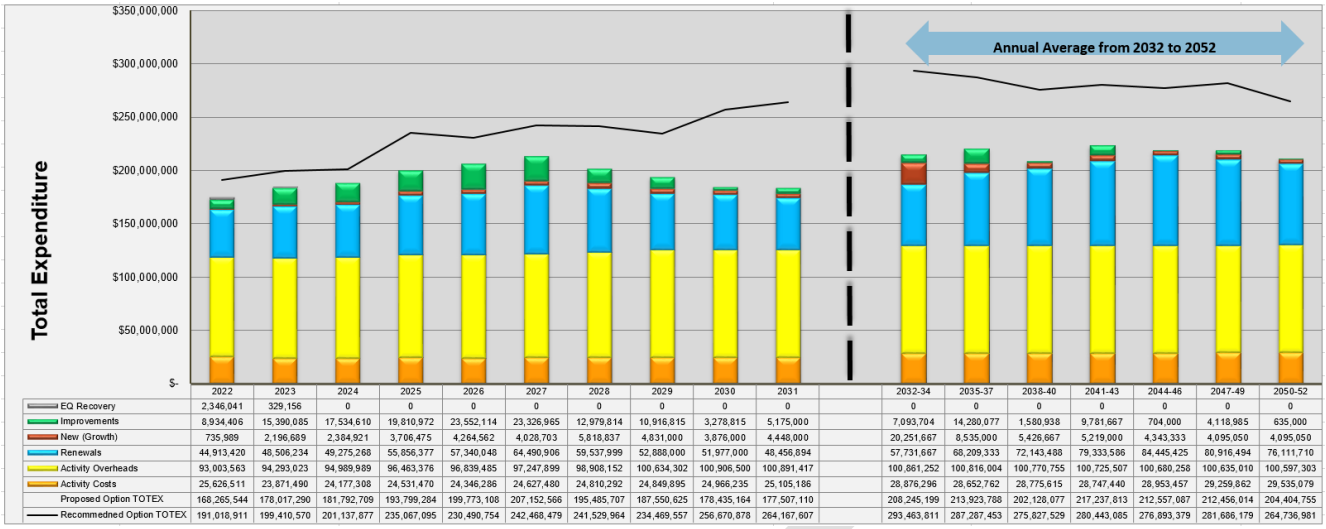
The detail of how the wastewater activity contributes to Council's community outcomes and the manner that the activity responds to Council's strategic priorities is provided in Section 2.

1.1.3 How much does it cost?

Projected cost of providing the necessary core services covered by this asset management plan (AMP) at the current levels of service is **2,296 million. Error! Reference source not found.** shows a breakdown of these costs into operations, maintenance, renewal, upgrade and earthquake recovery over the 10 years of the Long Term Plan (LTP) from Financial Year 21/22 to Financial Year 2031/32 (FY22 – FY32). **Error! Reference source not found.** shows historic expenditure of **$1,858 million** (see Figure 1-2**Error! Reference source not found.**). for the 10 year period FY2011 to FY2020. The significant projected increase is primarily due to a large proportion of the pipe network reaching end of life creating a backlog of deferred renewals.

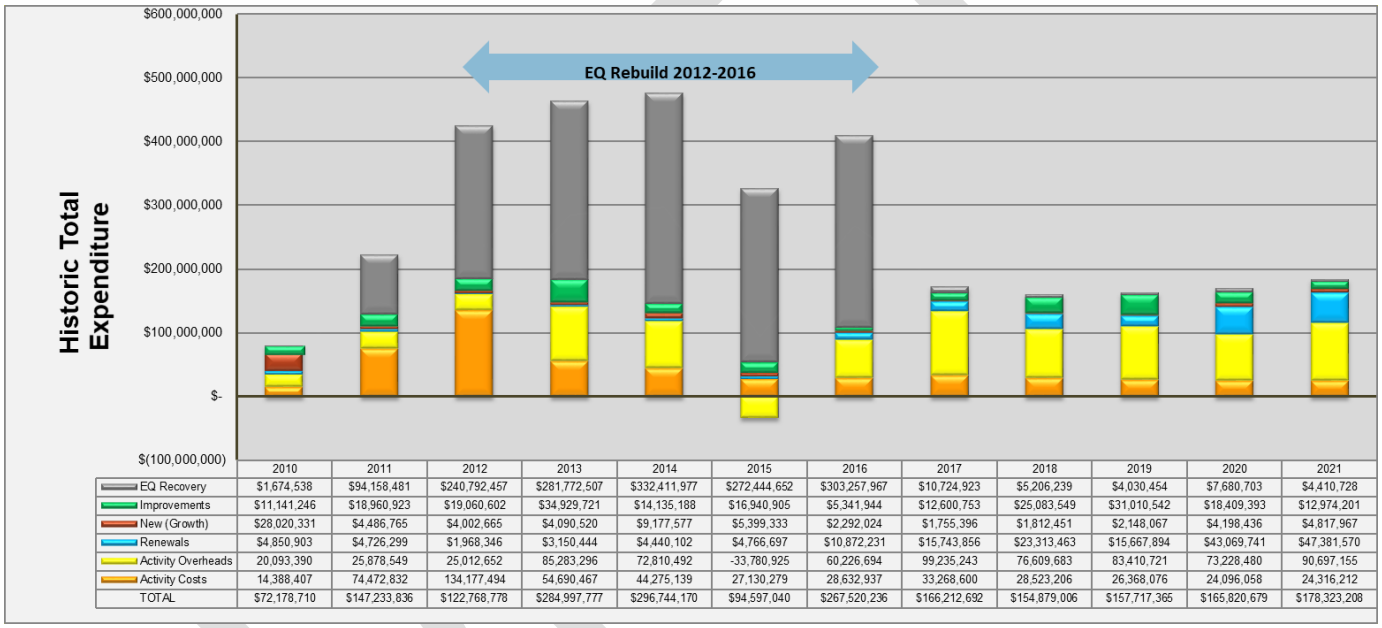
The funding allocated to providing the necessary core services covered by this AMP over the 10 years of the LTP is **$1842 million**. This is 80% of the cost (as outlined above) to provide optimised asset management at the lowest lifecycle cost.

Allocated funding leaves an annual average shortfall of **$454 million** over the 10 years of the LTP. Levels of service will decrease due to this shortfall.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
EQ Recovery	2,346,041	329,156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Improvements	8,934,406	15,390,085	17,534,610	19,810,972	23,552,114	23,326,965	12,979,814	10,916,815	3,278,815	5,175,000	7,093,704	14,280,077	1,580,938	9,781,667	704,000	4,118,985	635,000
New (Growth)	735,989	2,196,689	2,384,921	3,706,475	4,264,562	4,028,703	5,818,837	4,831,000	3,876,000	4,448,000	20,251,667	8,535,000	5,426,667	5,219,000	4,343,333	4,095,050	4,095,050
Renewals	44,913,420	48,506,234	49,275,268	55,856,377	57,340,048	64,490,906	59,537,999	52,888,000	51,977,000	48,456,894	57,731,667	68,209,333	72,143,488	79,333,586	84,445,425	80,916,494	76,111,710
Activity Overheads	93,003,563	94,293,023	94,989,989	96,463,376	96,839,485	97,247,899	98,908,152	100,634,302	100,906,500	100,891,417	100,861,252	100,816,004	100,770,755	100,725,507	100,680,258	100,635,010	100,597,303
Activity Costs	25,626,511	23,871,490	24,177,308	24,531,470	24,346,286	24,627,480	24,810,292	24,849,895	24,966,235	25,105,186	28,876,296	28,652,762	28,775,615	28,747,440	28,953,457	29,259,862	29,535,079
Proposed Option TOTEX	168,265,544	178,017,290	181,792,709	193,799,284	199,773,108	207,152,566	195,485,707	187,550,625	178,435,164	177,507,110	208,245,199	213,923,788	202,128,077	217,237,813	212,557,087	212,456,014	204,404,755
Recommedned Option TOTEX	191,018,911	199,410,570	201,137,877	235,067,095	230,490,754	242,468,479	241,529,964	234,469,557	256,670,878	264,167,607	293,463,811	287,287,453	275,827,529	280,443,085	276,893,379	281,686,179	264,736,981

Figure 1-1: Proposed Total Expenditure in the Long Term Plan FY22 - FY52



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
EQ Recovery	$1,674,538	$94,158,481	$240,792,457	$281,772,507	$332,411,977	$272,444,652	$303,257,967	$10,724,923	$5,206,239	$4,030,454	$7,680,703	$4,410,728
Improvements	$11,141,246	$18,960,923	$19,060,602	$34,929,721	$14,135,188	$16,940,905	$5,341,944	$12,600,753	$25,083,549	$31,010,542	$18,409,393	$12,974,201
New (Growth)	$28,020,331	$4,486,765	$4,002,665	$4,090,520	$9,177,577	$5,399,333	$2,292,024	$1,755,396	$1,812,451	$2,148,067	$4,198,436	$4,817,967
Renewals	$4,850,903	$4,726,299	$1,968,346	$3,150,444	$4,440,102	$4,766,697	$10,872,231	$15,743,856	$23,313,463	$15,667,894	$43,069,741	$47,381,570
Activity Overheads	20,093,390	25,878,549	25,012,652	85,283,296	72,810,492	-33,780,925	60,226,694	99,235,243	76,609,683	83,410,721	73,228,480	90,697,155
Activity Costs	14,388,407	74,472,832	134,177,494	54,690,467	44,275,139	27,130,279	28,632,937	33,268,600	28,523,206	26,368,076	24,096,058	24,316,212
TOTAL	$72,178,710	$147,233,836	$122,768,778	$284,997,777	$296,744,170	$94,597,040	$267,520,236	$166,212,692	$154,879,006	$157,717,365	$165,820,679	$178,323,208

Figure 1-2: Historic Total Expenditure for Wastewater FY10-FY21

Impacts of Covid-19 – short and longer term

Early forecasting advice from economic commentators (e.g. the Treasury, ChristchurchNZ, financial institutions) signals significant economic impacts locally, nationally and internationally. This advice is being updated regularly and is likely to change over time (the Treasury's economic scenarios released on April 2020 caution that economic impacts are "highly uncertain").

What might this mean for the wastewater activity?

- An initial focus on infrastructure that supports Covid-19 economic recovery and delivers projects critical to the capital programme or identified as part of a central government stimulus package, and completing committed projects.
- Short-term (now, and LTP years 1-3): possible delays in scheduled capital programme works, potential issues with workforce availability/contractor viability following lifting of restrictions; uncertainty about materials supplies; changing priorities for work programming and methodologies (e.g. accommodating the norm of

physical distancing). Opportunities for bringing forward 'shovel ready' work and increased financial pressure on Council budgets.
- Medium term (LTP years 4-6): Further consideration of capital works programme in light of the emerging Financial Strategy and Infrastructure Strategy response.
- Longer term (LTP years 6 – onwards): Uncertain at this stage; potentially dealing with the effect of any deferred expenditure due to the above factors.

1.1.4 How is it funded?

Council's Revenue and Financing Policy sets out how the expenditure needs for Council activities will be funded. The policy is based on who benefits.

Council reviewed its revenue and financing policy as part of the development of the LTP. In brief –

1. OPEX – is funded by rates generated by the collection of general, separate and differential rates and through Councils fees and charges.
2. CAPEX – is funded by borrowing and repaying over several years, enabling Council to match best the charges placed on the community against the period of benefits from capital expenditure.
3. Private Developer Vesting – as part of the subdivision process wastewater assets are created by the developer and vested with Council on completion of a subdivision.

1.1.5 How is it delivered?

The wastewater activity is primarily the responsibility of Council's internal Three Waters and Waste Unit. Section 6.2 provides the structure of the three waters and waste unit.

Council's Three Waters and Waste Network Operations Team operates the Christchurch wastewater network. The maintenance activities are carried out by Council's Three Waters and Waste Operations team City Care Limited under contract CN4600000778. City Care Limited is a Council Controlled Organisation (CCO). The Banks Peninsula WWTPs are also operated and maintained under this contract. Council's Water and Wastewater Operations Team provides supervision of and liaison with the external contractor. Reactive renewals, major maintenance, the SCADA system and LTP improvements are managed internally by Council staff.

The Christchurch Bromley WWTP and laboratory services are operated by Council staff.

External contractors and service delivery partners provide support in all phases of the service delivery and asset lifecycle.

1.1.6 What are the functions and services provided?

The key services that customers want delivered are:

- Council operates wastewater services in a reliable manner;
- Council operates wastewater services in a responsive manner;
- Public health is protected from Council wastewater services;
- Council has high wastewater discharge quality;
- Council wastewater networks and operations are sustainable

These key services form the basis of wastewater collection, treatment and disposal for the community through the sub-functions of:

- Wastewater flow monitoring and control
- Inflow and infiltration control
- Wastewater overflow management
- Wastewater Treatment
- Treatment by-product management
- Laboratory Services

1.1.7 Overview of assets

Christchurch's wastewaster system includes five treatment plants, one in Christchurch city and others on Banks Peninsula. Pipes and pump stations convey wastewater (sewage) from homes and businesses to the treatment plant. Total replacement cost of wastewater assets based on 2020 Valuations is $5.1 billion. Section 7.1 provides further information of Wastewater assets.

1.2 Where have we come from and where are we heading

1.2.1 Background

Christchurch's wastewater system has evolved from the various community reticulation schemes dating back to 1875. The Bromley site began as a sewage farm in 1882 and later developed an upstream treatment works in 1962. Standardisation of wasetwater reticulation and pumping increased from 1989 when five local bodies merged into the new Christchurch City Council. Stand-alone Banks Penninusla wastewater systems came into Council stewardship in 2006 following further amalgamation.

The 2010/2011 Canterbury earthquakes disrupted the wastewater collection, treatment and disposal service. A signficant programme of assessment and rebuilding followed, carried out by the Stronger Christchurch Infrastructure Recovery Team (SCIRT) alliance. 560 km of wastewater pipe was renewed, lined or repaired, 56 lift stations were installed, some existing networks were replaced by local pressure sewer systems and vacuum sewer systems. The SCIRT programme did not remediate all earthquake damage and many pipes with different levels of defects remain for Council to manage. The SCIRT Legacy Report[1] acknowledged that "*it will take many years and significant ongoing funding to address the remaining issues across the network*".

New pipework has been installed to enable the existing wastewater schemes of Governors Bay and Diamond Harbour to be pumped to the Christchurch WWTP, and allow the existing Lyttleton Harbour Basin treatment plant to be decommissioned.

New treatment and discharge options are being pursued in Akaroa and Duvauchelle to allow the current harbour discharges to end.

1.2.2 Looking Forward

Long Term Strategic Direction

The longer term strategic direction for wastewater is supported by Council's Te Wai o Tane Integrated Water Strategy. This is a strategy document that provides Council's vision, goals, objectives and suggested implementation actions for the city's water, wastewater and stormwater services. Wastewater asset management strategies are expected to align with the Integrated Water Strategy objectives.

The strategy states:

"Water supply, wastewater, stormwater, surface water and groundwater form a fundamental part of the life of the community. Christchurch City Council has a responsibility to ensure that its water services, infrastructure and water taonga are managed in a manner that supports the environment, social, cultural and economic wellbeing of current and future generations"

The strategy sets out 4 goals including; the value of water use by the community, the importance of water quality and ecosystem protection and enhancement, an understanding of the effects of climate change and assisting with community adaptation and the sustainable management of water in line with the principle of kaitiakitanga.

[1] SCIRT Legacy Report, CCC, October 2017 – TRIM://17/841599

Short-Term Tactical Direction

Network deterioration with a large proportion of pipes reaching end of life (see section **Error! Reference source not found.**) will hinder wastewater service delivery in the short to medium term. We anticipate the increase in pipes reaching end of life to cause an increase in infiltration and inflows and the number of pipe breaks meaning there will be more frequent wastewater interruptions. As these interruptions will occur on the poor condition pipes, it is likely groups of the same customers will suffer multiple interruptions and satisfaction with the wastewater will decrease. Pipe renewals will prioritise the pipes with highest consequences of failure so even though failure rates increase effects on the city as a whole are minimised.

Level of service changes reflect the short to medium term reduction in service quality.

Number	Level of Service	Performance Measure	Previous Targets	New Targets
11.0.1.7	Council operates wastewater services in a reliable manner	Number of wastewater system blockage complaints per 1,000 properties connected to the wastewater network per year	Year 1: ≤ 10 Year 2: ≤ 10 Year 3: ≤ 10 Year 10: ≤ 8	Year 1: ≤ 6 Year 2: ≤ 6 Year 3: ≤ 6 Year 10: ≤ 7
11.0.1.15	Council operates wastewater services in a reliable manner	Annual number of properties affected by wastewater blowbacks due to maintenance work carried out by the Council or its contractors	Year 1: < 24 Year 2: < 23 Year 3: < 21 Year 10: < 12	Year 1: ≤ 35 Year 2: ≤ 35 Year 3: ≤ 35 Year 10: ≤ 35
11.0.1.16	Council operates wastewater services in a reliable manner	Proportion of residents satisfied with the reliability and responsiveness of wastewater services (from Resident Surveys)	Year 1: ≥ 79% Year 2: ≥ 79% Year 3: ≥ 80% Year 10: ≥ 85%	Year 1: ≥ 67% Year 2: ≥ 65% Year 3: ≥ 65% Year 10: ≥ 60%

Table 1-1 lists the specific performance measures affected by the budget constraints.

Number	Level of Service	Performance Measure	Previous Targets	New Targets
11.0.1.7	Council operates wastewater services in a reliable manner	Number of wastewater system blockage complaints per 1,000 properties connected to the wastewater network per year	Year 1: ≤ 10 Year 2: ≤ 10 Year 3: ≤ 10 Year 10: ≤ 8	Year 1: ≤ 6 Year 2: ≤ 6 Year 3: ≤ 6 Year 10: ≤ 7
11.0.1.15	Council operates wastewater services in a reliable manner	Annual number of properties affected by wastewater blowbacks due to maintenance work carried out by the Council or its contractors	Year 1: < 24 Year 2: < 23 Year 3: < 21 Year 10: < 12	Year 1: ≤ 35 Year 2: ≤ 35 Year 3: ≤ 35 Year 10: ≤ 35
11.0.1.16	Council operates wastewater services in a reliable manner	Proportion of residents satisfied with the reliability and responsiveness of wastewater services (from Resident Surveys)	Year 1: ≥ 79% Year 2: ≥ 79% Year 3: ≥ 80% Year 10: ≥ 85%	Year 1: ≥ 67% Year 2: ≥ 65% Year 3: ≥ 65% Year 10: ≥ 60%

Table 1-1: Level of Service Changes

The quantity of pipes requiring renewal is greater than the market has capacity to construct, even should budget be available. As such, reductions in service quality are unavoidable and changing budgets will only change if or when we return to current service levels.

Vertical infrastructure in pump stations and treatment plants is also under stress with insufficient budgets to replace backlogs of obsolete, dangerous or past end-of-life assets along with additional requirements to meet waste water collection and treatment standards.

A number of pump station assets are either operating well beyond their theoretical effective lives or are obsolete and cannot be repaired or replaced should they fail. Budgetary constraints mean we cannot replace these assets and we are planning to keep pushing their lives further. These tactics increase the risk of station failure potentially causing health concerns, environmental impact and odour issues.

The majority of old technology motors and unsafe electrical equipment have been or are undergoing replacement under the 2021 LTP. However, a number of Electrical and control assets are well beyond their predicted asset life which carries risk to the provision of wastewater services. Furthermore a number of long life assets such as Wet-wells and pipework located at treatment plants and pumping stations require detailed inspections to better inform future budget requirements.

Constraints and Uncertainty

The current context surrounding the wastewater activity will continue to influence the current and future outlook. This includes new water regulation and environmental standards, water industry service delivery reform, renewal of ageing infrastructure, responses to climate change, addressing risk and resilience, moving to data rich smart technology solutions, engaging with customer expectations, managing financial constraints and the uncertainty surrounding the long term impacts of Covid-19. The strategic issues and risk are discussed in further detail in Section 1.3.

1.3 Successes, Issues, Opportunities and Risks

1.3.1 Success Factors

Success within the wastewater activity can be measured through the levels of service and customer satisfaction surevys[2]. Key focus areas are; customer satisfaction, eliminating blowbacks, management and inspection of poor condition pipes, climate change mitigation at treatment plants and financial efficiency.

The following figure is an excerpt from the customer satisfaction Survey Report:

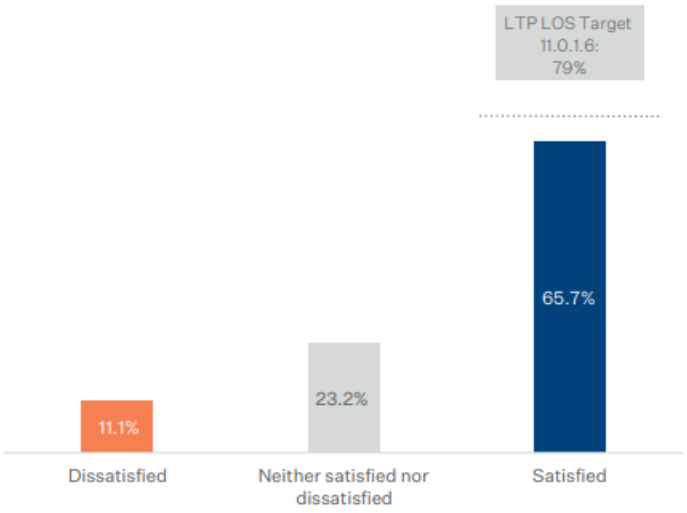
[2] Christchurch City Council 2020 General Service Satisfaction Survey, May 2020 - https://ccc.govt.nz/the-council/how-the-council-works/reporting-and-monitoring/residents-survey/

3.17 Satisfaction with sewerage and wastewater services

		Don't know/ not applicable	Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
Minimal odour from sewerage system	n	30	24	71	137	309	200
	%		3.2%	9.6%	18.5%	41.7%	27.0%
Wastewater services are reliable	n	23	13	47	136	335	217
	%		1.7%	6.3%	18.2%	44.8%	29.0%
Repairs and complaints are investigated in a timely manner	n	68	19	69	232	265	118
	%		2.7%	9.8%	33.0%	37.7%	16.8%
AVERAGE RATING			2.6%	8.6%	23.2%	41.4%	24.3%

Don't know/not applicable responses have not been included in all percentages

3.18 Average level of satisfaction with sewerage and wastewater services



Base: Total sample excluding don't know/not applicable

Figure 1-3: Christchurch City Council 2020 Service Satisfaction Survey - Wastewater Results

Where things have gone well

Wastewater discharge to the Lyttleton Harbour is being stopped with these harbour communities now being connected to the city scheme and Bromley WWTP.

The Asset Assessment Intervention Framework (AAIF) tool has been developed based on an improvement item identified in the 2018 AMP. Outputs from AAIF are now being used to inform renewal decision-making. This marks a key milestone in the continuous development of effective rationale for reticulation renewal planning.

Treatment upgrades and land disposal options for Akaroa Harbour being pursued.

Fault response times and flow and pressure complaints have consistently been tracking better than target levels.

The Bromley WWTP is meeting the high environmental stewardship target of 100% of biosolids diverted from landfill, and is at 94% self-generated power (target 97%).

Council has had no non-conformances or abatement notices regarding resource consent conditions.

Where improvements can be made

The identified wastewater treatment projects in Akaroa Harbour will provide multiple benefits for levels of service, growth and environmental/social outcomes.

There are key areas where increased data quality will lead to better decision-making outcomes. Focus on failure data, and on the asset data held for station and treatment assets will significantly improve data confidence.

Council has declared a climate change emergency however a clear strategy is needed to ensure that the most significant impacts to the wastewater activity can be planned for. Decisions regarding climate change require financial support and have long term service impact so require a robust decision-making process. The strategy and planning can also be expanded to included more detailed multi-hazard analysis in order to set clear strategy around infrastructure provision in high hazard zones.

Continuing the monitoring of wastewater overflow and the priority focus of reducing overflow risk.

There is opportunity to provide reticulated sewerage collection, treatment and disposal for Little River and Birdlings Flat where the communities currently have private septic tank on-site sewerage.

1.3.2 Strategic Issues and Risks

The key strategic issues and risks for the wastewater activity are summarised in Table 1-2 below.

Strategic Issue	Issue Description	Responses
Covid-19 Uncertainty	The impact of the Covid-19 pandemic and subsequent economic downturn will have an effect on Council's assets and services, as well as rating and Council's other revenue streams.	• The AMP has been prepared without a prediction of how the Covid-19 crisis will impact the activity. The future response is uncertain, but undoubtedly has the potential to impact the wastewater activity.
Asset Renewal	Historical material choices and growth periods result in a large cohort of pipes that require renewal in the next ten year period	• Asset Assessment Intervention Framework (AAIF) tool implemented to apply existing asset management data with a risk-basis to renewal planning. • Recommended renewal strategies for above and below ground infrastructure to address historic underinvestment • Improvement programmes for asset data collection, targeting failure records and above ground asset information
Climate Change	The many predicted effects of climate change (changing rain patterns, sea level rise, elevated groundwater levels etc.) are all going to affect the way that council operates, maintains and plans for the activity.	• Climate change risk assessments conducted to identify most significant issues • Introduction of carbon accounting tool and targeting emission reduction at treatment plants • Mapping of climate change related hazard zones • Discussion of climate change and responses within the AMP • Requirement for funding of specific wastewater climate change response investigation so that options and benefits can be established prior to promoting specific capital projects in the next LTP cycle
Treated wastewater discharge	Ocean water quality can be improved in both Lyttleton Harbour and Akaroa Harbour by addressing treated wastewater discharge.	• Wastewater discharge to the Lyttleton Harbour is being stopped with these harbour

		communities now being connected to the city scheme and Bromley WWTP • New treatment and discharge options are being pursued in Akaroa and Duvauchelle to allow the current harbour discharges to end. • No land based treated wastewater application is being actively pursued for the Bromley WWTP, although the high level costs have been presented in the 2018 Infrastructure Strategy.
Wastewater overflows	Dry weather overflows are usually caused by blockages and wastewater can enter private property or water courses. Wet weather overflows are a mix of wastewater, rainwater, and groundwater and causes discharge to watercourses when wastewater network is overloaded during rain events.	• Network upgrades are identified and prioritised through the hydraulic model optimisation. The model accuracy depends on updates and recalibration. • The Lyttleton Harbour Basin upgrade is currently in construction and will prevent overflows occurring at the previous Lyttleton, Diamond Harbour and Governors Bay sites. • The Akaroa sewerage scheme is improving system pumping and piping layouts and will reduce overflow. • Targeting a reduction in I&I through investigation and also through the mains renewal programme will reduce overflow risk
Government Review of Service Delivery	A Section 17A review for the delivery of 3-Waters Services was initiated in July 2019 for two key reasons:	Given the uncertainty with the Section 17A review, it is difficult to predict the impacts on the wastewater activity service delivery structure. The AMP is prepared on a "business as usual" assumption. Potential outcomes include: • business as usual • stand alone business unit • Council controlled organisation • cross boundary or regional joining of forces

Table 1-2: Strategic Issues and Risks

2 Introduction

2.1 Background

This asset and activity management plan (AMP) is the basis for wastewater activity planning. The purpose of this plan is to demonstrate responsive management of assets (and services provided from assets), compliance with regulatory requirements, and to communicate funding needed to provide the required levels of service over a 30-year planning period.

The objective of asset management is to:

"Deliver the required level of service to existing and future customers in the most cost-effective way."

In this context the specific objectives for this AMP are:

- To define the services to be provided, the target service standards that Council aims to achieve, and the measures used to monitor the performance of the wastewater activity.
- To translate Council's Strategic Vision and Goals into activity strategies and action plans. The plan identifies forward works programmes based on strategic outcomes sought and financial forecasts required to meet agreed service levels and cater for growth.
- To demonstrate responsible management of the wastewater activity infrastructure to stakeholders, ensuring that public funds are optimally applied to deliver cost effective services to meet customer expectations.
- To document current asset management practices used by CCC based on clear evidence as part of a sustainable and optimised lifecycle management strategy for the wastewater infrastructure, and identify actions planned to enhance management performance.
- To comply with the requirements of relevant legislation.

The key outputs of this AMP are inputs into the 2021-2032 10 Year Plan process, which will be the subject of a special public consultative procedure. The intention of this AMP is to set out how Council manages wastewater assets and services in a way that is appropriate for a readership including elected members of the Council, executive management, interest groups and business partners associated with the management of the wastewater activity along with interested members of the community. It covers the services that are provided from ownership and management of the associated assets.

This AMP covers a period of 30 years commencing 1 July 2021. Operational, maintenance and renewal programmes for the first 3 years are generally well defined with reasonable certainty of being implemented to budget as planned. Beyond this period, work programmes are generally based on projected trends and demands and there is less certainty with respect to scope and timing of the projects. All expenditure forecasts are based on unit costs as at 1 July 2020.

2.2 Relationship with other plans

Many of the assets planning activities undertaken by Council are applied to all infrastructure assets. For this reason, Council has developed asset management plans in two parts. A strategic asset management plan (SAMP) document[3] which provides an overview of asset management planning at the Council, and an AMP document for each asset group

[3] Strategic Asset Management Plan (Approved by ELT 5 October 2020) - *TRIM://20/1271862*

which describes the assets and how the principles contained within the SAMP are applied to the management of the assets.

Figure 2-1 depicts the relationship between the various processes and levels of planning within the Council required to deliver on Council's vision and goals.

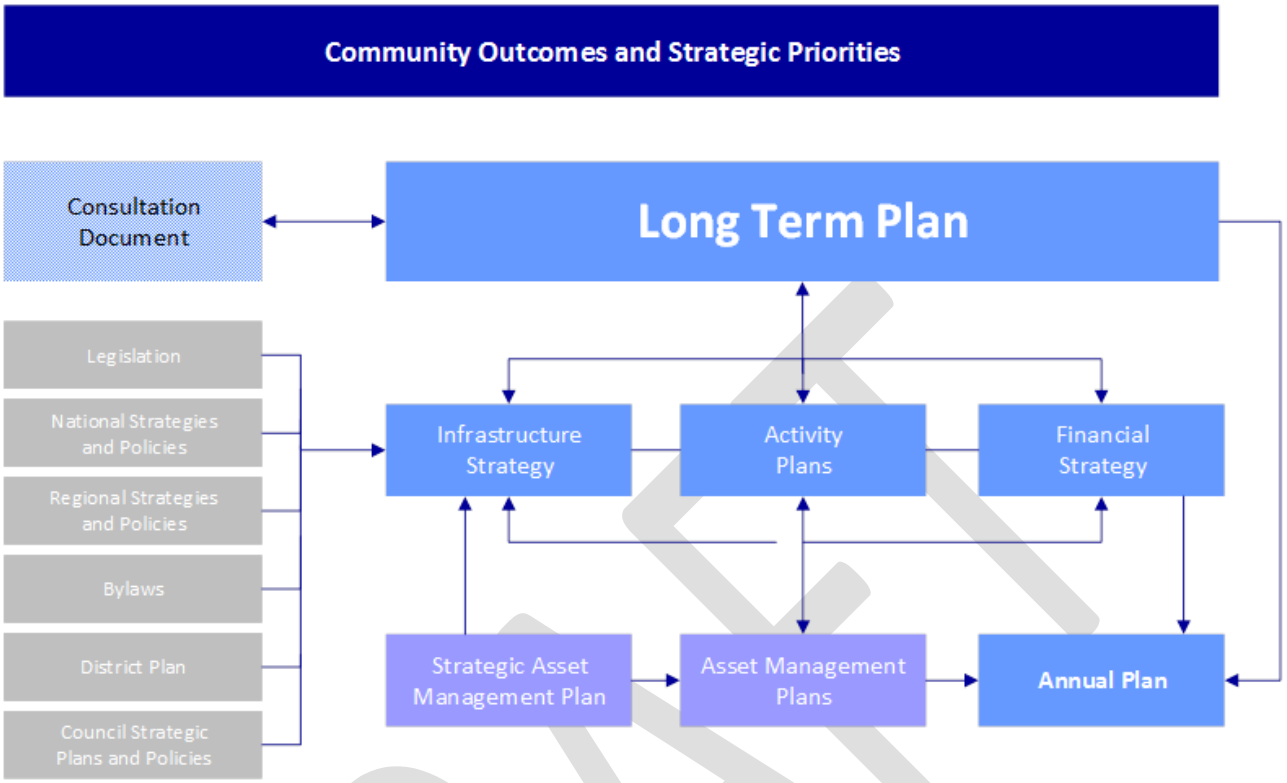


Figure 2-1 Council's Planning Framework

The SAMP provides an overview of the linkages between asset management planning and the other business processes of Council, such as strategic planning, risk management, financial management and compliance. Throughout this AMP references to the SAMP are frequently made.

The SAMP also describes the linkages between AMPs and other corporate plans and documents. In addition to these corporate documents, the following documents are specifically relevant to this AMP:

- Te Wai o Tane Integrated Water Strategy
- Whaka-Ora Healthy Harbour Plan (Lyttelton Harbour Basin)

2.3 Delivering on Council's Strategic Framework

2.3.1 Alignment of Outcomes, Priorities and Activity Objectives

Council's strategic framework and general implications for the activities are presented in Council's Strategic Asset Management Plan. Table 2-1 below summarises key responses by the activity to contribute to the community outcomes and strategic priorities.

Level	Community Outcome	How the Activity Contributes to the Community Outcome
Primary Outcome 1	Safe and healthy communities	We manage wastewater treatment and disposal to protect human health. In doing so we are protecting public health by limiting exposure of the community to pathogens and contaminants in wastewater.
Primary Outcome 2	Healthy waterways	Restricting, minimising or eliminating discharges of wastewater to waterways

Secondary Outcome 1	Modern and robust city infrastructure and facilities network	By setting requirements for network condition and performance we are managing for the efficiency, resilience and sustainability of the wastewater network. We strive for a resilient wastewater network, to support a healthy community, healthy environment and prosperous economy by: • Minimising damage from natural disasters by setting minimum requirements for new infrastructure. • Gathering an evidence base to support asset lifecycle decision making. • Performing lifecycle management to minimise whole of life costs. • Minimising disruptions to the water supply service. • Setting requirements for network condition and performance.
Secondary Outcome 2	Sustainable use of resources	We manage the wastewater network for resilience and energy efficiency. In doing so we are encouraging the use of by-products of the wastewater treatment process, such as use of methane in energy production;
Secondary Outcome 3	Great place for people, business and investment	We strive to manage costs and intergenerational debt by: • Controlling costs to minimise rates increases • Maintaining networks to prevent future generations inheriting a network in need of significant expenditure.

Table 2-1 Alignment of Outcomes, Priorities and Activity Objectives

2.3.2 Activity Responses to Strategic Priorities

Council has confirmed the following strategic priorities requiring specific focus for the next LTP. In response to these priorities, this AMP includes a number of responses as tabulated in Table 2-2 below, with reference to the relevant section in the AMP where further detail on responses is provided. Responses to natural hazard risks and building resilience are dealt with in Section 5.

Revised Strategic Priority	How the Activity Contributes to the Strategic Priority
Enabling active and connected communities to own their future	Active citizenship supported and promoted via: • Support to water management zone committee activities (e.g. the March/April 2019 'what's under your feet' field trips) • Community working parties for major wastewater projects (e.g. Duvauchelle wastewater working party) • Contributing to annual residents surveys, including views on the public wastewater • An improvement programme to increase customer engagement and levels of service consultation.
Meeting the challenge of climate change through every means available	Supporting climate change leadership by: • tracking energy use and greenhouse gas emissions associated with wastewater services through the resource efficiency and greenhouse gas emissions dashboard • biogas production and generation of energy from biogas at the Bromley wastewater treatment plant • considering carbon as part of project lifecycle costs for major wastewater projects
Ensuring a high quality drinking water supply that is safe and sustainable	Responsible collection, treatment and disposal of wastewater can support high quality drinking water by: • A high level of containment to ensure no cross contamination to water supply activity and network • reducing the risk of contaminating source water by reducing wastewater overflows and renewing leaky wastewater pipes

Ensuring healthy water bodies	Efficient, effective and resilient wastewater services healthy water bodies by: reducing wastewater overflows
Accelerating the momentum the city needs	A healthy economy is supported by: • the critical provision of a safe and sustainable wastewater system • a modern and resilient infrastructure base
Ensuring rates are affordable and sustainable	Providing the essential service of wastewater where financial decisions are prioritised using an evidence base that accounts for: • risk • public health safety • asset lifecycle cost considerations

Table 2-2 Activity Responses to Strategic Priorities

2.4 AMP Development Process

Figure 2-2Figure 2-2: AMP Development Timeline shows the process and timeline for AMP completion.

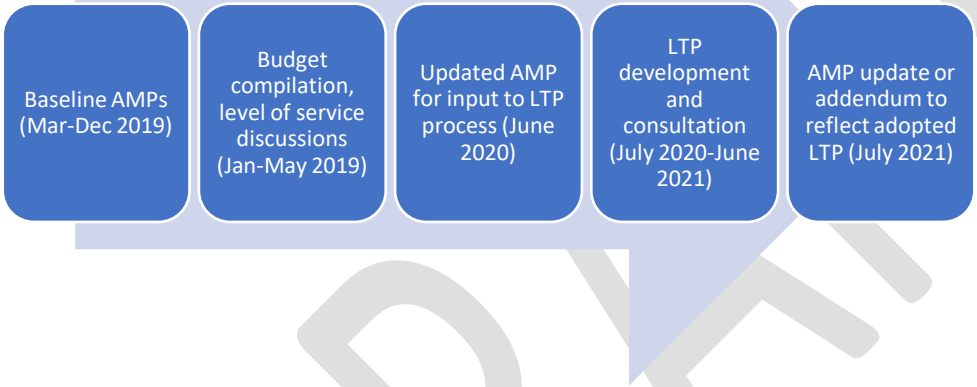


Figure 2-2: AMP Development Timeline

Data from AMPs informs the Activity Plans, Infrastructure Strategy and greater LTP with outcomes from these other documents feeding back into the AMP.

2.5 Navigating the AMP

The AMP follows the general format for AM Plans recommended in Section 4.2.6 of the International Infrastructure Management Manual. It comprises a series of logical steps that sequentially and collectively build the framework for sustainable asset management for the activity it serves.

Key elements of the plan are

- Levels of service – specifies the services and levels of service to be provided by the organisation,
- Future demand – how this will impact on future service delivery and how this is to be met,
- Life cycle management – how Council will manage its existing and future assets to provide defined levels of service,
- Financial summary – what funds are required to provide the defined services,
- Asset management improvement plan – the current and desired state of asset management practices and how the plan will be monitored to ensure it is meeting organisation's objectives.

3 The services we provide

This section outlines the drivers for the level of service requirements, sets out the proposed levels of service and performance measures, provides information on how Council has been performing in recent years against those requirements and identifies projects and programmes aimed at addressing any level of service gaps. (Levels of service gaps are where performance results achieved are consistently different from performance targets).

3.1 Level of Service Drivers

3.1.1 Customers and Stakeholders

Understanding service expectations from customers and stakeholders helps to inform what is important to customers and therefore what aspects of performance should be measured.

This activity provides wastewater collection, treatment and disposal for the people of Christchurch in a way that protects public health and the environment. The Council collects wastewater from approximately 160,000 customers in Christchurch, Lyttelton, Diamond Harbour, Governors Bay, Akaroa, Duvauchelle, Tikao Bay and Wainui, through 1000 km of laterals, 1,900 km of wastewater mains, 150 pump stations, 84 lift stations, and 34 odour control sites. It provides treatment at five wastewater treatment plants and disposal via three ocean/harbour outfalls and two land irrigation schemes. Previously used wastewater treatment facilities in Lyttleton Harbour are being decommissioned as part of a programme of works planned for completion in 2022. It will see all of the raw wastewater being pumped directly to the Christchurch Wastewater Treatment Plant. The wastewater reticulation and treatment infrastructure is monitored and controlled by an extensive communications system.

Table 3-1 identifies key stakeholders and customers to the Council public wastewater services.

Customers and Stakeholders	Specific Needs and Wants
• Residents • Businesses/Commercial Entities • Visitors/Tourists • Non-resident workers	• Protect human health • Safe handling of human and trade waste • Limiting exposure to waste, odour • Reducing wastewater overflows to waterways • Safe, efficient and affordable wastewater services • Polite and helpful customer service representatives • Prompt response to problems
• Contractors	• Clarity around standards of workmanship • Fair and open competition for their services
• Developers	• Capacity for new development • Fair and reasonable development contributions and connection fees
• Infrastructure providers (wastewater, storm water, roading, power companies, telecommunications companies)	• Clarity around standards of workmanship • Fair compliance monitoring
• Planners	• Clear, uniformly applied rules and procedures • Accessible and reliable information
• Elected Representatives (Councillors and Community Boards)	• Cooperation, information and compliance

• Canterbury Regional Council (Environment Canterbury (ECan) • Ministry of Health (MoH) • Community and Public Health (Canterbury District Health Board) • Fire and Emergency NZ	• Cooperation, information and compliance • Service available for all types of users • Sound long term planning • Compliance with plans, policies, standards, and consents • Protect public health
• Mana Whenua • iwi	• Consultation on issues with cultural aspects or environmental impacts • Sensitivity to concerns with overflows to rivers and discharge of wastewater to water bodies • Work in accordance with the Iwi Management Plan[4]
• Central Government • Office of the Auditor General • Ministry for the Environment • Department of Conservation	• Viable local authorities in the long term • Asset planning which enables sustainable community outcomes
• Special Interest Groups • Community Groups	• Inclusion in decision making – the need to be heard • Fair and reasonable charges • Flexibility
• Environmental and recreational interest groups, e.g. Fish and Game	• Appropriate inclusion in decision making – the need to be heard • Cooperation, early warning of changes to needs and systems • Compliance with policy and standards • Conservation of the environment, consultation about environmental impacts
• Christchurch International Airport Ltd • Lyttelton Port Company • Selwyn District Council • Waimakariri District Council	• Liaison • Cooperation and information sharing • Clear and open lines of communication • Agreed standards of supply/discharge • Early warning of changes to needs and systems

Table 3-1: Key Customers and Stakeholders

Council has several ways in which it seeks to identify customer expectations and the extent to which these expectations are being met. These include:

- Detailed customer research – last completed in 2000
- Satisfaction surveys – once a year
- Direct engagement with the community
    - Direct contact with the public;
    - Community Board meetings;
    - Complaints/phone calls to the Council's Call Centre;
    - Information provided and feedback from the Council website;
    - Formal consultation as part of the LTP and annual plan processes;
    - Delegations to Council meetings;
    - Submissions and petitions; and
    - Pre-development meetings with developers.

Findings from our engagement has identified key outcomes for customers are:

- Reliability
- Responsiveness

[4] Iwi Management Plan, 2013 https://www.mkt.co.nz/wp-content/uploads/2016/05/Mahaanui-IMP-web.pdf

- Safety/Public health protection
- Discharge quality
- Environmental stewardship/Sustainability
- Value for money

3.1.2 Legislation/Regulation

Alongside customer expectations, we consider legislation, regulation and standards that impose level of service standards for wastewater. These are summarised in Table 3-2.

Legislation / Regulation	Impacts on Levels of Service
Resource consents	Limits for treated wastewater disposal and consented wet weather overflows
Department of Internal Affairs Non-financial Performance Measures	Standard set of reported measures that needs to be made publically available for wastewater service providers.
Local Government Act	Requirement to assess and plan for future wastewater needs, report annual performance, provide continuous service and assess adequacy of services provided.
National Policy Statement for Freshwater Management/ New Zealand Coastal Policy Statement	Prescribes objectives and policies for matters of national significance which are relevant to achieving the sustainable management purpose of the RMA

Table 3-2: Legislative and Regulatory Level of Service Drivers

3.1.3 Strategic Framework

In addition to Council's strategic priorities described in section 2.3, Councils' Te Wai o Tane Integrated Water Strategy sets out a strategic direction for water supply, wastewater and stormwater. This document provides a summary of the other legislative and policy drivers for wastewater. The strategy reinforces the role of the community in the provision of services and stewardship of water. Within the purpose, vision, and guiding principles of the strategy there are statements that relate to customer engagement:

From within the purpose statement:

- *guiding Council decision making including how we will involve, work with, and reflect mana whenua values and community interests in freshwater management and decision making*

From within the vision statement

- *provide people, communities and future generations with access to safe and sufficient water resources*.

Table 3-3 provides a full list of the objectives and the desired outcomes for each objective from Te Wai o Tane[5].

Objective	Desired Outcome
Objective 1 - Awareness and engagement	Increase awareness and engage with the community and mana whenua regarding the multiple uses and values of water.
Objective 2 - Efficient and resilient infrastructure	Ensure efficient use of three waters infrastructure through a completely integrated management structure and ensure the resilience of entire

[5] Te Wai o Tane Integrated Water Strategy - TRIM://19/1465878

	networks (including natural waterbodies) to future environmental, social and/or cultural changes and natural hazard risks over the long term through timely asset renewal and/or better alternative solutions.
Objective 3 - Enhancement of ecological, cultural and natural values	Enhance the ecological, cultural and natural values (including amenity, recreation, customary use, heritage and landscape) of the waterbodies within the Christchurch urban area and settlements.
Objective 4 - Water quality improvement	Improve the water quality of surface water resources to protect ecosystem health and provide for contact recreation, food gathering, mahinga kai and cultural values.
Objective 5 - Wastewater overflow management	Reduce and work towards eliminating the effects of wastewater overflows.
Objective 6 - Flood risk	Understand the likely extent and effects of flooding, and the risk posed by flooding.
Objective 7 - Flood management and adaptation	Manage and adapt to the effects of flooding using natural systems, planning tools, community adaptation and infrastructure solutions.
Objective 8 - Sustainable wastewater systems	Manage the effects of the wastewater systems to meet community needs for environmental, social, cultural and economic sustainability over the long term.
Objective 9 - Groundwater protection	Advance source protection of groundwater recharge areas and surface water supply sources for all drinking water supplies.
Objective 10 - Improvement in understanding of aquifer system	Understand the vulnerability, transit times and extent of confining layers of the Christchurch aquifers as well as the link to surface water quantity and quality.
Objective 11 - Safe and sustainable water supply	Manage the water sources for drinking water supplies to meet the forecast reasonable demands over the long term and ensure efficiency of water use, and ensure demonstrably safe drinking water without the need for residual disinfection (e.g. chlorination).

Table 3-3: Objectives and Outcomes from Te Wai o Tane

3.2 Defining and Measuring Levels of Service

3.2.1 Measuring our Levels of Service

Council's Levels of Service (LoS) measures enable us to monitor and report against our outcomes and service performance. Based on the activity objectives defined in Section 2.3.1, the following levels of service objectives have been defined:

- Council operates wastewater services in a reliable manner;
- Council operates wastewater services in a responsive manner;
- Public health is protected from Council wastewater services;
- Council has high wastewater discharge quality;
- Council wastewater networks and operations are sustainable
- Value for money.

There are two types of performance measures that are used to report to the relevant stakeholders as per Table 3-4.

Community performance measures (C)	Management performance measures (M)
• *Key measures for governance and community* • *Focus on what the ratepayer gets* • *Typically involve mandatory measures from central government, accessibility of the service, quality, responsiveness, resident satisfaction, compliance with (key) legislation* • *Become staff performance development plan accountabilities* • *Reported to governance and to public in Annual Report*	• *Management oriented* • *Typically aimed at effectiveness, efficiency, compliance with legislation, completion of (key) processes* • *Become staff performance development plan accountabilities*

Table 3-4: Community versus Management performance measures

The two types of performance measures are presented in the Wastewater Activity Management Plan section 5 and are labelled as either "C" or "M":

3.2.2 How we are / should we be performing?

What's going well

The Lyttelton Harbour wastewater project will connect the harbour's wastewater to the main Christchurch system. The project will end the routine discharge of treated wastewater into the harbour, an important environmental milestone for our city. The target is to have all planned discharges of wastewater to the harbour end by 2021.

The $53 million project is being constructed in four stages and involves the installation of submarine pipes under the ocean floor to transport wastewater from Diamond Harbour and Governors Bay wastewater treatment plants to a new pump station on Simeon Quay in Lyttelton. Wastewater will then be pumped through Tunnel Road and the new Heathcote Valley pipeline and connect to the Christchurch wastewater treatment plant via an existing pump station in Woolston.

A fibreglass pipeline has been installed above the Lyttelton tunnel to transport wastewater from Lyttelton. This work was carried out in conjunction with NZTA's fire protection upgrade work on the tunnel. Submarine pipelines were buried approximately one metre under the seabed to transport untreated wastewater from the Governors Bay and Diamond Harbour wastewater treatment plants to Naval Point in Lyttelton. New underground pipes were installed to connect the Lyttelton wastewater treatment plant to the Simeon Quay pump station and the pump station to the Lyttelton tunnel wastewater pipe. Four new pump stations have been built around the harbour, to serve as powerhouses to pump all of the Lyttelton Harbour communities' wastewater over the hill to the main treatment plant in Bromley.

The Lyttelton Harbour wastewater project will end the routine discharge of treated wastewater into the harbour, an important environmental milestone for our city. The new wastewater network will be operational in late 2021, once the entire system has been tested and commissioned.

Fault response times and flow and pressure complaints have consistently been tracking better than target levels.

The Bromley WWTP is meeting the high environmental stewardship target of 100% of biosolids diverted from landfill, and is at 94% self-generated power (target 97%).

Council has had no non-conformances or abatement notices regarding resource consent conditions.

Mixed progress

While the water quality in Christchurch river catchments has improved between 2013 and 2017, it has moved generally from being rated poor to being fair, with the proportion of poor water quality decreasing by half from 80% to 40%. However, just 19% of sampling sites have water quality rated as good or very good.

All beaches in Christchurch, Lyttelton and Banks Peninsula were considered suitable for swimming (contact recreation) over the 2017/18 summer. However, only 57% of sites in the Avon Heathcote Estuary and 25% of river or lake sites in urban Christchurch were considered suitable for swimming.

Where improvements are required

The percentage of total wastewater gravity network pipework length at condition grade 5 remains high at 9.7%. The currency of CCTV data is dropping over time with representing a growing gap in accuracy for condition grading the poorest condition assets.

Resident satisfaction with the reliability and responsiveness of wastewater services is 65.7[6]% and less than the target of 79%, although system faults remain low compared to national benchmarks.

Upgrades to Akaroa and Duvauchelle WWTPs are listed in the next section and will improve capacity and environmental level of service outcomes for these communities.

3.2.3 Performance Framework, 2021-2031

In this LTP period the following performance changes are specifically targeted:

- *Resident satisfaction*
- *Blowbacks affecting customers*
- *Condition profile statistics and CCTV currency*
- *Climate change mitigation at WWTPs*
- *Major improvements to LoS outcomes through the Akaroa and Duvauchelle WWTP projects*

Please refer to Wastewater Activity Plan, Section 5 Specify Levels of Service.

3.3 Level of Service Projects and Programmes

Table 3-5 lists improvement projects or programmes where the primary driver is to increase level of service. A number of projects that are primarily renewal or demand/growth projects will also improve levels of service, and are listed under their respective sections of this AMP.

Major Initiatives to address level of service gaps	Indicative $ over 30 years
Treatment upgrades Includes key projects such as • WW Duvauchelle Treatment and Disposal Renewal ($12.4M) • WW Akaroa Reclaimed Water Treatment & Reuse Scheme($60.6M)	Over $183M
Reticulation upgrades Includes key projects such as • Smart Overflow Reduction ($1.05M) • Hayton Road Main Renewal ($4.4M) • Riccarton Interceptor ($5.4M)	Over $134.8M
Pumping upgrades Includes key projects such as • Locarno Street Pump Station Renewal • Dufek Crescent Pump Station Renewal • Pump & Storage Electrical Renewals	Over $121.7M

[6] Christchurch City Council 2020 General Service Satisfaction Survey, May 2020 - https://ccc.govt.nz/the-council/how-the-council-works/reporting-and-monitoring/residents-survey/

Hydraulic modelling upgrades	Over $10.8M
Software upgrades	Over $3.2M

Table 3-5: Major Initiatives to address Level of Service gaps

4 Demand for our Services

This section provides an overview of growth and demand forecasts that will affect the management, provision and utilisation of services and assets. The need for new works has been based on the information outlined in this section.

Wastewater demand is considered in terms of dry weather flow and wet weather flow.

Dry weather flow is the wastewater that originates from customers; for example domestic laundry, cooking, cleaning, toileting, commercial businesses and industrial trade waste. Dry weather flow represents the average wastewater flow demand.

Wet weather flow includes the impact of rainfall on wastewater network flows. Rainfall has a direct impact on wastewater demand from surface water **inflow** and groundwater **infiltration** (I&I). I&I from heavy rainfall creates the peak wastewater flow demand and can cause the network to overflow and result in peak flows at the treatment plant.

4.1 Demand Drivers

4.1.1 Water Supply Demand

Dry weather wastewater flow is closely related to water supply demand, given that water supply is a primary input for wastewater flows. Therefore wastewater demand will be influenced by the demand drivers described in the Water Supply AMP.

4.1.2 Population Growth

The SAMP forecasts population increase of 72,000 people in Christchurch over the next 30 years, giving a population of around 475,000 residents. Population growth will have a direct effect to increase wastewater demand.

4.1.3 Urban land use density

Christchurch urban growth over the next 30 years is planned to be concentrated in the west, northwest and southwest suburbs. Intensification in these areas will increase localised wastewater demand.

Excess industrial land may convert to commercial use in areas such as Sydenham where there is a longer term commercial shortfall. Depending on the commercial use, the local wastewater demand will either increase or decrease.

Christchurch has an ageing population. Wastewater generation is not expected to vary as a direct relationship with customer age, however any resulting change in people per dwelling as a consequence of the aging population could impact wastewater demand.

In general, urbanization and dwelling intensification will result in an increased wastewater demand.

4.1.4 Economic Growth

Predicted growth in commercial and industrial business activities will impact wastewater and trade waste volumes.

4.1.5 Temperature, rainfall and climate change

The likely expected climate change scenario for Canterbury is drier climate conditions and more frequent intense rain storms (Infrastructure Strategy, 2018). More frequent intense rain storms will exacerbate current I&I capacity issues and may lead to increased overflows.

Rising sea water levels are predicted to increase groundwater levels which will further exacerbate the peak demand from infiltration. It is possible that potential increases in groundwater salinity will affect pumping and conveyance material durability as well as final treatment processes.

Under longer term scenarios, areas of coastal or low lying land may be frequently inundated causing gravity sewers to stop working and forcing different sewerage technologies to be adopted or services to be abandoned.

4.1.6 Ageing infrastructure

Pipes at or near the end of their theoretical useful asset lives will continue to degrade. Pipe deterioration contributes to I&I as groundwater enters the wastewater network through various pipe defects, leading to an overall increase in flow.

The renewal or rehabilitation (i.e. pipe lining) of pipes with existing infiltration issues will reduce peak wastewater demand.

4.1.7 Private infrastructure

I&I from sewer pipes on private property is a significant contributor to wastewater peak flows since 41% of the wastewater network is privately owned. Defective private infrastructure such as cracked pipe laterals, poorly positioned or unsealed gully traps and illegal stormwater cross connections into the wastewater network all increase I&I. Projecting the current situation into the future, it is expected that further deterioration of these assets will increase overall wastewater flows, operational costs, disruption to services and possibly overflows into the environment.

Dry weather flow demand is also impacted by defects on private property such as leaking water supply faucets.

4.1.8 Environmental attitudes

It is possible that a growing environmental conscience within the community over the next 30 years will affect wastewater demand. Changes in environmental attitude may put the spotlight on untreated wastewater overflows and the acceptability of existing treated discharges. This may drive a desire to reduce wastewater demand in order to avoid overflows.

Another environmental attitude is customer water conservation. As customers individually use less water there will be a correlated decrease in dry weather wastewater flow.

Energy conservation could drive Council and customers to reduce demand to save pumping and treatment costs across the wastewater activity.

4.1.9 Maori Values

Discharge of treated wastewater to natural water bodies is in contrast to Maori values. An increased awareness and priority is given to this perspective and new land based discharge options identified. Increased infrastructure and operational costs of land based disposal would be a driver to minimise overall wastewater demands including reduction of I&I.

4.1.10 Resource consent changes

More stringent resource consent conditions will require improved management of wet weather flows as well as trigger wastewater infrastructure upgrades in order to limit the frequency and volume of overflow incidents.

Increased effluent standards may require new and/or additional treatment processes for continued compliance.

4.1.11 Alternative technologies and delivery

It is expected that the implementation of modern or alternative technology over the next 30 years could be helpful in managing wastewater demand. For example:

- Local pressure sewer systems (LPSS) that have lower susceptibility to I&I
- 'Smart' sewer monitoring to manage demand better during storm events
- Improved industry and business trade waste treatment and re-use
- Cost effective trenchless methods of pipe rehabilitation to reduce I&I
- Water efficient devices will have a direct impact on wastewater flow

4.1.12 Demand for Service

There is a high level of uncertainty over the degree that each of the demand drivers will affect demand growth. The demand growth used within this AMP is based on the most predictable demand drivers of changes in population growth, climate change and ageing infrastructure.

The likely changes in demand over time from the various demand drivers are presented in Table 4-1 below.

Demand Driver	Present Position	Projection
	Upward demand pressure	
Population growth	Medium	High
Urban land use density	Low	Medium
Economic growth	Low	Medium
Temperature, rainfall and climate change	High	High
Ageing infrastructure	Medium	High
Private infrastructure	High	High
	Downward demand pressure	
Environmental attitudes	Low	Low
Maori values	Low	Low
Resource consent changes	Low	Low
Alternative technologies and delivery	Low	Low
Water supply demand management	Low	Medium

Table 4-1: Demand Drivers and their Impacts

4.2 Demand Forecasts

4.2.1 Historic Demand Changes

98% of wastewater generated within Christchurch is serviced by the Christchurch wastewater network for treatment at the Christchurch wastewater treatment plant. Due to the complexity of the Christchurch wastewater network comprising 148 catchments and 129 pump stations, the historic demand profile presented herein is focused on the Christchurch wastewater treatment plant. The historic demand to the Christchurch wastewater treatment plant is measured at the outfall and therefore not representative of inflow fluctuations because of retention inherent in the treatment plant and effluent ponds.

A review of historic demand at the Christchurch wastewater treatment plant highlights an overall decrease in discharge from 2013 to 2016, which may be attributed to reduced inflow and infiltration resulting from earthquake renewals. This is substantiated by an increased organic load over the same period. As of 2016, the dry weather wastewater demand has increased due to population growth, but the impact is less visible due to a decreased trade waste flow over the same period.

Historic demand analysis of the Banks Peninsula treatment plants (Akaroa, Duvauchelle, Wainui and Tikao Bay) highlights limited growth in average dry weather flow but with high variance in peak wet weather flows.

4.2.2 Forecast Future Demand

Due to the uncertainty of individual demand drivers on demand growth, the demand growth presented within this AMP is based on the most predictable demand driver of population growth. The impact of other demand drivers (such as reduced I&I) are not quantified at this stage but could have likely impacts as presented in Table 4-1. The annual review of the demand forecast will ensure that impacts of other demand drivers (such as reduced I&I) will be factored into future growth predictions.

The capacity of a wastewater treatment plant is dictated by its ability to reduce organic load to acceptable standards, and not primarily by its hydraulic capacity. The figures below provide the expected growth in dry weather flow, wet weather flow and organic load (for the Christchurch wastewater treatment plant). The future demand on the wastewater network is modelled as part of the Council's dynamic wastewater model for growth up to 2068.

The future demand forecast for the Christchurch wastewater treatment plant confirms that:

- Dry weather wastewater flow is predicted to increase by more than 30% in the next 35 years, This is aligned with the expected growth in water demand over the same period. A base flow amounting to 1.6 of the per capita design flow of 220 litres per person per day, confirms that more wastewater enters the network from household leakages and/or groundwater intrusion. Measures to reduce infiltration will therefore remain important to manage the available wastewater network and treatment capacity.
- The design allowance for inflow and infiltration will exceed the peak wet weather flow capacity of the terminal pump stations by 2023, emphasising the need for the implementation of the wet weather overflow reduction programme. Due to capacity limits within the network, the peak wet weather flow capacity at the treatment plant is not expected to be reached, however an increase in capacity of any of the 5 pump stations which discharge into the treatment plant could require additional hydraulic capacity at the treatment plant as soon as 2028.
- The Christchurch wastewater treatment plant will have sufficient capacity to treat the predicted growth in organic load to beyond 2040, however increases in trade waste will impact the available capacity and may require an earlier upgrade. The Christchurch wastewater treatment plant has adequate hydraulic capacity to accommodate the expected growth in dry weather peak flow.

The future demand forecast for Banks Peninsula wastewater treatment plants reiterates the importance of reducing inflow and infiltration in order to maintain compliance with discharge consent conditions. In addition, the demand forecast confirms that:

- The **Akaroa wastewater treatment plant** to be upgraded to effectively treat wastewater during peak summer periods and to provide for future growth including the longer term plan to provide a wastewater service to residents of Takamatua. Additional capacity is also required to accommodate peak wet weather inflows during rain events.
- The peak wet weather inflow to the **Duvauchelle wastewater treatment plant** will have to be managed to ensure continued compliance with the discharge consent. The demand analysis in peak summer periods will become important since the future growth profile suggests that the plant will be operated close to capacity during these times.
- The long term plan to provide a wastewater services to all residents in Wainui, will require an increase in capacity of the **Wainui wastewater treatment plant**.

Currently, no wastewater networks are in place to service the communities of Little River, Birdlings Flat and Pigeon Bay.

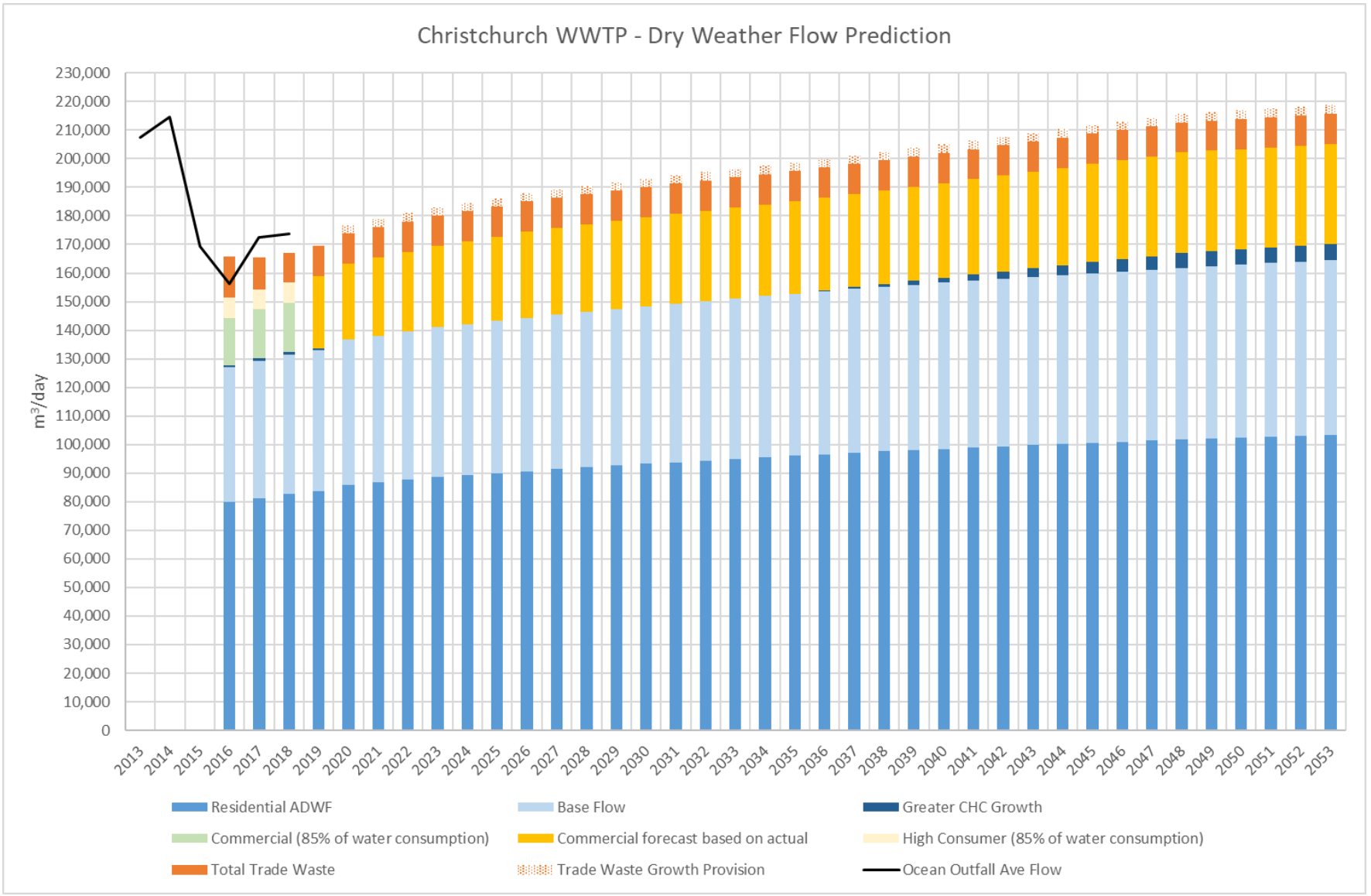


Figure 4-1: Dry weather flow prediction to Christchurch WWTP

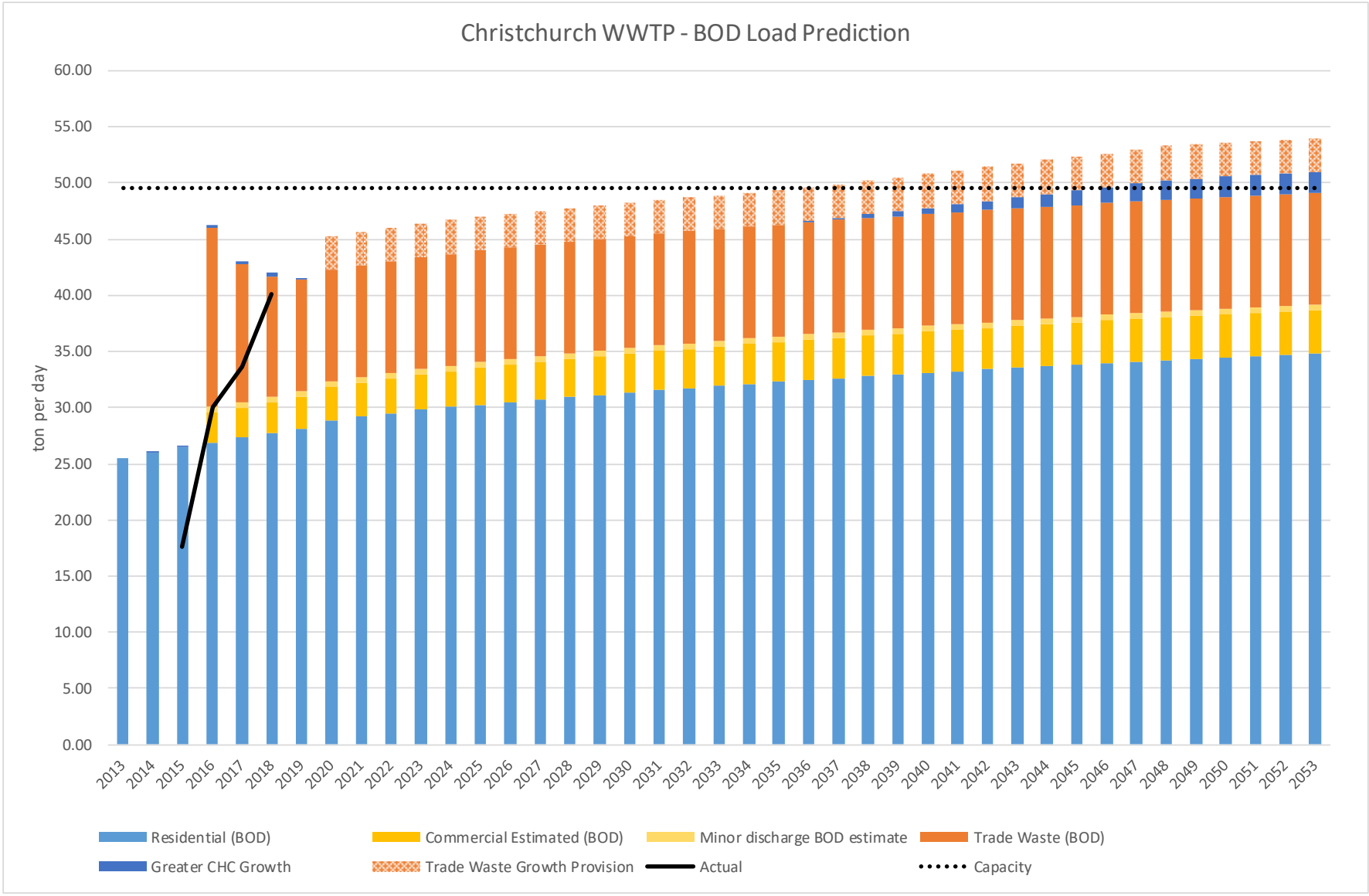


Figure 4-2: Organic load prediction to Christchurch WWTP

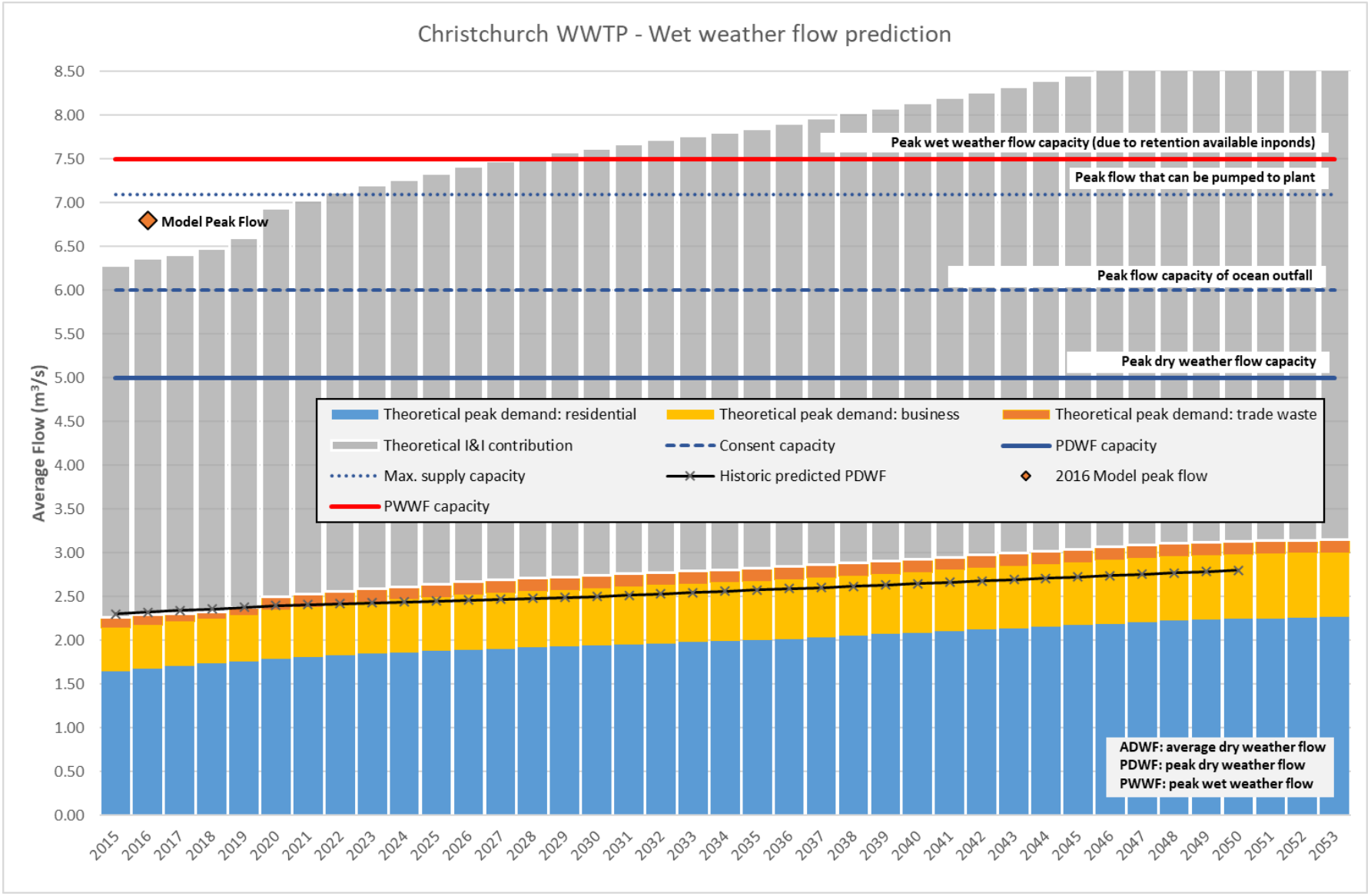


Figure 4-3: Wet weather flow prediction to Christchurch WWTP

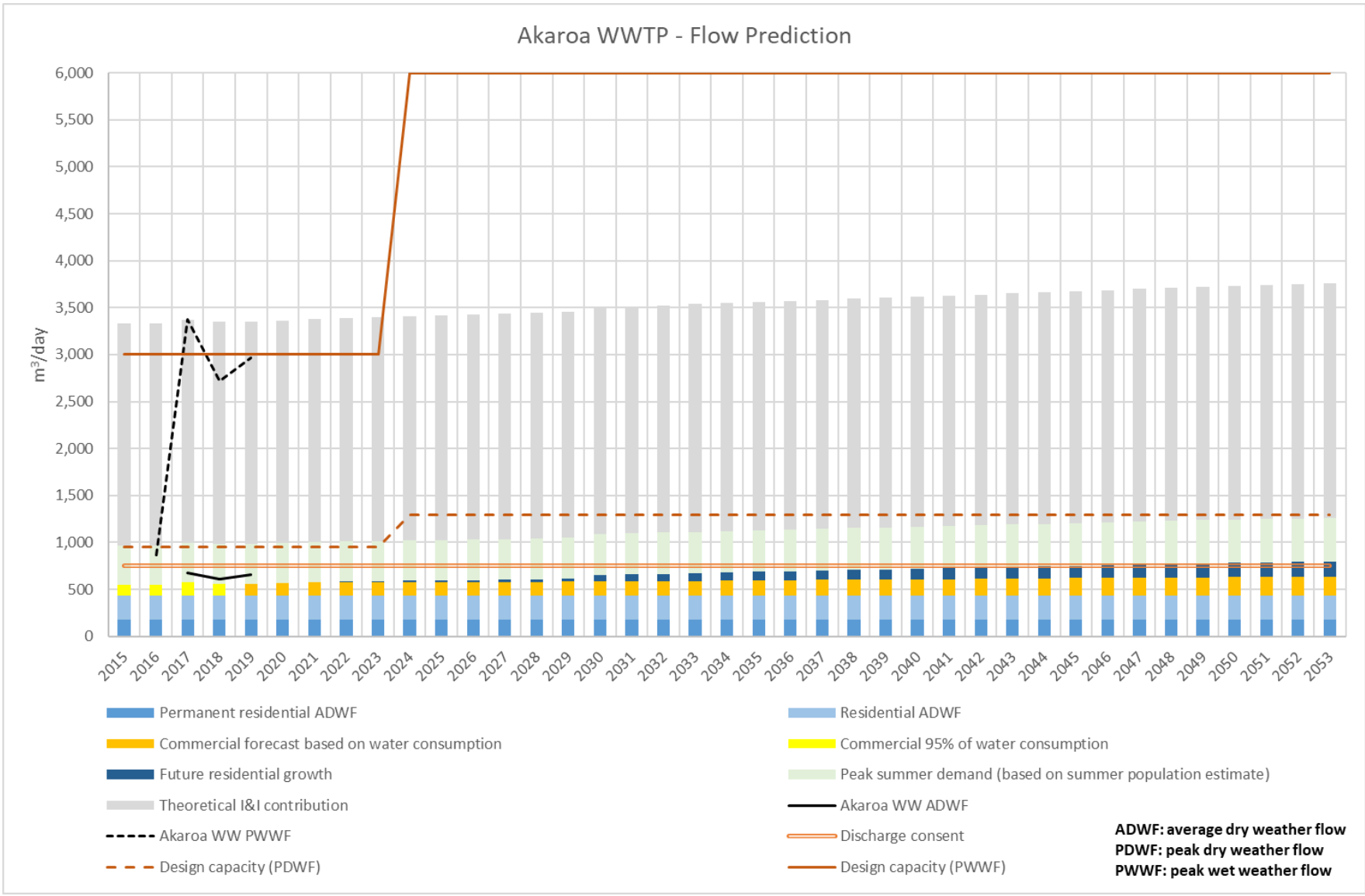


Figure 4-4: Flow prediction to Akaroa WWTP

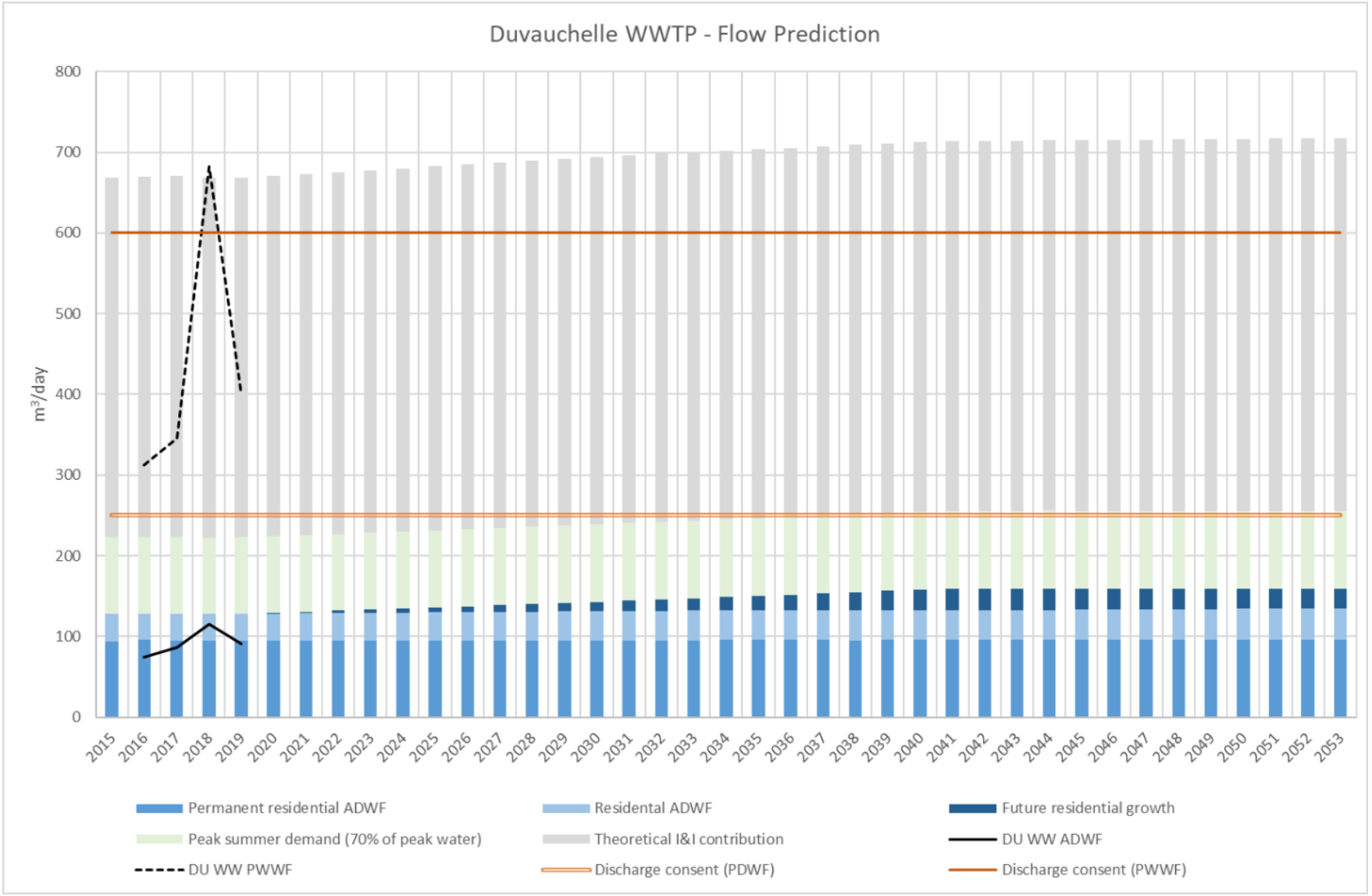


Figure 4-5: Flow prediction to Duvauchelle WWTP

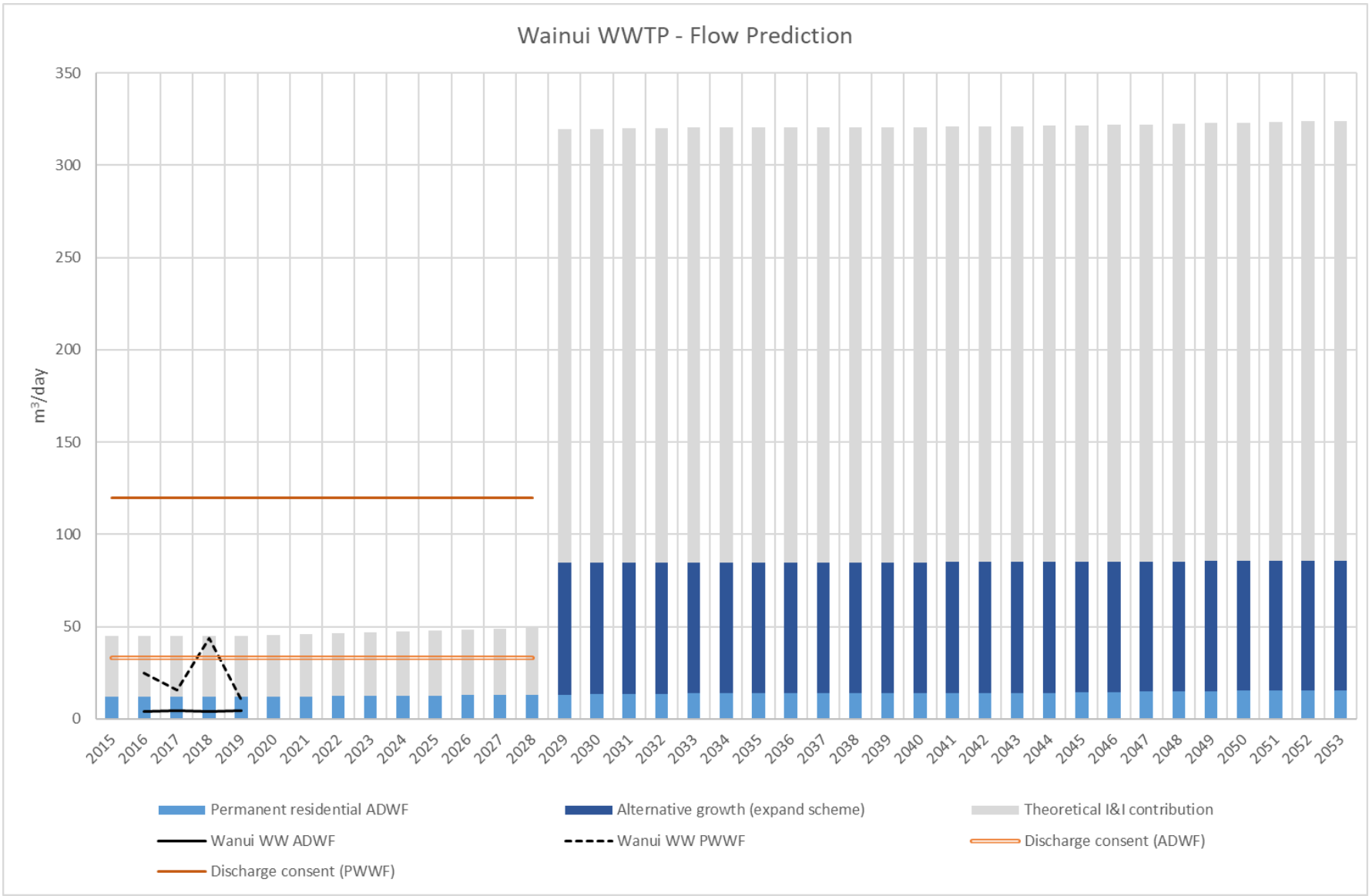


Figure 4-6: Flow prediction to Wainui WWTP

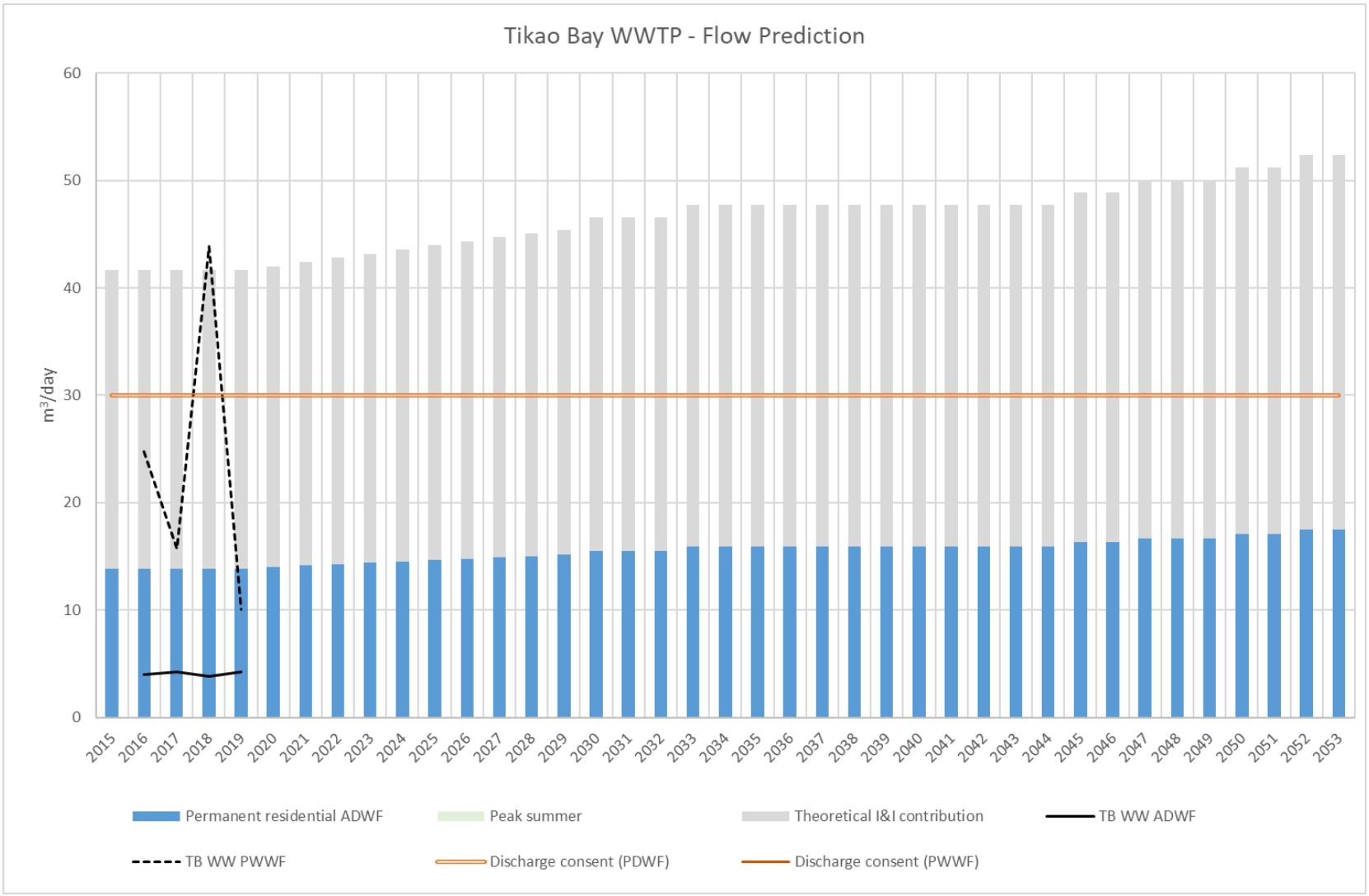


Figure 4-7: Flow prediction to Tikao Bay WWTP

The following recommendations should be considered to improve future demand forecasts:

- The analysis of wastewater demand will improve if the inflow into the respective wastewater treatment plants is monitored. In the case of the Christchurch wastewater treatment plant, this can be achieved by either upgrading the inlet works in order to record inflow or by ensuring that all terminal pump stations are equipped with accurate and calibrated flow meters.

Upon completion of the wastewater model calibration project, Council to identify the catchments and pump stations with high utilisation rates in order to ensure focused planning for wet weather flow reduction and/or capacity upgrades.

4.3 Impact of Changing Demand on Existing Assets

The impact of increased demand on assets and service provision is considered below.

Overflows

Increased peak wastewater demand will put an increased burden on pipe, pump station and treatment plant assets that are currently operating at or near capacity. More overflows will occur where pipe capacity is exceeded. To reduce overflow risk, new or replacement assets will be needed i.e. larger diameter pipes, additional pumps, upsized or more pump stations and additional treatment processes.

Increased pumping and treatment costs

Total costs of pumping and treatment will increase to cater for the greater flows in the network. Pumping costs will also rise from lost efficiency when flows exceed pipe capacity, creating bottlenecks in the network.

Increased reactive maintenance costs are likely as maintenance staff respond to more overflows. Mechanical and electrical equipment now operating with increased run hours will need more frequent maintenance and repair.

Increased operational costs (reactive maintenance, temporary pumping, surcharge monitoring)

Increased reactive maintenance costs are likely as maintenance staff respond to more overflows. Mechanical and electrical equipment now operating with increased run hours will need more frequent maintenance and repair.

With higher peak demand Council faces a greater need to monitor overflow or near-overflow (surcharge) conditions. This means more instruments installed within the network to measure the operational water levels and performance.

Bypass pumps and temporary pumps are used to keep wastewater flowing when assets are out of action for repair or renewal. Greater peak wastewater demand will increase the capacity required for these temporary solutions and in some cases may trigger the need for permanent diversion structures and pipes.

Reduced asset life

Pipes operating under higher pressures or mechanical and electrical equipment operating with increased run hours will have reduced asset lives.

Assets with insufficient capacity can be replaced with assets of greater capacity. However, the replaced asset may still have several years of useful life remaining that then gets financially written off. Therefore assets requiring “early” replacement due to rising demand don’t provide their full whole of life benefit compared to assets that remain in use for their expected useful life.

New assets required

Demand triggered by new developments will require new infrastructure to be established in order to convey wastewater into the existing wastewater system. A downside of new development in the west of Christchurch is the conveyance distance required to reach the treatment plant in the east (Bromley) which adds to existing odour issues and pumping costs.

Cannot meet development needs

Areas of the network with constrained capacity will not be able to accommodate new gravity connections. In these cases Council may require new customers to install local pressure sewer systems with on-site storage which will have less effect

on peak wastewater demand. A growth limit exists for areas serviced by vacuum sewer systems, where limited alternatives exist to upgrade available capacity.

Increased risk of pipe collapse

Increased groundwater levels will result in increased groundwater infiltration pressure. High groundwater levels increase the risk of pipe collapse and ground subsidence.

Changing infiltration patterns

Infiltration allows groundwater to drain into the gravity network and reduces the local groundwater level. If infiltration is significantly reduced then some local groundwater levels will be higher and may contribute to drainage, spring water issues and flooding in wet weather events.

Future Demand on Assets

Demand modelling of the wastewater network identified several infrastructure upgrade requirements to deliver adequate capacity to meet the growing demand. A schematic representation of growth areas is overlapped with identified growth projects in Figure 4-8 and highlights the impact of growth on the existing assets. The detail of these growth projects is presented in section 4.5.

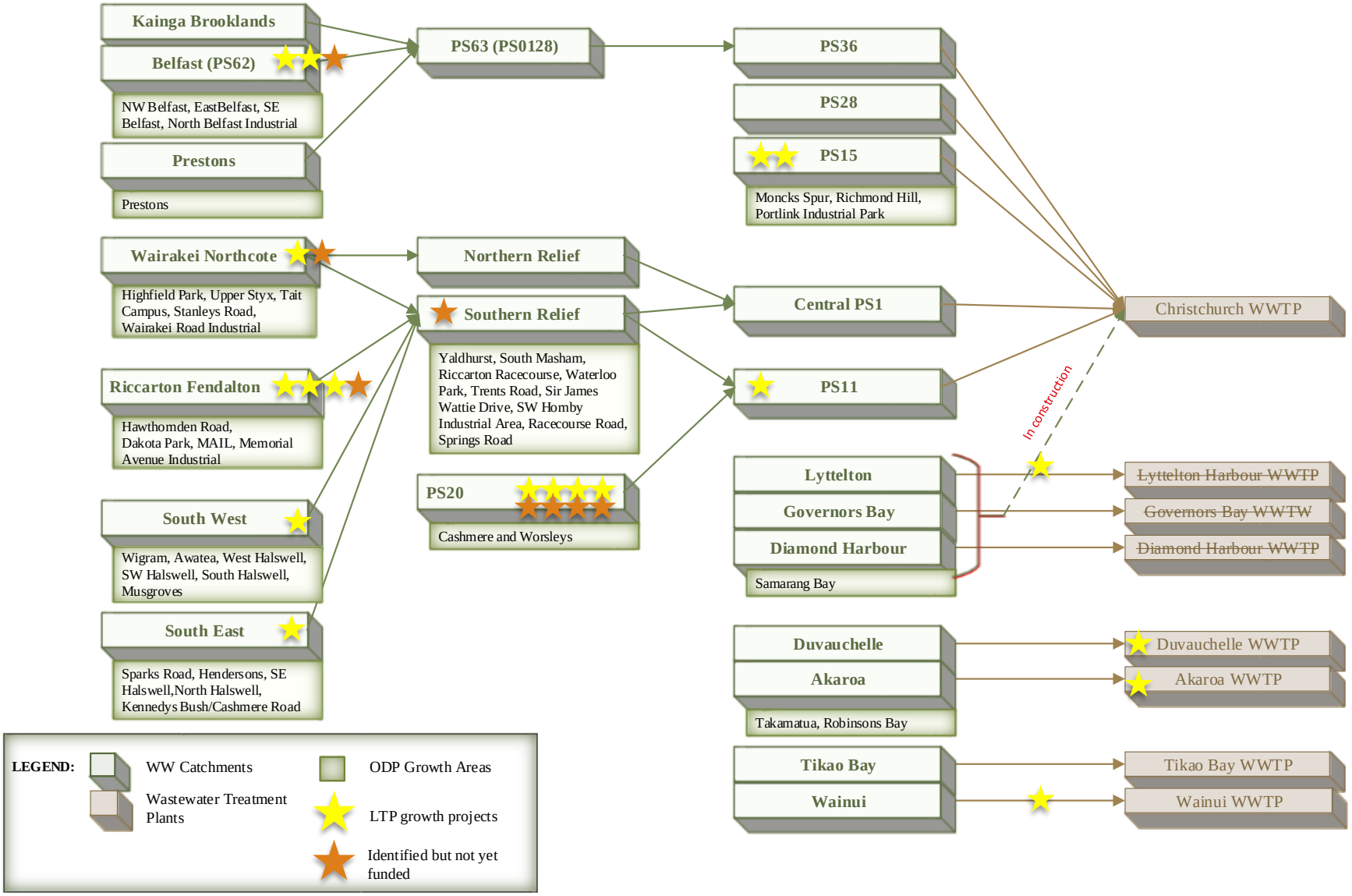


Figure 4-8: Future demand areas mapped to wastewater service area

Asset Utilisation

Asset utilisation will change as a result of demand, leading to potential levels of service issues and increased maintenance and renewal costs.

Council quantifies asset utilisation through predictive hydraulic modelling with actual measurement of flow to calibrate the model. This reveals where assets are over utilised and face capacity constraints. Accurately quantifying asset utilisation helps optimise the responses to increased demand and is an ongoing focus. The success of quantifying utilisation depends on the ongoing funding of Council's hydraulic models.

Hydraulic modelling has identified **wastewater capacity constrained areas** where current demand is likely to exceed capacity during peak wet weather events. New connections in these areas are required to implement smart local pressure sewer systems to provide attenuation during peak demand periods. These systems are predicted to improve demand conditions in the interim until infrastructure upgrades are able to alleviate the capacity constraint. The wastewater capacity constrained areas are shown in Figure 4-9 below:

Figure 4-9: Overview of wastewater capacity constraint areas

The Christchurch wastewater network includes three **vacuum sewer systems** which were sized to service the prevailing land use at the time of design. Intensification in these areas place an increased demand on capacity and can lead to over-utilisation of the vacuum infrastructure. Due to options for alternative servicing limited in vacuum sewer areas, Council needs to manage the available capacity on an ongoing basis. The vacuum sewer areas are shown in Figure 4-10 below.

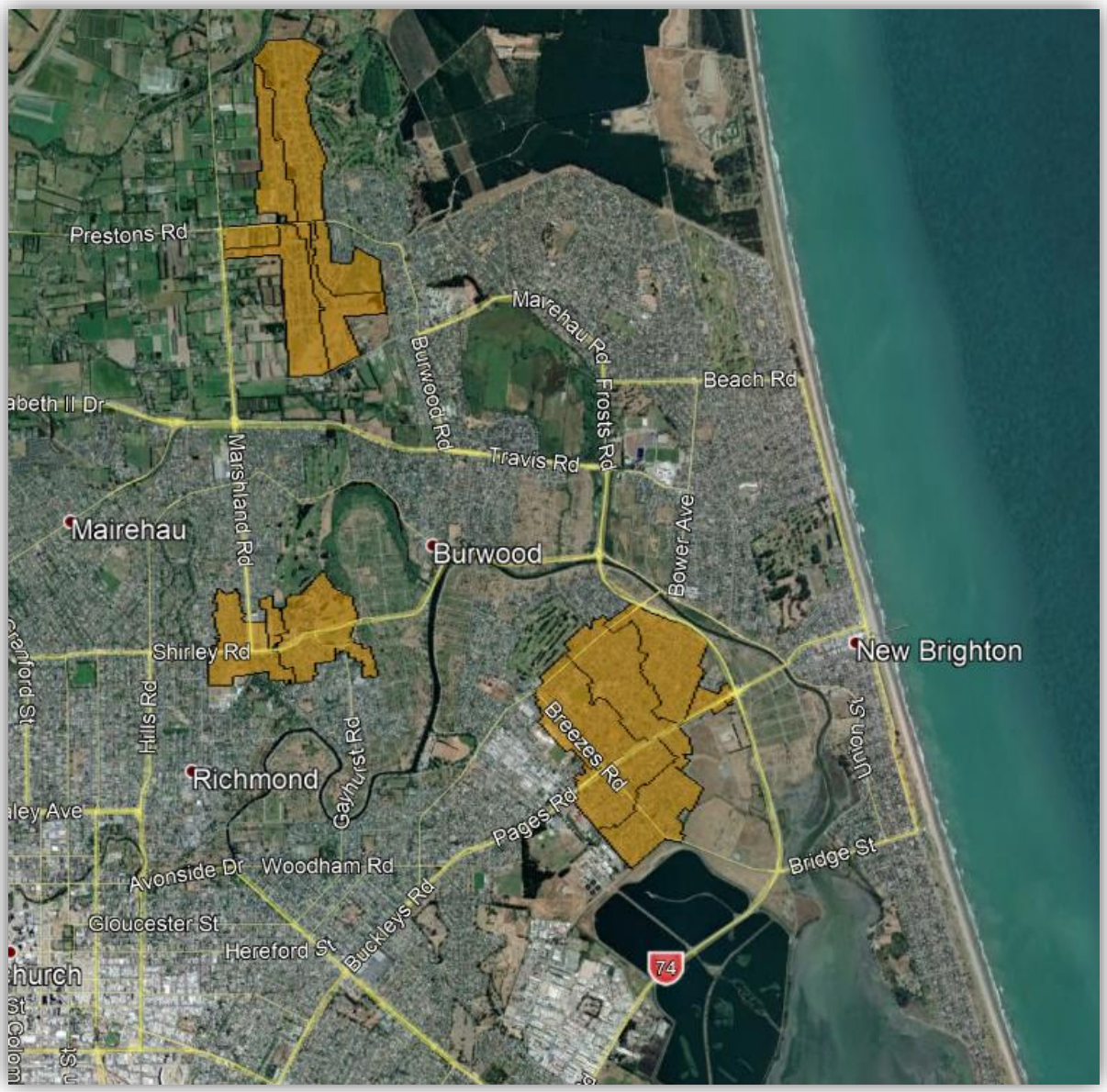


Figure 4-10: Overview of vacuum sewer serviced areas

Council also uses hydraulic modelling to predict when and where overflows will occur as a result of various heavy rain events. The modelling is used to inform **the city-wide wastewater optimisation** which determines the most cost effective capital projects required to maintain compliance with the current overflow consent. To reduce or resolve overflows the options are to increase network capacity, provide storage and/or to reduce inflow and infiltration. The priority projects are now being implemented.

Council is working to more effectively integrate asset utilisation planning into other asset management functions. This will improve outcomes within the long term renewal programme, and operation and maintenance strategy. Currently there are a number of manual checks to ensure that pipe renewals are designed with sufficient capacity for future demand scenarios. Council plans to automate this process so that outputs from demand scenario models are directly integrated into renewal planning and maintenance optimisation.

There are some areas in Christchurch where wastewater infrastructure has excess capacity or where future demand may reduce. The depopulation of Red Zone areas in eastern Christchurch after the earthquakes has reduced demand for existing infrastructure in these areas. Assets that are no longer needed have been decommissioned. Other assets are now servicing fewer customers and therefore have a lower priority for renewal decisions, and will potentially deliver lower levels of service over time.

Certain areas are expected to experience greater risk of natural hazards in future, particularly coastal zones subject to flood risk, rising groundwater levels, sand deposits, erosion and tsunami. Changes in future land use within these areas may reduce demand and the need for the same level of infrastructure provision. Council is still developing their approach to address these predicted changes in risk profile.

4.4 Demand Management Plan

Demand for new services will be managed through a combination of managing existing assets, upgrading of assets, providing new assets to meet demand and demand management. Demand management practices include non-asset solutions, insuring against risks and managing failures.

Demand management initiatives may increase or decrease the demand for a Council service. This could have an impact on the need for assets and their management. Demand management are activities that are undertaken by the activity provider (Council) to alter demand. It is not related to external factors that influence demand – these are the demand drivers, discussed earlier in Section 4.1.

In many instances demand management is understood as trying to limit the need for a service. However, demand for a service can also be increased by initiatives undertaken.

Opportunities identified to date for demand management are shown in Table 4-2. Further opportunities will be developed in future revisions of this asset management plan.

Initiative that influences demand	Effect of initiative on demand (↑, ↓, ↔)	Can this effect be quantified – what assumptions have we made about the effect of the initiative	Potential impact on asset planning (operation / maintenance / revenue / renewal / capex) etc
Current Initiatives			
Wastewater capacity constrained areas	↓	New connections are required to install smart local pressure sewer systems complete with 24 hour storage capacity.	Improved utilization and CAPEX/OPEX efficiency
Targeted I&I improvements	↓	Wet weather contributes a factor of at least 3 times peak dry weather demand (pipes and pumps must be sized 200% larger)	Improved utilization and CAPEX/OPEX efficiency
Pipe renewals	↓	Pipe renewals will reduce groundwater infiltration to zero along the new pipe length. Infiltration will still exist from connected private infrastructure	Improved utilization and CAPEX/OPEX efficiency
Water supply demand management	↓	Some (likely minor) reduction in dry weather demand	Improved OPEX efficiency
'Smart' local pressure sewer serviced areas	↓	This servicing option provides for the management of peak flows and reduced inflow & infiltration.	Improved utilization and CAPEX/OPEX efficiency
Future planned initiatives			
Further requirements to reduce I&I on private infrastructure	↓	Identifying pipe defects when undertaking public lateral inspections to inform private owner and resolve through EQC.	Improved utilization and CAPEX/OPEX efficiency
'Smart' sewer monitoring and demand management during storm events	↔	Reduction in overflows by improved utilisation of storage capacity inherent in the wastewater network	Improved utilization and CAPEX/OPEX efficiency

Table 4-2: Demand Management Initiatives and Impacts

Other demand management initiatives listed below are not currently planned but could be considered and implemented in future:

- Composting toilets as an option for un-reticulated small communities
- Alternative wastewater technologies and service in red-zoned areas
- Treated wastewater reuse demonstration projects
- Private infrastructure leak policy
- Treated wastewater reuse demonstration projects
- Water-efficiency in City Housing
- District plan changes

4.5 Growth Related Projects and Programmes

Table 4-3 summarises the major asset solutions planned to support demand growth and to manage demand impacts.

Description of asset(s)	Year Start	Value Total
New Mains Programme for Growth		
WW Riccarton Interceptor (Upper Riccarton)	FY2022	$5,463k
WW Avonhead Road Main Renewal	FY2023	$4,260k
WW New Mains Programme (as required)	FY2025	$39,742K
WW Subdivision Additional Infrastructure (as required)	Ongoing	$731K
WW Copper Ridge PDA (Awatea ODP area)	FY2023	$390K
WW Hayton Road Wastewater Main Upgrade (Southern Relief)	FY2022	$4,414K
New Pump Stations for Growth		
WW Tyrone Street Pump Station Capacity Renewal (Stage 2) (PS62)	FY2027	$1,974k
WW New Pumping Stations for Growth	Y2029	$17,250k
WW Overflow Reduction Programme		
WW Somerfield Pump Station & Pressure Main	FY2022	$7,395k
WW Eastern Terrace Wastewater Main Renewal	FY2022	$853k
WW Tilford Street Pump Station & Pressure Main Capacity Renewal (PS13)	FY2022	$995K
WW Opawa Road Pump Station Capacity Renewal (PS44)	FY2023	$130K
WW Overflow Reduction Programme	FY2029	$3,700K
WW Treatment		
WW Duvauchelle Treatment and Disposal Renewal	FY2022	$12,423k

Table 4-3: Asset Solutions Supporting Growth

Acquiring these new assets will commit the Council to fund ongoing operations, maintenance and renewal costs for the period that the service provided from the assets is required. These future costs are identified and considered in developing forecasts of future operations, maintenance and renewal costs in Sections **Error! Reference source not found.** and **Error! Reference source not found.**.

5 Managing Risk and Investing in Resilience

This section outlines Council's approach to managing risk and investing in resilience. It includes responses by the activity to build resilience across a number of identified 'disruptors'. A risk register and schedule of proposed risk mitigation actions are also included.

5.1 Council's Approach

Investing in Resilience

The Resilience Greater Christchurch Plan (RGCP) provides a framework and multi-agency actions towards a more resilience City. All Council's activities play a role in contributing to this Plan by becoming more resilient to 'disruptors'.

To build resilience in our asset networks, we need to firstly understand the potential disruptors and the impacts on our assets and services. These are outlined in Section 5.2.1.

Key projects or activities to improve resilience, that we have identified and defined sufficiently to be included in this AMP programme, are included in Section 5.2.2.

Where further investigation is required to understand the impacts of disruptors and ways to be more resilient, opportunities are identified in Section 5.2.3.

Risk Management

Council's corporate approach to managing risk is defined in its Risk Policy and assessment framework. The framework provides a means for consistently identifying, recording and assessing risks such that risk mitigations can be prioritised across Council. The risk management framework and application to AMPs is summarised in Section 4.3.3 of the SAMP.

Whilst the resilience programme focusses on the big, strategic challenges such as natural hazards and globalisation, Council's risk register (recorded in ProMapp) is also intended to be used to manage higher frequency, lower probability events. For example, while another major earthquake would have very high consequences for many of Council assets, lower consequence risks such as third-party damage may be so frequent as to also warrant attention.

In Section 5.3.1 we provide a snapshot of the highest risks recorded for this activity and in 5.3.2 summarise the major mitigation actions that have been included in this AMP.

Resilience Definitions

Acute Shocks: Sudden, sharp events that threaten us e.g. the Canterbury earthquakes represent one of the most significant types of shock any place can endure.

Chronic stresses: Activity that weakens the fabric and functioning of a city on a day-to-day or cyclical basis.

Resilience is the capacity of individuals, communities, businesses, and systems to survive, adapt and grow, no matter what chronic stresses and acute shocks they experience. (100 Resilient Cities)

The Resilience Dividend: The practice of designing projects and policies to address multiple challenges at one time, improving services and/or saving resources i.e. the net social, economic and physical benefits achieved when designing initiatives and projects. (*100 Resilient Cities)*.

Multiple Dividends accrue from investment in disaster risk reduction and can: (1) Avoid or minimise losses when disasters strike. (2) Stimulate economic activity in a zone as a result of reduced disaster risk; and (3) develop co-benefits, or uses, of a specific investment.

Absorption is the ability to absorb shocks or stresses without triggering non-linear, abrupt environmental change (in the wider sense of 'environment' not just the natural environment). *New Zealand Treasury Resilience and Future Wellbeing 2018.*

Adaptation changing something in order to make it suitable for a new use or situation. In a climate change context, the UN Development Program calls it a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented. *(Oxford Dictionary).*

Mitigation is the action of reducing or minimising the severity and seriousness of any harmful impact *(Oxford Dictionary).*

Resilient Qualities are the characteristics of resilient projects and systems. The 100 Resilient Cities define these characteristics as reflective, resourceful, robust, redundant, flexible, inclusive, and integrated.

5.2 Investing in Resilience

5.2.1 Understanding our Resilience Challenges

Appendix 1.6 of the SAMP details the 'shocks and stresses' (disruptors) that provide resilience challenges for Christchurch.

Table 5-1 summarises the most significant potential impacts of disruptors on waste water assets and services, with references stated at the end. Climate change is discussed in length as a disruptor given the Council strategic priority in this area.

Council has undertaken a natural hazard risk screening for the waste water activity to identify risks at a greater level of detail and also to rank risks according to relative severity – Refer Climate Change Risk Assessment TRIM FOLDER20/298.

Type	Disruptors	Potential Impacts on our Assets and Services
Chronic Stressors	Climate Change	Increased high intensity rainfall – increased flood risk (see Acute Shock: Flooding), increased I&I in wastewater network, increased wet weather overflow potential. Sea level rise, coastal erosion and coastal inundation - reduced viability to services some properties and possibility of stranded assets. Groundwater rise – reduced asset life and performance of buried assets, increased groundwater infiltration in wastewater network, reduced viability to service some properties and possibility of stranded assets. Shallowing of groundwater increases liquefaction risk in coastal areas Groundwater salinity – reduced asset life and performance of buried assets Increased landslides and erosion in Banks Peninsula due to devegetation by drought or fire, followed by more intense rainfall events and stronger winds. Risk of landslide damaging infrastructure in the hills and Banks Peninsula. Possible biological response to higher temperature- example: change in treatment bacterial conditions, increased odour and corrosion. Climate change mitigation – carbon accounting required for capital and operational projects requiring different costs, time and methodologies Desire to cut emissions resulting in alternate wastewater treatment methods and technology required that may require significant investment.
	COVID-19 and its economic impact	Early forecasting signals significant economic impacts locally, nationally and internationally. There is great uncertainty. This advice is being updated regularly and is likely to change over time. What might this mean for the wastewater activity? Initial focus on critical projects, government stimulus projects and completing committed projects Short-term possible delays in scheduled capital programme works, potential issues with workforce availability/contractor viability, uncertainty about materials supplies, changing priorities, and increased financial pressure. Opportunities for bringing forward 'shovel ready' work. Medium term consideration of capital works programme in light of the emerging Financial Strategy and Infrastructure Strategy response. Longer term horizon is very uncertain. Potentially dealing with the effect of any deferred expenditure due to the above factors. e.g. intergenerational equity as a result of assets consumption outstripping renewals.
	Globalisation	Being an isolated island nation, we are exposed to the cost of materials. Any trade embargos/wars may affect the costs for replacing assets beyond budget forecasts, or preventing renewals resulting in lower levels of service.
	Population Health	Public health expectations for environmental discharge of treated and untreated waste – higher standards for managing overflows or treated discharges
	Housing and Social Inequity	Fairly charging users of the service – expectations that users only pay for their own use and do not subsidise high users through universal rating

		Intergenerational equity and debt – expectations that the cost of assets and services are equitably applied to the generations that do (and will) receive the benefits
	Regulation	Government Three Waters Review – expected changes in regulation, funding, organisational arrangements Shared service delivery – potential sharing of service delivery between multiple councils and organisations Centralisation - potential amalgamation or national delivery organisations National Environmental Standards – changing targets and controls for environment outcomes
Acute Shocks	Flooding	Flooding causing inundation in serviced areas - damage to assets, environmental overflows, cost of pumping, and lost or impaired service Further risk profiling of areas of greatest flood hazard - reduced viability to service some properties and possibility of stranded assets.
	Seismicity	Large earthquake causing ground shaking , liquefaction, landslides and permanent ground deformation, uplift, subsidence or tilting – damage to assets and lost or impaired service Further risk profiling of areas of greatest seismic hazard - reduced viability to service some properties and possibility of stranded assets.
	Tsunami	Large tsunami causing inundation, high water velocity and large quantities of entrained sediment and other debris in serviced areas - damage to assets and lost or impaired service Further risk profiling of areas of greatest tsunami hazard - reduced viability to service some properties and possibility of stranded assets.

Table 5-1: Potential Impacts of Resilience Disruptors

References:

- Vulnerable: the quantum of local government infrastructure exposed to sea level rise, LGNZ & Tonkin & Taylor Ltd, 2019
- Effects of Seal Level Rise for Christchurch City, Tonkin & Taylor, 2013
- Ministry for the Environment 2018. Climate Change Projections for New Zealand: Atmosphere Projections Based on Simulations from the IPCC Fifth Assessment, 2nd Edition. Wellington: Ministry for the Environment.
- The impacts of climate change in Canterbury: a summary of the literature, ECan, 2019
- Te Wai Ora o Tāne Integrated Water Strategy, Christchurch City Council, 2019
- List of assumptions prepared for 2021 Infrastructure Strategy
- Department of Internal Affairs: Three Waters Review
- Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007
- National Policy Statement for Freshwater Management 2014 (Updated 2017)
- Tsunami research TRIM 18/45483
- Council Wide Climate Change Risk Assessment 2020

5.2.2 Resilient Projects or Activities in this Plan

Error! Reference source not found., **Error! Reference source not found.** and **Error! Reference source not found.** detail the projects and programmes helping build the resilience of our assets. These projects and programmes are already underway and/or are included in this AMP programme. Although not being conducted specifically for resilience, outcomes of these projects will position Christchurch to be better prepared for, and more resilient to, the disruptions identified in the Resilient Greater Christchurch Plan as most likely to impact community wellbeing.

Network improvements for wastewater overflow reduction	
Project Description	Programme of work to reduce dry weather wastewater overflows.
Scope and Expected Impact	Hydraulic modelling and subsequent project optimisation identified priority projects to improve the performance of the wastewater network with a specific focus on overflow reduction.
The Case for Change	Reducing dry weather wastewater overflows is a key strategic driver to improve community and environmental outcomes. The optimisation process identified the most cost-effective projects for network performance improvement and reduced overflow impact.
The Resilience Dividend	The programme includes upgrades providing co-benefits of: increased capacity, renewed aged assets, adopting current resilient design and material standards as well as reducing overflow impact.
Further Opportunities	The wastewater hydraulic model is being further calibrated which will precede another round of optimisation to identify the next suite of network improvement projects that provide the greatest net benefit.

Table 5-2: Wastewater Overflow Reduction

New Akaroa and Duvauchelle wastewater treatment and disposal infrastructure:	
Project Description	Completely new (or upgraded) wastewater treatment plant for Akaroa and also Duvauchelle in the future
Scope and Expected Impact	Options on the table include realising the long term environmental and public health benefit of applying treated wastewater to land. Consideration is also being given to the possibility of removing the plant from the current site.
The Case for Change	The Council has a consent (CRC202179) for the discharge to the harbour, which expires on 8 October 2020.
The Resilience Dividend	Improving treatment standards and converting the harbour discharge to land application will have public health, environmental and cultural/social benefits.
Further Opportunities	Lessons learnt in the Akaroa wastewater treatment plant project can be transferred to the Duvauchelle project in future.

Table 5-3: New Akaroa and Duvauchelle wastewater infrastructure

5.2.3 Building the case for Resilience Investment - 2021 LTP and beyond

Investigation is needed to build the case for future investment in resilience e.g. information/data, policy directions, guidelines, modelling, etc. The opportunities presented below have potential to inform the 2024 and 2027 LTP's:

Climate change

There are two sides to climate change: mitigation and adaptation

Mitigation: Council has declared a Climate Change Emergency and has helped set targets for the district. These are:

- Net zero gas emissions by 2045
- 50% reduction from 2016/17 baseline levels by 2030 (excluding methane)
- 25% minimum reduction in methane by 2030 and 50% reduction by 2045

Key steps to reach these targets and understand the implications are still being developed. There are opportunities to monitor and reduce carbon within operational activities and new capital projects.

Adaptation: National and regional climate change risk screening is currently underway, with district wide (Christchurch and Banks Peninsula) to be started early in 2020. More detailed screening of coastal suburbs is also in the early stages. Screening is the first step in Local Government guidance for climate change adaption shown in Figure 5-1.

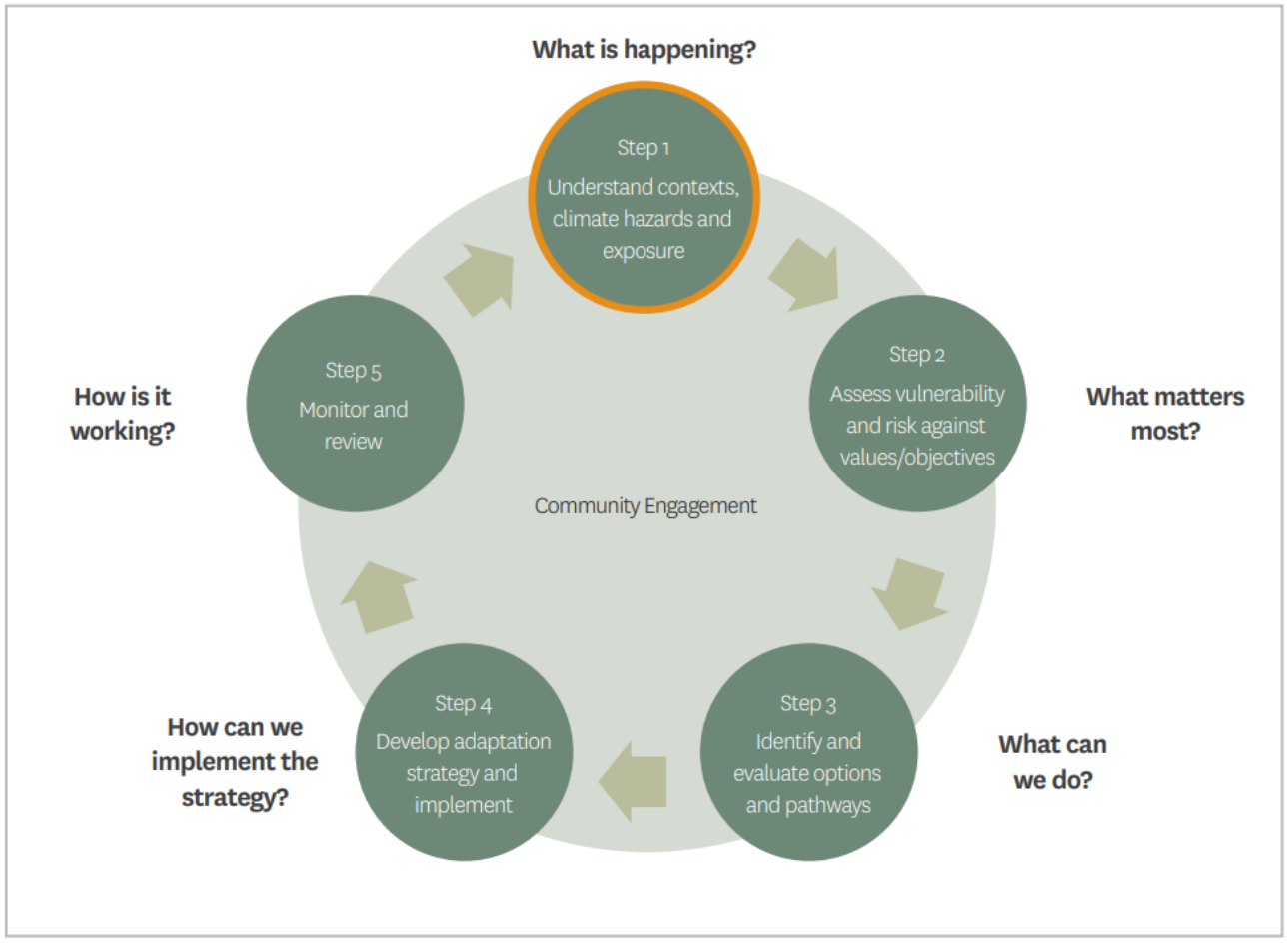


Figure 5-1: The climate change adaptation process, Exposed: Climate change and infrastructure, LGNZ, 2019

These screening projects will lead to more detailed risk assessments so that council can assess the extent of exposure to climate change impacts (Step 2) and areas that we will need to adapt (Step 3).

Climate change factors include rising temperatures, increased drought, more extreme storminess and high rainfall events, rising and increasingly saline groundwater in coastal suburbs, and rising sea levels. In-ground infrastructure in coastal areas may be exposed to a diurnal wet-dry cycle of salty water, likely to increase pipe deterioration.

Currently, no projections have been adopted for how wastewater services will change with climate change.

Sea level and groundwater level rise will put wastewater infrastructure at risk. Council has estimated at a high level that $335M of wastewater infrastructure is vulnerable to a 1.0 m sea level rise. This increases to $864M for a 3.0 m sea level rise. Planning for the future of the vulnerable infrastructure cannot occur until strategies detailing which areas to strengthen and which to abandon are in place.

Table 5-4: Climate Change Risk Mitigation Measures

lists projects that will include climate change consideration in future asset planning.

Climate Change Risk Mitigation Measure	Timeframe	Resources
Use ground water and sea level change modelling to evaluate asset specific risk profiles, and spatial level of service impacts	2021	$ 150,000
Develop Council strategy on infrastructure management in areas of high hazard	2022	$ 100,000
Combined Lifelines planning with transportation and consider realignment projects	2021	$ 50,000
Use carbon accounting tool in option phase	2021	$ 100,000

Table 5-4: Climate Change Risk Mitigation Measures

Covid-19 and economic impact

The AMP has been prepared without a prediction of how the Covid-19 crisis will impact the activity. The future response is uncertain, but will undoubtedly be significant for the wastewater activity. Some potential impacts and responses have been included earlier in Table 5-1.

Population health

The case for addressing emerging contaminants is still being developed and requires specific further investigation to understand what is happening prior to identifying response options.

Ongoing community and stakeholder engagement is needed to ensure that public expectations around wastewater containment and discharge are part of decision-making.

Table 5-5 lists projects aiming to mitigate population health risks.

Population Health Risk Mitigation Measure	Timeframe	Resources
Develop strategies for emerging contaminants	Medium priority – address over next 10 years	From internal staff as needed
Develop risk communication strategy for wastewater discharge	Medium priority – address over next 10 years	From internal staff as needed
Liaison with ECAN on Land and Water Regional Plan	Medium priority – address over next 10 years	From internal staff as needed
Level of service and customer engagement improvement programme	Medium priority – address over next 10 years	From internal staff as needed

Table 5-5: Population Health Risk Mitigation Measures

Housing and Social Inequity

The opportunities presented in Table 5-6 are investigations that are needed in order to shape decisions in future LTPs.

Housing and Social Inequity Risk Mitigation Measure	Timeframe	Resources
Investigate ability to pay and tenant/landlord cost burden of volumetric charging	2022	From internal staff as needed
Investigate ability to pay for enforce private Infiltration & Inflow reduction	2022	From internal staff as needed
Investigate intergenerational equity of infrastructure and financial strategy	2022	From internal staff as needed

Table 5-6: Housing and Social Inequity Risk Mitigation Measures

Regulation

Wastewater regulation change is occuring with the new Water Services Bill and dedicated water regulator. The full extent of changes aren't yet known however Council expects greater emphasis on compliance enforcement.

The Government's Three Waters Review is proposing changes to service delivery that will impact the wastewater activity. Early cost estimates area also needed to stay ahead of proposed changes to the National Environmental Standards. Table 5-7 lists projects aiming to mitigate regulation risks.

Regulation Risk Mitigation Measure	Timeframe	Resources
Anticipate changing wastewater legislation and plan improvements to ensure compliance	2021	From internal staff as needed
Develop early cost estimates for proposed National Environmental Standards	2022	$ 50,000

Table 5-7: Regulation Risk Mitigation Measures

Flooding, Seismicity, and Tsunami

Earthquake exposure is relatively well understood following the 2010/2011 earthquakes. Increased design and construction standards have already been implemented to increase resilience. A next step is to develop policy for infrastructure investment in areas of high hazard and combine the earthquake risk with flood and tsunami.

A new liquefaction tool models the connection between liquefaction potential and groundwater levels. Further input is still needed to predict the rate that sea level rise will affect the groundwater/liquefaction profile in coastal suburbs.

NIWA has modelled the 500 year tsunami exposure for Christchurch and Banks Peninsula including various increments of sea level rise. This shows significant areas in the east are exposed to tsunami. While in-ground assets may be less affected than those at surface, the vulnerability/fragility of infrastructure to tsunami still needs further investigation, with guidance developed on how to manage the risk.

Council has estimated at a high level that 982km of pipes and 38 stations are within a 200 year flood exposure zone. For tsunami, the estimate is 292km of pipes and 26 stations exposed to this risk.

Table 5-8 lists projects aiming to mitigate Flooding, Seismicity and Tsunami risks.

Flooding, Seismicity and Tsunami Risk Mitigation Measure	Timeframe	Resources
Use earthquake, flood and tsunami modelling to evaluate asset specific risk profiles, and spatial level of service impacts	FY2021	$ 150k
Develop Council strategy on infrastructure management in areas of high hazard	FY2022	See climate change target above
Combined Lifelines planning with transportation and consider realignment projects	FY2023	See climate change target above
Making the comprehensive flood mapping more available to decision-makers	FY2021	$ 100k
Integrate tsunami warning 3Waters Business Continuity Plans	Lower priority	None identified

Table 5-8: Flooding, Seismicity and Tsunami Risk Mitigation Measures

5.3 Managing Risks

Council's approach to managing risk is detailed in its Risk Management Policy (including a risk assessment framework) which is summarised in Section 1.6.2 of the SAMP as a background to the content in this Section.

5.3.1 Strategic Risks

Business unit leads have the responsibility for identifying, recording and monitoring business risks using 'Promapp'. The reporting within Promapp ensures that there is visibility of risks Council is managing. The Council risk framework sets out the levels for escalating, reporting and governing residual risks.

High-risk issues from Promapp fall into the following strategic themes for water supply:

Strategic risks include, the risk that:

- Drinking water supply is contaminated
- Major/critical infrastructure fails
- Customers are dissatisfied with chlorine levels
- We are unable to supply sufficient water
- The water supply operation harms staff, public or the environment
- The assets are managed poorly, resulting in high costs or poor service outcomes
- Our staff are not able to deliver our project, operational, and improvement commitments
- Covid-19 and the economic downturn affect the Council's ability to execute the recommendations within this AMP

5.3.2 Asset Risks

The Three Waters and Waste unit identifies risks and records risk responses at a more detailed level, summarised risks form part of the strategic risks in Table 5-9. Refer to Promapp for the full list of risk items and their mitigation measures.

Risk Title There is a risk that/of:	Caused By:	Resulting In:	Controls and Mitigations
There is a risk while managing the wastewater infrastructure to provide wastewater collection and treatment services, that Council pollutes the environment causing environmental damage.	• Operations and/or Maintenance failures in wastewater treatment processes • Failure to maintain network capacity • Treatment plant not properly maintained and/or operated • Lack of staff/contractor capability and/or capacity, or negligence • Vandalism, theft and deliberate damage • Insufficient trained and experienced staff (Council and Citycare) • Wastewater entering the environment from broken or leaking pipes, septic tanks or wastewater overflows	• Water borne disease outbreak or unacceptable public health issues • Breach of consent and prosecution by regulator • Costly clean-up and/or legal issues • Reduction in ecosystem health. (Low water quality resulting in poor ecological and cultural health of waterways) • Offensive or objectionable odour • Increasing dissatisfaction from community and increased number of complaints to Council • Loss of amenity value • Reputational damage • Negative economic impact • Failure to provide waste water collection in a safe and efficient manner to meet ratepayer expectations and/or Levels of Service (LoS) • Unbudgeted reactive expenditure • Excess contaminant loading on stormwater treatment facilities and waterways as a result of overflows	• Providing sufficient funding in the Long Term Plan for operational, maintenance and capital costs • Programmed CCTV inspections of high consequence of failure pipes • Qualified and experienced Maintenance staff to operate and maintain the wastewater treatment plants to documented procedures and contractor plans • Regular maintenance • Appropriately resourced 3 waters business unit • Increased communications and engagement with community, ECan and local iwi • Microbial and chemical contamination monitoring, risk assessment and reactive processes • Monitoring of Inflow/Infiltration • Installing all fuel tanks above ground within adequate containment structures to capture leaks • Appropriate decommissioning of retired infrastructure • Clean up, disinfection and communication plans • Monitoring and mapping high odour (H2S)risk areas to inform planning of future Odour treatment facilities • Succession plans for all critical and specialist roles requiring specific knowledge, especially where scarcity in the market exists • Maintaining up to date Asset Management Plans with renewal programmes based on the best available data ensuring prioritisation to the most critical assets

Risk Title There is a risk that/of:	Caused By:	Resulting In:	Controls and Mitigations
There is a risk that Councils wastewater services do not comply with its ECan resource consents or the Health Act.	• Operations and/or Maintenance failures in wastewater treatment processes • Treatment plant not properly maintained and/or operated due to insufficient maintenance and renewals budget • Lack of staff/contractor capability and/or capacity, or negligence	• Breach of consent and abatement notice by regulator • Breach of consent and infringement notice by regulator • Breach of consent and infringement notice by regulator • Breach of consent and prosecution by regulator • Costly legal issues and unplanned expenditure • Reputational damage	• Monitor and record resource consent parameters • Flow and load models maintained for each plant and compared regularly against actual flows and loads to determine need for upgrades or process changes • Open and honest communications with stakeholders; community, local iwi and the regulator (ECAN) • Maintain appropriate Trade Waste Bylaws to reduce likelihood of overloading the treatment plants. • Providing sufficient funding in the Long Term Plan for operational, maintenance and capital costs

Table 5-9: High Level Risk Items

5.3.3 Risk Mitigation Strategies

Risk management is inherent in all of Council's asset management processes. Table 5-9 lists specific risk treatments. Significant risk management strategies for this activity include:

Asset Design

Significant effort has been applied to updating design and construction standards for infrastructure to become more resilient to earthquakes, specifically targeting: flexible materials, jointing systems, foundation designs, structural interfaces and alternative sewerage systems.

Design requirements are set out in Council's Infrastructure Design Standards (IDS). This includes:

- approved materials, jointing systems and design solutions to provide resilient earthquake performance
- duty/standby pumping for redundancy
- storage requirements

Where necessary, new infrastructure installed since the 2010/2011 Canterbury earthquakes is made of modern materials to the latest design standards and therefore has greater resilience to future earthquake damage and potentially other disruptions.

Insurance

The Strategic Asset Management plan states:

"Insurance is a risk transfer strategy to mitigate financial risks associated with disruptors. Council's approach is to attract and consolidate a balanced insurer panel and secure the maximum amount of insurance possible for the best possible price."

Business Continuity and Emergency Response Planning

The business continuity plans for wastewater are located within the Three Waters and Waste Business Continuity Plan. An index of the individual plans is shown below:

- CWW-WW-051: Process Failure at a WW Treatment Plant
- CWW-WW-052: Rupture of Large Gravity Main
- CWW-WW-053: Rupture of Sewer Pressure Main
- CWW-WW-054: Failure of WW Terminal Pump Station
- CWW-WW-055: Failure of other WW Pump Station
- CWW-WW-056: Biological, Toxic or Explosive Substance released into the Sewage Network
- CWW-WW-057: Death or major harm incident in the operations area (all activities). Workplace accident or incident
- CWW-WW-058: Failure to repeatedly meet Resource Consent discharge parameters
- CWW-WW-059: Other natural event incidents excluding earthquake and tsunami (3 waters)
- CWW-WW-060: Contractor is terminated for insolvency or poor performance

5.4 Summary of Risk and Resilience Projects

There are a number of capital programmes being implemented to primarily address level of service, demand or renewal that will provide a resilience dividend. These projects are listed in those respective sections of this AMP. For example, where possible the pipe renewal programme will replace poor condition pipes with new pipes less prone to damage from local risks.

The table below summarises these initiatives and includes programmes to improve resilience for the wastewater activity. Large scale capital projects have not yet been identified to address certain disruptors such as climate change and other natural hazard risks specifically. The proposed programme to address these risks and disruptors is to dedicate significant resources within the next LTP period to identify and evaluate options such as large scale capital projects, so that decisions can be made for the next AMP cycle to invest in the most beneficial options.

Major Initiatives to address resilience	Response to	Indicative $ 2022-2024
Asset renewal programmes	Seismic / Regulatory / (asbestos removal in buildings)	Refer Section 8
Climate change issues and options, promoting capital programmes and projects prior to 2024	Climate change	$500k (not yet in OPEX forecast) Refer Section 10 for related AMP Improvement Programme
Natural hazard issues and options, promoting capital programmes and projects prior to 2024	Flooding / Seismicity / Tsunami	$250k (not yet in OPEX forecast)
Contaminant investigation and risk communication strategy	Regulation	$50k (not yet in OPEX forecast)

Table 5-10: Major Initiatives to Address Resilience

6 How we Deliver our Services

This section explains how Council delivers the activity through its organisational structure, contracting partners and other agencies involved in service delivery.

6.1 Historical Context

Pre-1900: The reticulated wastewater system in Christchurch City dates back to 1875. Significant expansion of the network followed in 1882-1885.

1900-1989: Further specific periods of expansion occurred in the periods of 1906-12 and 1951-1975.

1989-2000: Following the 1989 local government reforms, the five local bodies providing local government to Christchurch were merged into the new Christchurch City Council. The existing wastewater activities of the local bodies and Christchurch Drainage Board were merged into the Council.

2000-2010: In 2006 the Banks Peninsula District Council was incorporated into the Council. This includes wastewater schemes for Akaroa, Duvauchelle, Tikau Bay and Wainui. Additional assets from this merger were first incorporated into the 2015 CCC Wastewater Asset Management Plan. There is a lower confidence in the data records for incorporated Banks Peninsula assets compared to Christchurch City.

2010-2015: The 2010/2011 Canterbury earthquakes resulted in major disruptions to the Christchurch City and Lyttleton Harbour Basin wastewater networks. The Stronger Christchurch Infrastructure Recovery Team (SCIRT) was established to respond to horizontal infrastructure recovery, assessment, rebuild and repair after the earthquakes. The SCIRT programme covered all Council owned wastewater collection assets but not the wastewater treatment plants (WWTPs) and outfalls, or private laterals. Significant changes occurred through the SCIRT programme with 560 km of wastewater pipe renewed, lined or repaired. An additional 56 lift stations we installed. In some areas with poor ground conditions the existing gravity wastewater network was replaced by local pressure sewer systems or vacuum sewer systems. Condition assessments conducted by SCIRT have provided Council with recent condition data for approximately 50% of all gravity wastewater pipes. However, the SCIRT programme did not remediate all earthquake damage and many pipes with different levels of defects remain for Council to manage.

2015-2019: Existing resource consents for discharging treated wastewater into Lyttleton Harbour expires in 2029. New pipework has been installed in 2019/2020 to enable the existing wastewater schemes of Governors Bay and Diamond Harbour to be pumped to the Christchurch WWTP, and allow the existing Lyttleton Harbour Basin treatment plant to be decommissioned. In Akaroa Harbour Council are pursuing treatment and discharge options to allow the current harbour discharges to end. A new treatment plant for Akaroa is under construction on a new site allowing land disposal for some or all of the effluent. Land disposal investigations are also occurring for Duvauchelle Bay.

6.2 Internal Business Structure

The wastewater activity is primarily the responsibility of the Three Waters and Waste Unit. This unit reports directly to the Council CEO as shown in Figure 6-1. Table 6 1 lists the key teams delivering the water supply activity and their roles.

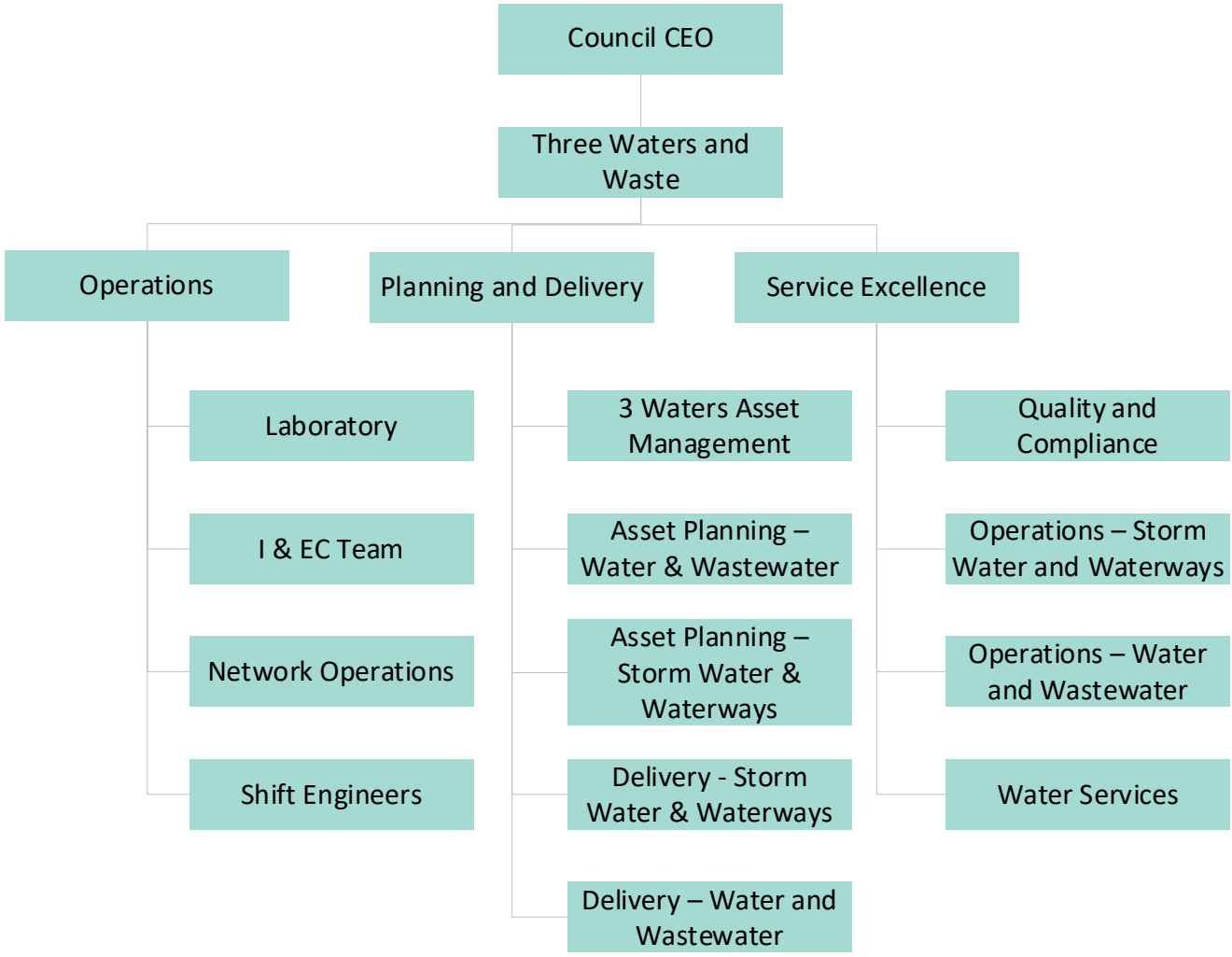


Figure 6-1: Organisational Structure

High level strategic and systematic asset management work is completed by the Asset Management Unit. Operational, asset lifecycle planning and day-to-day project level asset management work is completed by the Planning and Delivery Unit.

The roles of the main service delivery teams within Council are shown in Table 6-1

Team within Council	Role in Delivering Wastewater
Laboratory	Collecting and testing water samples and providing timely results to demonstrate compliance with the drinking water standards.
IE&C Team	Maintenance and replacement of instrumentation, electrical and control systems.
Network Operations	Operate the pump stations and treatment plant from the Christchurch WWTP control room.

Shift Engineers	Day to day maintenance and operations of Christchurch WwTP electrical and mechanical assets.
3 Waters Asset Management	"Asset owners" responsible for lifecycle planning of assets, design reviews to ensure assets meet requirements. Renewals planning.
3 Waters Asset Planning – Water and Wastewater	Water supply and wastewater infrastructure planning for long-term supply and demand, including growth and land development.
3 Waters Asset Planning – Storm Water and Waterways	Storm water and waterway infrastructure planning for long-term supply and demand, including growth and land development.
3 Waters Project Delivery – Water and Wastewater	Manage the capital projects within the water supply and wastewater activities.
3 Waters Project Delivery – Storm Water and Waterways	Manage the capital projects within the storm water and waterway activities.
Quality and Compliance	Writing and implementing water safety plans. Ensuring drinking water security and safety. Resource consent compliance monitoring and reporting. Ecological and environmental monitoring and reporting.
Operations – Storm Water and Waterways	Oversees the network maintenance contract and provides liaison with the external contractor. Liaison with the public regarding complaints and service requests.
Operations – Water and Wastewater	Oversees the network maintenance contract and provides liaison with the external contractor. Liaison with the public regarding complaints and service requests.
Water Services	Processing applications, issues and billing for water supply metering and trade waste consents. Ensuring backflow suitability and compliance. Investigation into water pressure, flow and contamination complaints.

Table 6-1: Wastewater Service Delivery Teams

The Three Waters and Waste Unit also interfaces with departments across Council which support the asset management and service delivery functions.

6.3 External Contracts and Partners

Council uses a combination of internal and external capability to deliver the wastewater services. The rationale for the current service delivery approach is continuing the existing procurement arrangement of using internal capabilities for functions where Council is the best party to manage risk and influence performance, and using external contractors elsewhere. A review of Council's current approach is within the scope of a wider business review described later in section 6.5.

Maintenance of the wastewater pipe network and pump stations is carried out by an external contractor City Care Limited under contract CN4600000778. City Care Limited is a Council Controlled Organisation (CCO). The Banks Peninsula WWTPs are also operated and maintained under this contract. Council's Reticulation and Maintenance Unit provide the liaison with the external contractor.

The following is excluded from the maintenance contract and is managed directly by Council:

- SCADA equipment maintenance
- Renewals, major maintenance and improvements that have been identified in the LTP
- Operations and maintenance of the Christchurch WWTP in Bromley. This is managed by Council's Network Operations Unit by staff located at the plant.

The main contracts are summarised in Table 6-2

Contract	Term and Type	Contract Management Approach
Water and wastewater network maintenance contract, City Care Limited contract # CN4600000778	External contractor term maintenance contract. Partial lump sum and partial measure and value. Currently extended until March 2022.	Preventative and reactive maintenance of water and wastewater assets. Council provide the maintenance scope through the contract service information, specification and contract meetings. Also includes the operation of Bank Peninsula treatment plant assets to agreed performance standards.
Bromley WWTP Asset management and technical services, Beca	Professional services contract Expires June 2021.	Ongoing asset management and technical services relating to treatment, management and operation at the Bromley WWTP
12 CCTV approved contractors provide inspection services. CCTV data storage provision by external contractor(s)	12 CCTV contractors on approved register. CCTV data storage contract currently under review.	Approach being developed where CCTV contractors record and score video data. Data storage to be provided within existing IT contract.
Vacuum units servicing and monitoring	Service contract	
Local pressure sewer system monitoring by South East Water	Service contract	Reporting of data feeds from the Iota Onebox smart units. Only access to a reporting portal for Council and alarm triggers sent to maintenance contractor.
Overflow monitoring and manhole sewer level monitoring by Mott McDonald	Service contract	

Table 6-2: Major Contracts for Service Delivery

6.4 Other Service Delivery Partners

Council is the provider of community wastewater services in the city. The communities of Little River, Birdlings Flat and some rural residents, have private wastewater disposal (e.g. septic tanks).

Planning and constructing new capital works involves liaison with internal and external utility providers to ensure that capital works are coordinated between the different activities. Transport, water supply, wastewater and land drainage asset engineers aim to maintain draft renewals programmes to ensure works proceed in a logical and cost effective manner and minimise disruption to residents. Draft programmes are also available to external service providers through the forward works viewer.

Table 6-3 identifies partners supporting Council's Three Waters and Waste Unit in the delivery of wastewater services.

Service Delivery Partner	Role
Council (internal) - Technical Services Unit	Provide engineering design services for new capital works and contribute to Council's engineering standards.
Council (internal) - Roading	Coordination of renewal works capital projects between Transport and wastewater to optimise pavement life in locations of pipe trenching.
Council (internal) Project Management Office	Develop the process for how projects and programmes are delivered. Review and support alternative delivery models and frameworks.
City Care Limited	Contractor providing wastewater network and plant maintenance, and operation of Banks Peninsula wastewater treatment plants.

Consultants Panel	Professional service consultants providing ongoing design and construction management for wastewater capital works.
Land developers	Build wastewater infrastructure to service newly developed land. Infrastructure is vested in Council.
Selwyn District Council	Agreement for some Selwyn communities to discharge into the City wastewater network (e.g. Tai Tapu)
Environment Canterbury	Approve and monitor discharge resource consents for Council's wastewater activities
Ministry of Health/Government Regulator	New legislation expected to enable the government regulator to advise on acceptable limits for wastewater discharge

Table 6-3: Wastewater Service Delivery Partners

6.5 Business Reviews Undertaken

A Section 17A Service Delivery Review (S17A) is a legal requirement under the Local Government Act and determines whether the existing means for delivering a service remains the most efficient, effective and appropriate approach. The legislation requires that a S17A Service Delivery Review should periodically assess:

"The cost-effectiveness of current arrangements for meeting the needs of communities within its district or region for good quality local infrastructure, local public services, and performance of regulatory functions".

A review of wastewater activities was initiated in July 2019 for two key reasons:

- the expiry of the existing 3 waters maintenance contracts and a desire to go out to market for these services
- to enable Council to be prepared for the outcomes of the Department of Internal Affairs' 3 Waters review

The section 17A review was completed in June 2020 and presented to Council in August 2020. The review confirmed that there were underlying challenges with the status quo. Central Government's water reform programme gained significant momentum in mid-2020 and Council agreed to sign a non-binding Memorandum of Understanding with the Crown at the same extra ordinary Council meeting in August 2020 regarding water reform. Due to the increasing pace of water reform, the status quo was the recommended way forward for the section 17A review. The reform is going to lead to significant changes to water service delivery across the country and adding in further structural change during the reform process was not seen to add value to Christchurch.

The Government has announced a new national water regulator and is reviewing how to improve the supply arrangements of drinking water, wastewater and stormwater; including financing provisions and decision-making capability. Any changes implemented at a national level will have an impact on Council's service delivery.

Given the uncertainty in terms of the outcomes and timing water reform, it is difficult to predict the impacts on the water supply activity service delivery structure. The AMP is prepared on a "business as usual" assumption. Potential outcomes include:

- Regional or larger asset owning 2 waters entity
- Regional, top of the South Island or full South Island entity that includes storm water and waterways

6.6 Significant changes planned for the activity

A central government program of water reform is underway addressing outcomes from the Havelock North water contamination event and subsequent inquiries. Outcomes and timing of water reform remain uncertain but are likely to include significant change to the delivery of wastewater, watersupply and land drainage services.

In the shorter term, until confirmation of water reform outcomes, the main significant change is the renewal of the water supply and wastewater maintenance contract. The new maintenance contract will be very prescriptive rather than outcomes based, and involve the collection of key asset condition and performance data to support optimisation of maintenance plans/schedules performed by the maintenance contractor.

The new contract is likely to have a short term to allow for changes occurring as part of water reform.

7 Portfolio Lifecycle Management Plan

The lifecycle management plans detail how the Council plans to manage the network of assets at the agreed levels of service (defined in Section 3) while optimising life cycle costs.

Section 7 provides the lifecycle management information and strategies at a portfolio level. Section 8 provides this information at an asset class level.

7.1 Asset Lifecycle Approach

Council has established a lifecycle management framework, aligned to the *International Infrastructure Management Manual* as illustrated in Figure 7-1. Section 7 and 8 are structured to align to the lifecycle stages.

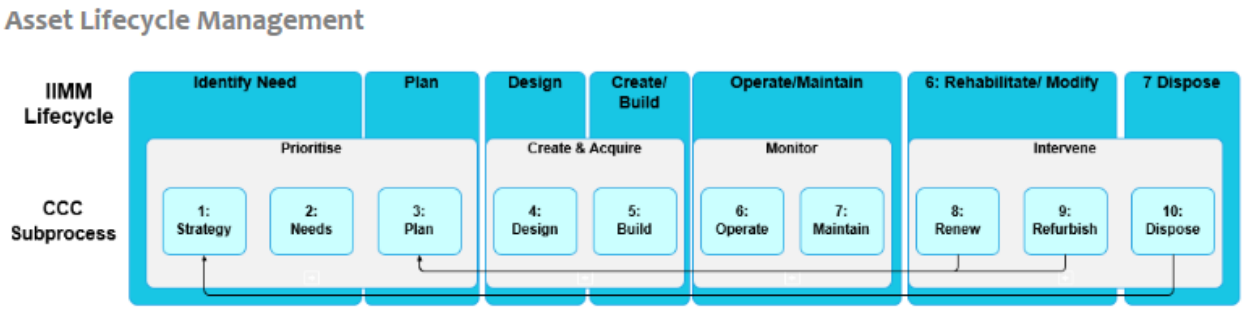


Figure 7-1: Asset Lifecycle Categories

7.2 Our Asset Portfolio

7.2.1 Location and Value

Table 7-1 below lists the value of wastewater assets based on the 2020 Valuations. Total replacement cost of wastewater assets is $5.1 billion with a book value of $2.79 billion and an annual depreciation of $65.4 million. [7]

Asset Class	Asset Type	Quantity	Replacement Value	Book Value	Annual Depreciation
Pipe Assets	Gravity	1,622 Kms	$2,950,594,972	$1,504,113,697	$33,418,580
	Pressure	253 Kms	$494,463,768	$357,653,639	$7,032,946
	Vacuum	61.5kms	$55,453,081	$52,975,490	$554,440
	Overflow	3.208 Kms	$7,947,302	$4,379,262	$107,358
	Syphon	1.3 Kms	$3,323,062	$1,772,817	$43,474
	Laterals	1,002 Kms	$690,881,706	$381,926,191	$7,941,069
	Biogas	17.5 Kms	$12,750,129	$11,371,391	$127,482
	Sub-total	**2,961 kms**	**$4,215,414,020**	**$2,314,192,487**	**$49,225,349**
Non-Pipe Assets	Built Structures	1,165	9,099,209	7,346,712	100,498
	Vents	92	322,178	206,753	6,371

[7] Sourced from Trim Document 20/897727 : CCC Three Waters FINAL Valuation June 2020 report

Asset Class	Asset Type	Quantity	Replacement Value	Book Value	Annual Depreciation
	Valves	2,789	12,856,839	9,379,036	293,984
	Air Gaps	90	161,817	33,617	3,031
	Flush Tanks	111	1,855,122	799,952	18,369
	Manholes	27,666	211,047,766	117,290,197	2,092,786
	Pressure Sewer	9,405	$23,835,982	$20,027,486	$672,712
	Vacuum	4,353	$13,166,794	$12,157,350	$230,625
	Pipe Protection	1,094	$2,396,317	$1,725,574	$23,890
	Biogas Valves	10	$19,575	$14,682	$492
	Outfalls	158	$500,516	$299,901	$5,000
	Pipe Restraint	86	$90,043	$66,930	$1,126
	Sub-total	**47,019**	**$275,352,157**	**$169,348,190**	**$3,448,883**
Pump Station Assets	Buildings and Structures (Civil)	366	44,198,284	16,077,186	945,000
	Control System	734	7,556,830	1,772,788	358,652
	Electrical	968	26,117,276	12,558,698	747,248
	Gantry Crane	22	3,518,681	2,781,027	69,272
	Mechanical	638	16,238,311	7,301,973	308,297
	Pipework	986	18,251,809	11,251,796	200,740
	Standby Equipment	39	4,022,253	2,614,057	79,617
	Sub-total	**3,753**	**$119,903,444**	**$54,357,525**	**$2,708,824**
Odour Control Assets	Buildings and Structures	22	612,104	387,997	12,242
	Electrical	79	1,565,948	584,795	51,558
	Pipework	42	2,630,882	1,872,399	26,417
	SoilFilter	66	4,445,415	3,132,547	87,196
	Sub-total	**209**	**$9,254,349**	**$5,977,738**	**$177,413**
Lift Station Assets	Buildings and Structures (Civil)	154	6,632,830	5,671,661	66,328
	Electrical	682	1,216,142	905,934	48,646
	Mechanical	68	389,938	306,655	12,998
	Pipework	443	1,584,544	1,351,281	15,845
	Sub-total	**1,347**	**$9,823,454**	**$8,235,532**	**$143,817**
Vacuum Station Assets	Buildings and Structures (Civil)	3	7,134,356	6,869,902	102,487
	Control System	64	177,821	112,530	11,855
	Electrical	92	1,927,741	1,456,278	58,280
	Gantry Crane	4	484,666	428,896	9,693

Asset Class	Asset Type	Quantity	Replacement Value	Book Value	Annual Depreciation
	Mechanical	25	1,517,556	1,246,269	50,834
	Pipework	122	656,739	610,422	8,209
	Standby Equipment	3	446,363	310,309	8,843
	Sub-total	**313**	**$12,345,242**	**$11,034,607**	**$250,200**
Treatment Plant Assets	Buildings and Structures (Civil)	135	216,527,811	138,918,291	2,756,568
	Civil Earthworks	12	13,743,165	13,743,165	0
	Electrical	102	25,153,559	5,938,043	491,254
	Filter Media (CWTP)	4	35,864,550	2,766,535	740,218
	Instrumentation & Control	700	42,795,068	11,251,145	2,107,741
	Mechanical Equipment & Plant	1,556	68,897,798	23,261,641	2,440,587
	Pipework	159	52,137,572	32,613,412	695,168
	Standby & Generation	23	10,759,855	5,598,822	270,686
	Sub-total	**2,691**	**$465,879,378**	**$234,091,053**	**$9,502,221**
Total Waste Water			**$5,107,972,044**	**$2,797,237,132**	**$65,456,708**

Table 7-1: Wastewater Asset Quantity and Value

Figure 7-2 and Figure 7-3 show an overview of where the wastewater reticulation, station and treatment assets are located in Christchurch city and in Banks Peninsula.

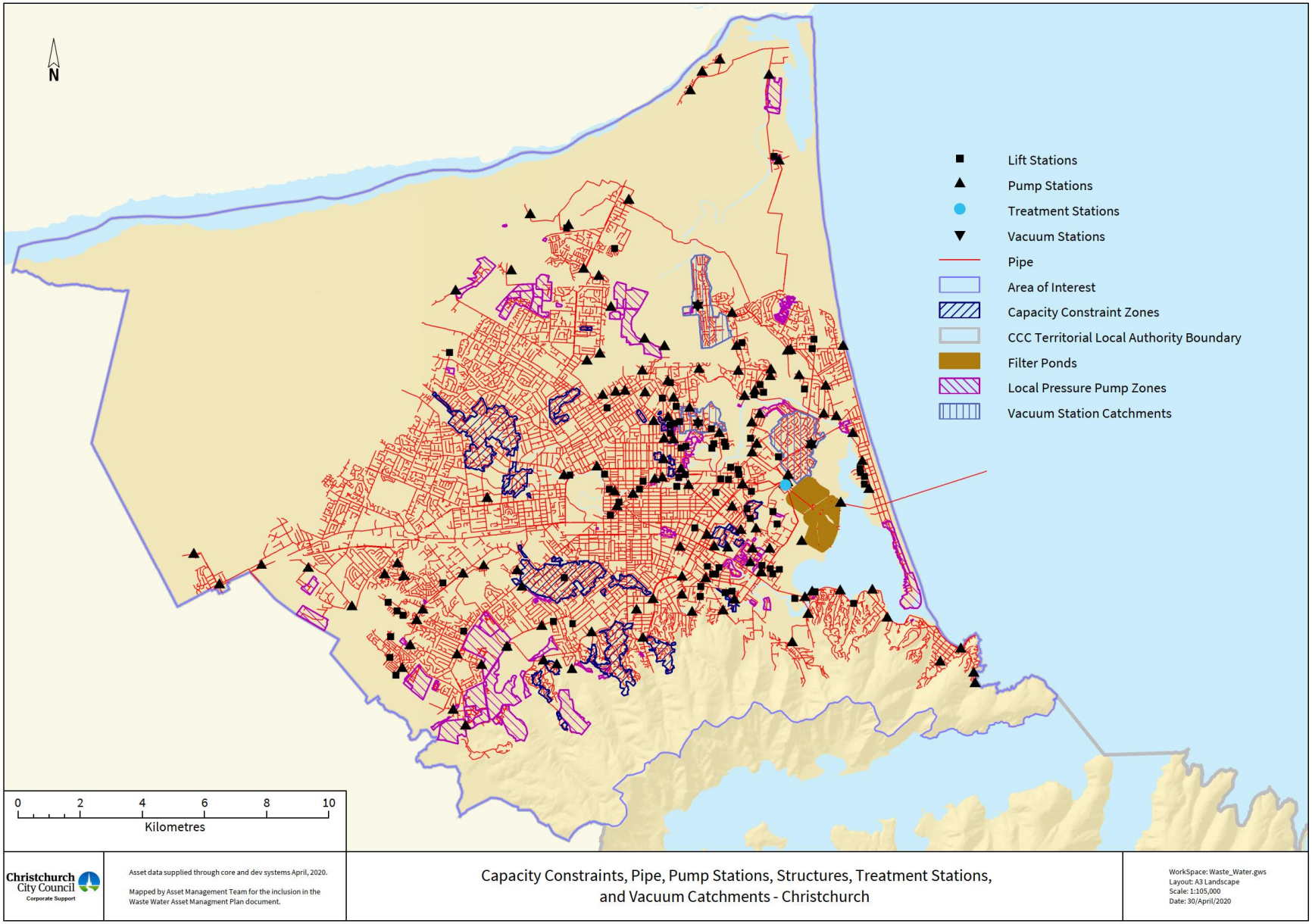


Figure 7-2: Christchurch City Wastewater Asset Locations

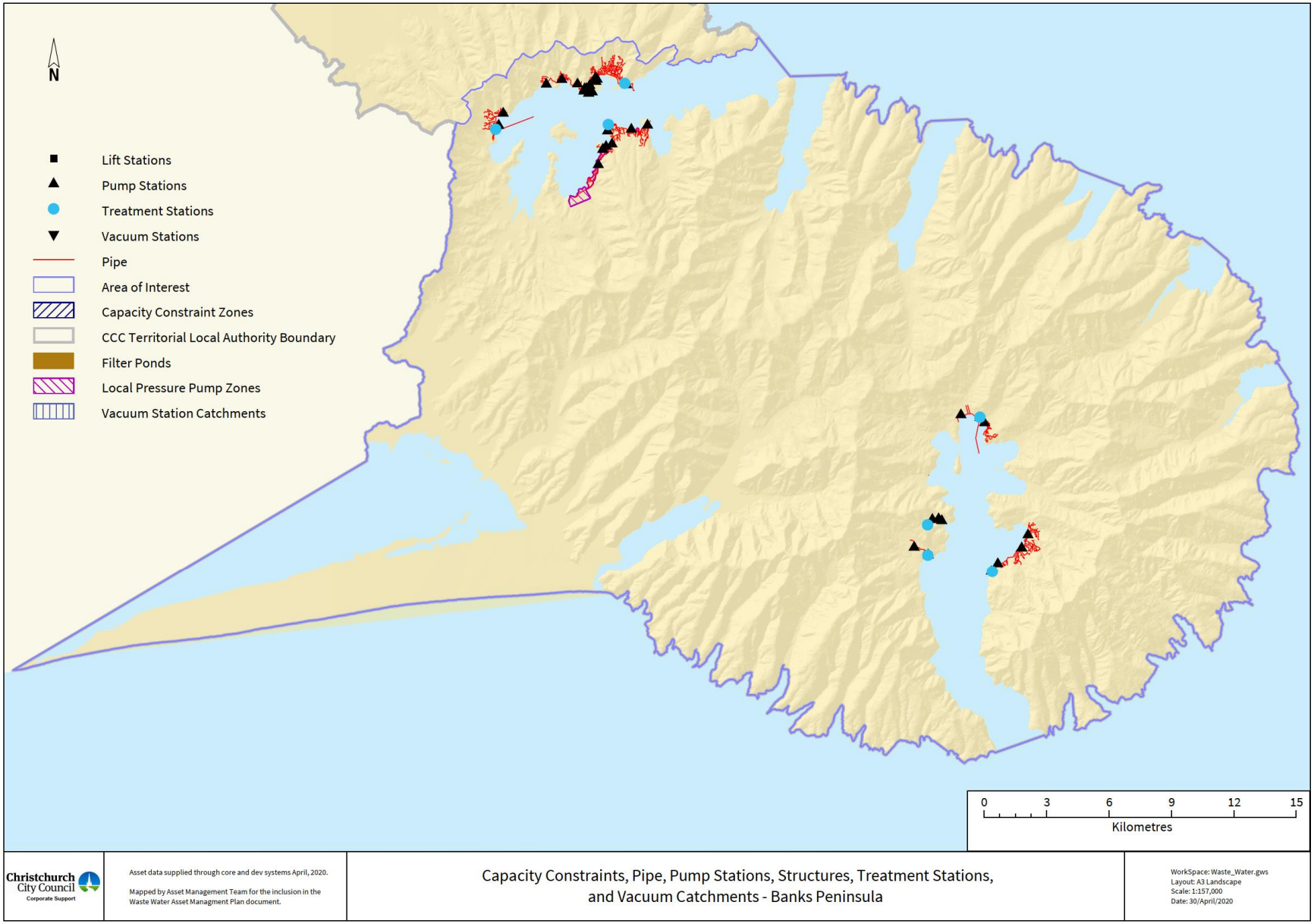


Figure 7-3: Banks Peninsula Water Supply Asset Locations

7.2.2 Condition

Condition assessment of individual assets applies a 1 to 5 scale. **Error! Reference source not found.** describes the grading system.

Condition Grade	Description	Percentage Theoretical Useful Life Remaining
1	Excellent	Life remaining ≥ 50%
2	Good	25% ≤ Life remaining < 50%
3	Average	15% ≤ Life remaining < 25%
4	Poor	5% ≤ Life remaining < 15%
5	Very Poor	Life remaining < 5%

Table 7-2: Asset Condition Grades

7.2.3 Assets with High Consequences of Failure

Consequences of failure, often also referred to as criticality, grades the importance of individual assets to the delivery of the service. Within three waters we do not call this criticality as national data standards limit criticality only to the consequences of failure on service delivery to customers while with consequences of failure we are looking at financial, environmental, cultural, heritage, damage to other infrastructure, health and safety and reputational outcomes as well. In general assets with high consequences of failure receive a higher level of asset management than other assets.

The criteria used for assessing consequences of failure for wastewater assets are defined in the Draft 3 Waters Lifecycle Management Manual (TRIM 16/212372). Consequence of failure assessments have been completed for reticulation assets but criteria are still being developed for station and treatment assets. In the interim a basic criticality concept has been applied for station assets where all assets at the station location are given the same criticality score based on the total flow provided by that station. Consequences of failure are not a criteria that is used explicitly for treatment assets, however the criticality can be inferred by looking at the criticality of the upstream adjoining pipework.

Reticulation asset criticality is covered in more detail with a map showing assets located by criticality in Section 8.1.5.

7.2.4 Asset Performance

National data standards define performance as the ability of an asset to deliver its design function. In the reticulation network this relates to the ability of a pipe to carry the design flow while for a pump this would be the ability to pump the design flow to required pressures. Performance of assets is covered in more detail under performance subsections of respective asset classes in Section **Error! Reference source not found.**.

7.2.5 Asset Repairs Maintenance and Operations

Repair, Maintenance and Operations (RMO) grades are a 1 to 5 score for each asset based on the historical number and frequency of failures and maintenance interventions. RMO assessment currently only applies to reticulation assets and is detailed further in Section **Error! Reference source not found.**.

7.2.6 Network Age and Lifecycle Stage

The age and condition of reticulation assets, station assets and treatment assets are discussed in more detail under condition subsections of respective assets classes in Section 8.

7.2.7 Asset Data Confidence

Table 7-3 summarises the confidence of asset data for wastewater assets while Table 7-4 describes the confidence assessment system. Asset data is held in SAP, GIS and InfoAsset sytems.

Due to historical data collection practices and earthquake rebuild works some areas of the information is known to be incomplete, inaccurate or out of date.

Although the numbers of most assets and asset types are available, detailed data is commonly lacking. The subterranean nature of the majority of the wastewater network makes inspection and data collection difficult.

Asset Group	Data Confidence				
	Quantity	Age	Condition	Performance	RMO
Buildings	Highly Reliable	Reliable	Uncertain	Reliable	Unknown
Electrical and electronic equipment	Highly Reliable	Very uncertain	Uncertain	Reliable	Unknown
Mechanical equipment & plant	Reliable	Uncertain	Uncertain	Uncertain	Unknown
Land	Very uncertain	N/A	Very uncertain	N/A	Unknown
Station Pipework	Highly Reliable	Uncertain	Uncertain	Uncertain	Unknown
Structures	Reliable	Reliable	Uncertain	Uncertain	Unknown
Reticulation	Highly Reliable	Reliable	Uncertain	Uncertain	Reliable
Spares	Uncertain	Very uncertain	Very uncertain	Very uncertain	Unknown

Table 7-3: Asset Data Confidence

Confidence Grade	Description
Highly reliable	Data based on sound records, procedures, investigations and analysis, documented properly and recognised as the best method of assessment. Dataset is complete and estimated to be accurate ± 2%
Reliable	Data based on sound records, procedures, investigations and analysis, documented properly but has minor shortcomings, for example some of the data is old, some documentation is missing and/or reliance is placed on unconfirmed reports or some extrapolation. Dataset is complete and estimated to be accurate ± 10%
Uncertain	Data based on sound records, procedures, investigations and analysis which is incomplete or unsupported, or extrapolated from a limited sample for which grade A or B data are available. Dataset is substantially complete but up to 50% is extrapolated data and accuracy estimated ± 25%
Very Uncertain	Data is based on unconfirmed verbal reports and/or cursory inspections and analysis. Dataset may not be fully complete and most data is estimated or extrapolated. Accuracy ± 40%
Unknown	None or very little data held.

Table 7-4: Asset Data Confidence Descriptions

7.2.8 Asset Data Improvements

The following improvements to data quality are included in the AM Improvement Plan in Section 10.

- Reticulation operation and maintenance data standards and collection
- Operation and maintenance data financial data collection
- Stations and treatment assets data hierarchy and system use refresh
- Stations and treatment assets data inventory collection
- Stations and treatment assets standard condition assessment criteria

7.3 Asset and Network Planning

7.3.1 Asset planning strategies

Te Wai Ora o Tāne Integrated Water Strategy

This is a strategy document that provides Council's vision, goals, objectives and suggested implementation actions for the city's water, wastewater and stormwater services. Asset planning strategies are expected to align with the Integrated Water Strategy.

Asset Assessment Intervention Framework (AAIF)

The AAIF is a project focussed on continuous improvement of the lifecycle management and renewal planning. AAIF uses multiple-criteria to determine which assets should be prioritised for various interventions. Assets are assigned 1-5 grades across a number of schema. Schema completed for wastewater pipes to date include:

- Condition
- Repairs, Maintenance and Operation (RMO)
- Degradation
- Consequences of Failure

A number of asset data sources are used as inputs into AAIF such as condition assessment and operation and maintenance reporting. Collectively these schema provide an overall Risk profile for reticulation assets.

Electrical and Automation Strategy

This is a strategy document that provides the vision, goals, objectives and suggested implementation actions for SCADA and communications systems used to monitor and control the water supply network.

Implementation of this strategy provides information for future planning and renewal planning.

Hydraulic Modelling Strategy

This is a strategy document that provides the vision, goals, objectives and suggested implementation actions to ensure hydraulic models are fit for purpose and available to inform network expansion and operation.

Hydraulic network models

Hydraulic network models representing the physical network asset cover the majority of the reticulated wastewater network. Models are used by the business teams to assist decision making throughout the asset lifecycle; for growth & network planning, operations and maintenance, renewal and asset management.

Optimisation analysis

The hydraulic network models are used to evaluate and optimise network improvement alternatives in order to achieve increased efficiency and compliance. The city-wide wastewater optimisation study informs the wastewater overflow reduction programme.

Master planning

Master planning focused on catchments, water and wastewater supply areas or growth areas provides for the establishment of long-term servicing plans to meet the future demand. As such, annual growth and demand forecasts inform the need for master plans.

Feasibility studies

These are conducted to determine the net benefits of proceeding with a particular option where significant changes in infrastructure provision are anticipated. For example: Lyttleton Harbour basin wastewater scheme, Akaroa wastewater scheme.

Scoping capital projects

A capital project scoping phase is implemented to ensure that the budget for asset renewal is applied in the most effective manner. Council staff investigate those assets that are candidates for renewal and create discrete packages of work that can move into the design phase followed by construction.

7.3.2 Asset Planning Improvements

The following improvements to asset planning processes are included in the AM Improvement Plan in Section 10.

- Collect operation and maintenance data that can be used effectively for asset planning
- Continue to refine the importance of each schema under the AAIF and how each is used for decision-making
- Increase resourcing for condition assessment (i.e. CCTV) where necessary to justify decision-making
- Develop underlying masterplans so that interventions are aligned to long term goals
- Include the strategies required to meet Councils agreed targets of carbon neutrality by 2030 as per the Infrastructure Sustainability Council of Australia (ISCA) documentation

7.4 Asset Creation (Design and Build) and Acquisition

7.4.1 Identifying and recording capital projects

New works are those works that create a new asset that did not previously exist or works which upgrade or improve an existing asset beyond its existing capacity. Assets may be developed by Council, or by developers and then handed over on completion of the development. In this AMP, a number of projects have been identified through consideration of:

- Level of service requirements (Section 3).
- Growth and demand requirements (Section 4).
- Investment in network resilience (Section 5).
- Other asset planning initiatives described in Section 7.3.
- Asset class lifecycle management (Section 8)

7.4.2 Selection criteria

Potential projects for new assets are collated and recorded and then selected using criteria for inclusion into the capital works programme. This process is described below for projects required under each of the heading categories:

7.4.3 Level of Service requirements

These are generally referred to as “Improvement Projects”.

Collated by:

- 3 Waters Asset Planning Team
- 3 Waters Asset Management Team

Identified and documented through the following processes:

- Requirements to support current and future resource consents
- Using the Optimatics software process with hydraulic models to identify the lowest cost option for reducing wastewater overflows to the target level
- Identifying urgent and emerging needs for the wastewater service delivery

Selected for inclusion in capital works programme based on criteria:

- If the project is required for meeting resource consent compliance
- The Optimatics outputs (lowest cost for greatest reduction in wastewater overflows)
- Case-by-case development and presentation of individual project business cases
- Professional judgement

An example is for wastewater overflow reduction where Optimatics runs simulations using pipe unit rates and overflow frequencies to find the greatest reduction in overflows for the least costs

7.4.4 Growth and demand requirements

Collated by:

- 3 Waters Asset Planning Team

Identified and documented through the following processes:

- Growth and demand forecasting
- Hydraulic modelling supported by flow calibration
- Compliance to wastewater overflow and discharge consents
- Service plans for growth areas identified in the District Plan
- Service plans for current unserved areas
- Infrastructure master plans
- Other plans including; wastewater optimisation plan, urban development strategy

7.4.5 Investments in network resilience

Risk and resilience is generally considered in conjunction with asset renewal, growth and demand, and regulation compliance. As a tactic to improve resilience within the capital work programme, Council look to add logical and often low cost resilience measures to the renewal, improvement and growth projects.

Collated by:

- No specific team

Identified and documented by:

- Risk and resilience workshops
- Increased resilience awareness and mindset
- Asset management plans

7.4.6 Asset class lifecycle management

- Discussed in detail in Section 8

7.4.7 Asset Design

The design phase is where a lot of value can be added to the project. The aim is to report whole-of life costing (Capex + Opex) for the whole project when considering design options. We use todays' dollars to report, for the purposes of simplicity.

During the asset design phase the following mechanisms are used that contribute to successful whole-of-life asset management outcomes:

Updating costs estimates

Project costs are prepared during the initial project brief, then updated during preliminary design and detailed design. This allows the budget expectation adjustments throughout design to ensure delivery of maximum value from the project.

Predicting operation, maintenance and monitoring requirements

These requirements are outlined during the initial project brief and then refined during the design phases. This helps convey understanding of the longer term requirements and costs that accompany the project and allow other parts of Council's City Services Unit to plan.

Risk assessment and workshops

Risk registers created during the initial project brief are maintained, monitored and updated throughout the project lifecycle. Regular risk workshops allow different perspectives for consideration when identifying risks. During project closure, the final risk register identifies the residual risks for transfer to the relevant stakeholder.

Safety in design

Safety in design workshops occur the design phase to identify any design changes that can be made to maximise safe constructability and the long term safe operation, maintenance and monitoring of the asset.

Hazard and operability study (HAZOP)

HAZOP workshops take place during the design phase to systematically identify issues with more complex assets such as stations and treatment plants to identify and evaluate problems that may eventuate during operation, maintenance and monitoring.

An increase in requirements for Building Information Modelling (BIM) models to support HAZOP and safety in design workshops is underway.

Sustainability workshops

Sustainability workshops can take place during the design phase to identify issues and opportunities to improve environmental and sustainability outcomes, such as measuring and reducing carbon footprint, through design changes.

Resilience checklist

A resilience checklist is used as resilience baseline in the planning or design phase of a project, and again towards the end of the project lifecycle to check if resilience to natural hazards, changing climate conditions, and other anticipated future disruptors has been improved. The checklist is also used as a gaps/needs analysis to identify areas for improvement, where further emphasis and resourcing is required to improve resilience.

Options reports

If value-add opportunities are identified the design phase can pause while options reports are prepared to consider the benefits of potential changes in project scope.

Design Standards and Guidelines

Council maintains the Infrastructure Design Standard (IDS), Construction Standard Specification (CSS) and approved materials list. These standards list the materials that can be used on wastewater construction and the parameters that must be met by the designs. The CSS and IDS are used by designers to ensure the final design meets Council requirements. Council have a number of other design guidelines and documents and is in the process of integrated or linking these to the IDS.

Where design requirements introduce additional steps, such as sustainability workshops and climate change impact assessments, these introduce new costs to the design phase of capital projects that need to be taken into account when forecasting activity costs.

7.4.8 Capital Investment Programme

Section 9 details the wastewater capital investment programme.

7.4.9 Management of Vested Assets

Property vesting is handled through the Council property consultancy, but service-providing assets must be approved as compliant to Council requirements by the business unit which is accepting them for operational purposes. Vesting agreements do not proceed for assets which fail to meet requirements.

Capital works are carried out to adhere with standard Contract documents which list Council's design, specification and construction documents that the works must accord with. If provision of the required quality assurance records, compliance with Contract and/or Consent documents and provision of asset data demonstrates the quality of construction, then assets are accepted for hand over. Once the asset has been accepted by Council, the asset information is captured within the asset management systems, and provision made for the appropriate operation and maintenance of the asset, according to the life-cycle plan for that asset.

7.4.10 Asset Creation and Upgrade Improvements

The following improvements to asset creation processes are included in the AM Improvement Plan in Section 10.

- Whole of life costs and anticipated maintenance requirements estimated at design phase;
- Complete the works highlighted by the Asset Management Unit to improve the Asset Data Handover Process including the empowerment of staff in Roles and Responsibilities

7.5 Operations and Maintenance

7.5.1 Portfolio-level O&M Strategies

Current strategy is based on executing the conditions of the maintenance contract within the contract budget. The annual contract budget is agreed through negotiation each year and is largely based on previous years' budgets and the maintenance outcomes achieved. Throughout the year the maintenance effort is managed to balance the budget under the contract and the expected level of maintenance.

Further work has been identified to formalise the maintenance strategy, basic maintenance requirements, categorisation of maintenance costs and the desired split between proactive and reactive works.

Figure 7-4 shows the value of proactive and reactive work carried out under Maintenance Contract over the previous four years.

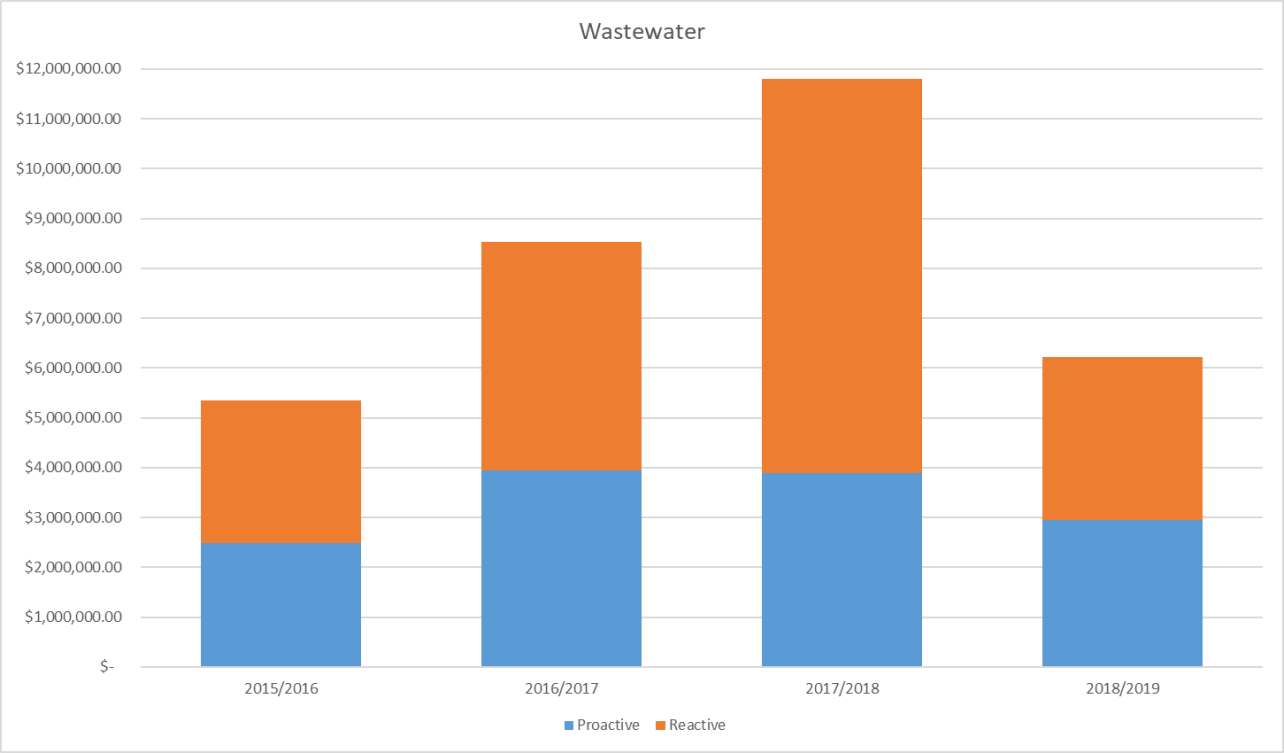


Figure 7-4: Historic Wastewater Maintenance Contract Costs

The ratio of preventative to reactive maintenance is generally 50%/50%. A large portion of the proactive maintenance is cleaning, and inspection throughout the network and at pump stations. The reduction in maintenance 2017/2018 to 2018/2019 is reflective of a focussed effort to reduce costs under the maintenance contract.

The maintenance cost breakdown for reticulation, stations and treatment assets is provided separately in Section 8.

7.5.2 Operations and Maintenance Improvements

The following improvements to operations and maintenance processes are included in the AM Improvement Plan in Section 10.

- Formalise maintenance strategy
- Specify maintenance requirements at an asset level and considering criticality

- Measure effectiveness of preventative maintenance over time and adjust frequency of intervention
- Risk based maintenance strategy – criticality
- Proactive CCTV assessment
- Collect O&M data to inform decision making
- Collect O&M financial data at sufficient detail to inform decision making. Including OPEX costs outside of maintenance contract

7.6 Renewals

7.6.1 Portfolio Renewal Strategies

Renewal expenditure is major work which does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing asset to its original or lesser required service potential. Work over and above restoring an asset to original service potential is upgrade/expansion or new works expenditure.

Where possible, renewals planning uses a risk based approach that considers the condition and criticality. For some asset groups there is a lack of key data (such as condition and install data) to effectively inform renewals planning and in these situations it has been necessary to make assumptions based on the data that is available and anecdotal information from staff involved with the day to day management of the assets.

The general renewal strategy is to either replace or rehabilitate assets when justified by:

1. Age and condition – the age or condition of the asset will result in a condition based failure.
2. AAIF project - the project aims to provide an on-tool renewals planning process that is evidence based, transparent, documented, fast and repeatable. Under the AAIF assets are assigned 1-5 grades across a number of schema. Schema completed for wastewater pipes to date include:

    - Condition
    - Deterioration
    - Consequences of failure
    - Repairs, Maintenance and Operation (RMO)

    AAIF uses multiple-criteria to determine which assets should be prioritised for various interventions. Rules and weightings around these schemas allow renewal planning to be aligned with Council strategic priorities and requirements of elected representatives. The AAIF process includes the advancement or delay of renewals based on consequences of failure to develop different risk profiles.

    A number of asset data sources are used as inputs into AAIF including district plan rules, LIDAR surveys, national databases, ECan databases and internal Council models.

3. Asset Performance – when it fails to meet the required Level of Service. Non-performing assets can be identified, often following an unspecified event, by factors such as:

    - Repeated asset performance failure
    - Structural failure (condition based)
    - Excessive maintenance requirements
    - Ineffective and/or uneconomic operation
    - Exceedance flooding

4. Risk – the risk of failure of the asset and the associated financial, environmental and social impact justifies action.
5. Economics – the cost of maintenance for that asset component is deemed to be uneconomic to continue repairing the asset when the annual cost of repairs exceeds the annualised cost of renewal. Economic factors may also come into consideration in order to co-ordinate renewals with other major works. This model of economic cost does not consider effects on other Council directives such as the community well-being outcomes. As Councils asset management systems matures, then perhaps other models of economic cost can be considered.
6. Political and Community Feedback – Any feedback received from political or community sources that influence or change decision making.

Renewal detail is covered in detail in Section 8 under the separate asset class categories of: reticulation, stations and treatment.

7.6.2 Renewal Process Improvements

Renewal process improvements are covered in detail in Section 8 under the separate asset class categories of: reticulation, stations and treatment.

7.7 Asset Disposal

Disposal includes any activity associated with disposal of a decommissioned asset including sale, demolition or relocation. Any revenue gained from asset disposals is accommodated in Council's long-term plan.

Asset disposal is covered in detail in Section 8 under the separate asset class categories of: reticulation, stations and treatment in accordance with the Council's Disposal Policy[8].

[8] Asset, Equipment and Materials Disposal Policy *TRIM://18/8676160*

8 Lifecycle Management Plans

8.1.1 Reticulation Issues and Priorities

Key Issue	Priority for this Plan
Aging assets and deferred renewals	Addressing the renewal of pipes with assessed poor condition (including legacy earthquake damage) from CCTV records
Replacing (or rehabilitating) concrete pipes	The large cohort of old and poorly performing concrete pipe forms a significant part of the renewal strategy
Reducing wastewater overflows	Targeting a reduction in I&I. Prioritising pipe renewal for public mains with infiltration defects. Increase resourcing to target I&I from laterals
Optimising renewal intervention strategy	Embedding a process of condition assessment, and renewal/rehabilitation option selection as part of early design
Reducing reactive maintenance	Prioritising pipe renewal based on risk and using maintenance history data effectively
Increase maturity and transparency of investment decision-making	Use the outputs of the AAIF to inform renewal criteria and integrate with growth and improvement criteria
New approach in renewal budget forecasting	Collect data to calibrate renewal forecasting tool
Aging assets and deferred renewals	Use the outputs of the AAIF to inform renewal criteria and integrate with growth and improvement criteria

Table 8-1: Reticulation Issues and Priorities

Wastewater reticulation includes gravity mains, manholes, pressure mains, low pressure sewer systems, vacuum sewer mains and chambers, and connections. Asset management effort is typically focussed on the mains (gravity/pressure/vacuum) as these make up the majority of the value of the reticulation network. At a programme level it is assumed that the auxiliary assets connected to mains are part of that asset and included in the cost of any treatment such as renewal.

Low pressure sewer systems and vacuum sewer reticulation assets are relatively new (built following the 2010/2011 earthquakes) and have their own lifecycle management programmes outside of the reticulation renewal programme.

The Asset Assessment Intervention Framework (AAIF) described in Section 7.3.1 is improves asset management maturity by providing a transparent, repeatable, accurate and fast process for determining renewals requirements. AAIF is operational for reticulation, determining renewals requirements through a multi-criteria assessment based on the following criteria:

- Condition
- Repairs, Maintenance and Operation (RMO)
- Degradation
- Consequences of Failure

The Lifecycle Management Manual (TRIM 16/212372) lists full details on the criteria and the overall AAIF process.

8.1.2 Reticulation Age and Condition

Asset Condition

Wastewater reticulation condition grades use the 1 to 5 scale as described in Section 7.2.2. CCTV inspection results are the primary source of wastewater reticulation condition data with valid inspections recorded for 52% of mains. The remaining 48% have an estimated condition grade based on installation year. These theoretical useful lives are based on industry guidelines and staff knowledge.

The oldest reticulation assets still in use date back to 1882 in Christchurch City, 1885 in Akaroa, 1900 in Lyttelton. Typically a network dating back to 1880 with building booms in 1910-1920, 1950-1960 and the 1980s, there would be a very large cohort of pipes approaching end of life at the same time. For Christchurch a significant portion of the reticulation network was renewed

after the earthquakes and this peak is not as pronounced. Installation dates and materials of the Council wastewater reticulation network is shown in Figure 8-1 below.

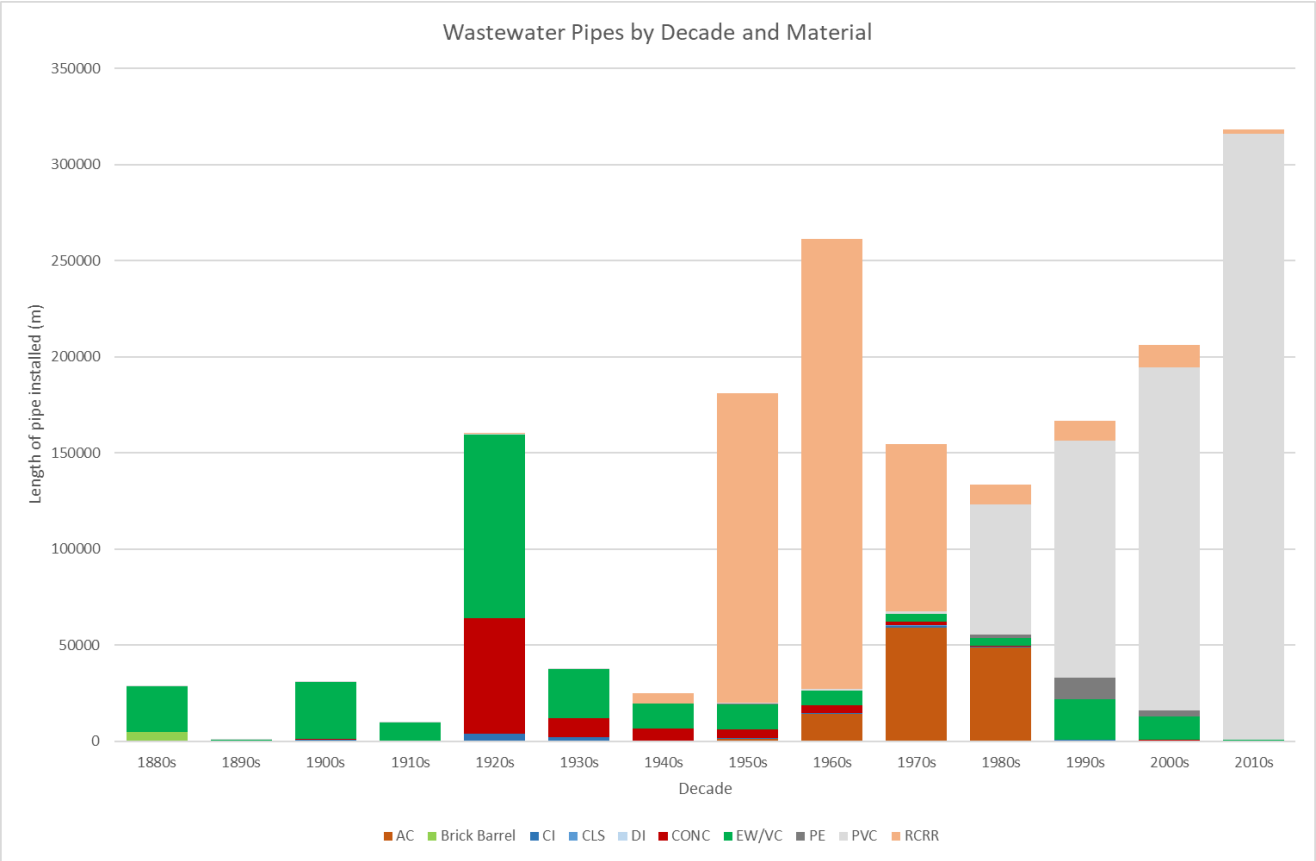


Figure 8-1: Pipe Installation Decades

The overall condition profile of the Council wastewater reticulation network is shown in Figure 8-2. This figure indicates a significantly improved condition profile compared to previous AMPs, due to the new condition grading process developed as part of the AAIF project.

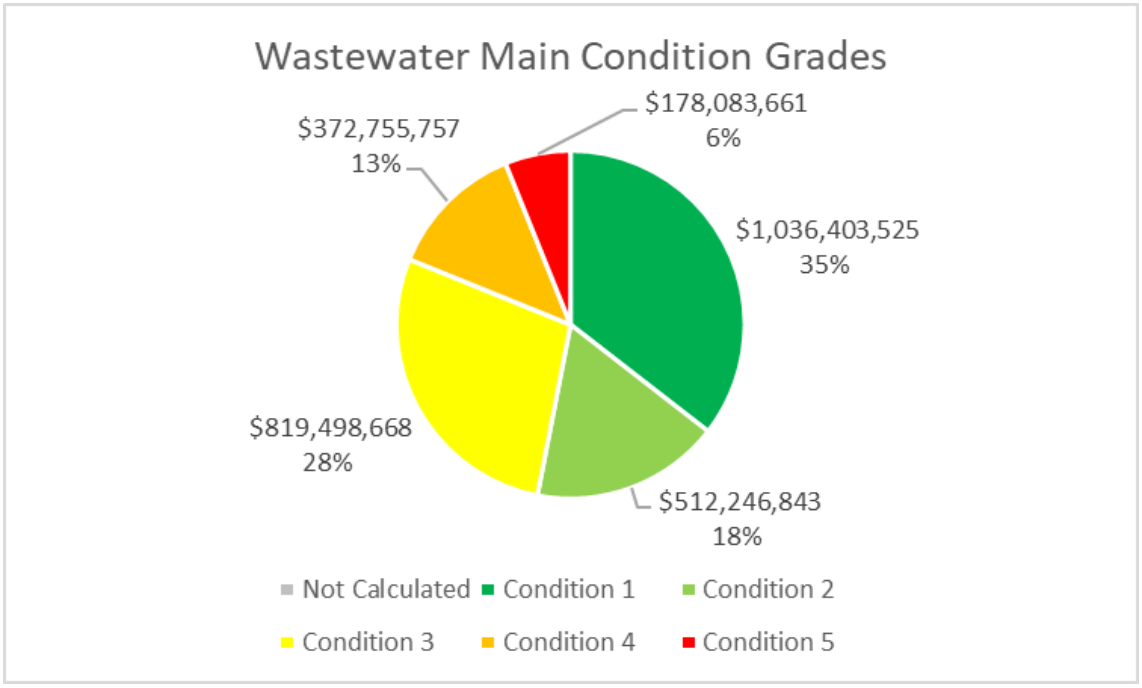


Figure 8-2: Wastewater Main Condition

CCTV inspections are targeted at pipes approaching the end of their lives. The proportion of condition grades based on CCTV evidence is 64% for condition 4 pipes, and 95% for condition 5 pipes. Continued proactive CCTV inspection is essential to maintain these levels of condition grade confidence.

Damage to wastewater pipes includes:

- Cracks and breaks from ground movement, including movement from construction, traffic or earthquakes.
- Corrosion of cementaceous pipes from hydrogen sulphide gas given off by wastewater.
- Changes in pipe levels when ground has liquefied or moved.
- General deterioration and loss of strength from age.
- Corrosion or abrasion of pipe interiors from discharge of harmful substances.

A higher proportion of earthquake damage was to the older, more brittle pipes. However, newer pipes also suffered damage. Earthquake recovery budget limits mean that some of this legacy earthquake damage remains. RCRR pipes make up a large proportion of the remaining poor condition pipes, both due to their brittle nature and the corrosive effects of sewer gases. This is shown in the breakdown of the condition 5 pipes shown in Figure 8-3.

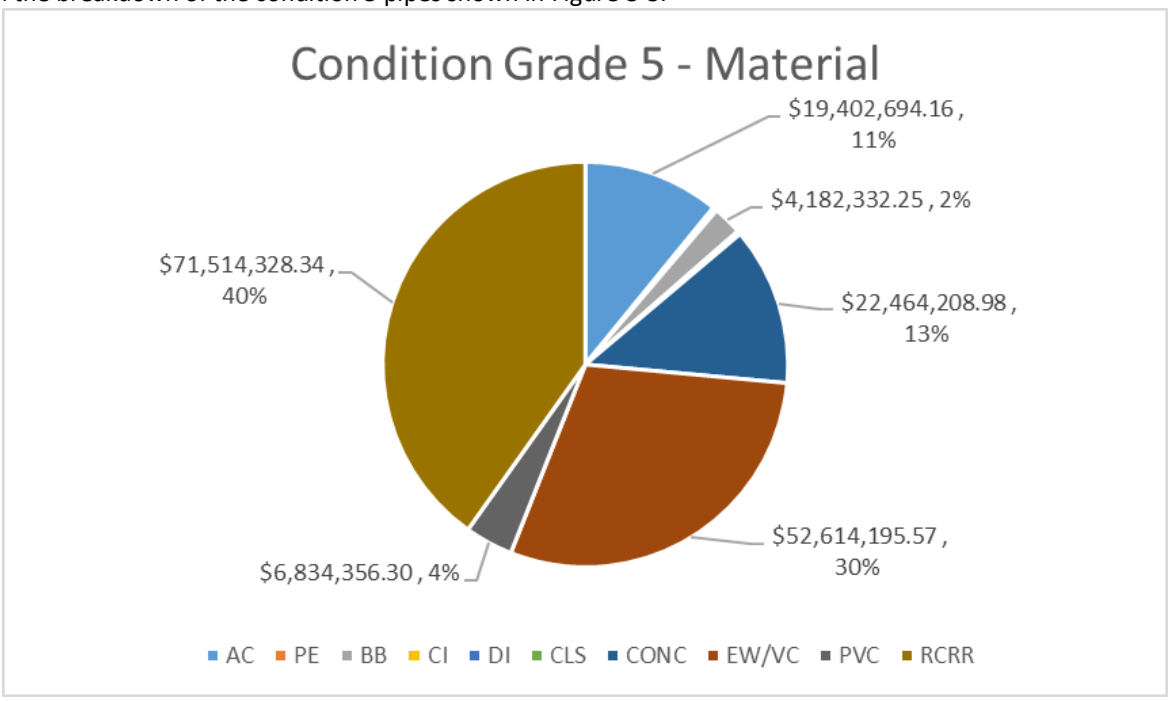


Figure 8-3: Breakdown of the condition 5 pipes by material

Figure 8-4 shows condition grades over the Christchurch water supply network by location.

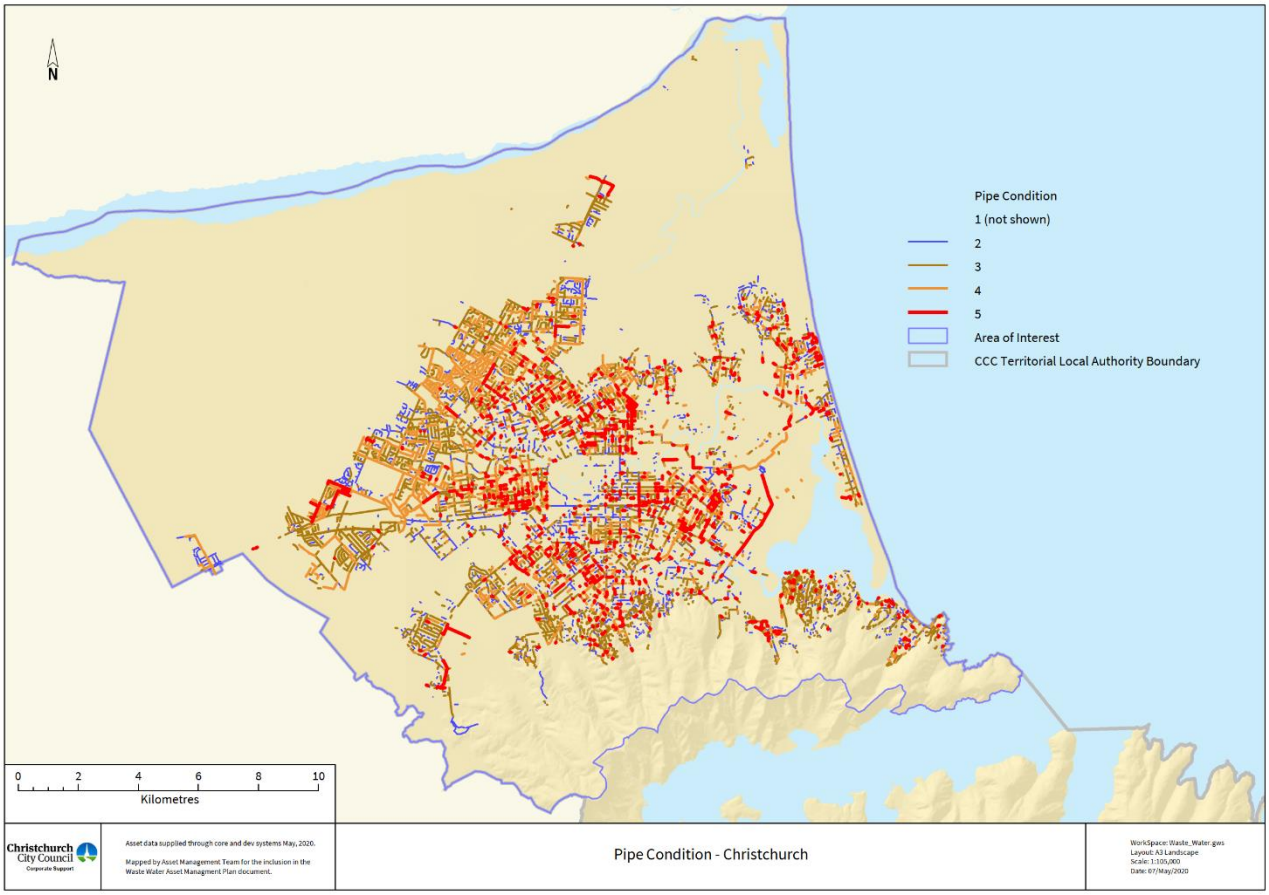


Figure 8-4: Wastewater Pipe Condition Map

8.1.3 Reticulation Repairs, Maintenance and Operation (RMO) Grading

The repairs, maintenance and operation (RMO) assessment provides a score of 1 – 5 based on estimating the amount of maintenance intervention required to keep each pipe operating.

Maintenance interventions include flushing, root cutting and clearing blockages. Pipe dips and other recorded defects likely to cause blockage are also considered.

The RMO schema uses the digital maintenance records of which assets have required operational interventions and the frequency of them as well as the CCTV results for root intrusion and dipped pipes.

Condition monitoring and proactive maintenance intervention has a relatively low cost compared to renewal. Some maintenance issues such and fat or foreign object blockage do not relate to pipe condition. For these reasons, the RMO criteria is not used as the primary criteria for determining end of useful life. RMO is used to pinpoint where poor condition pipes result in high maintenance, and therefore should be prioritised within renewal programmes.

The RMO profile for wastewater pipes is shown in Figure 8-5 below.

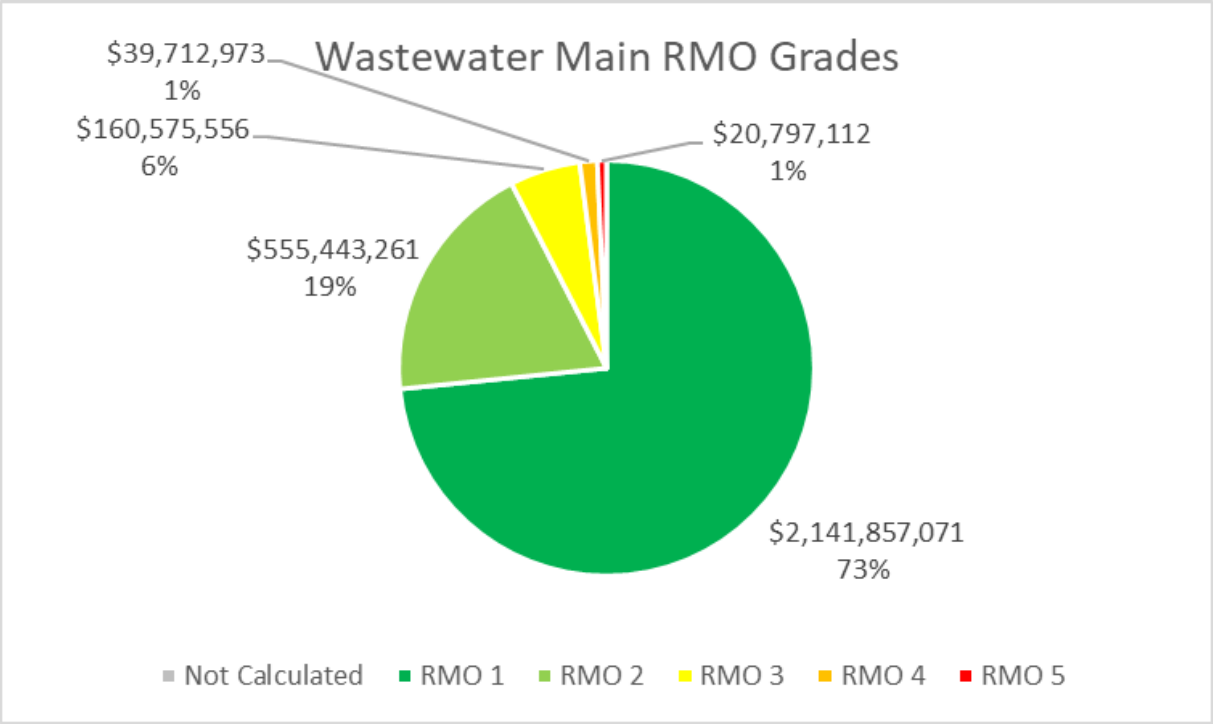


Figure 8-5: Wastewater main RMO grades

Locations of the different RMO graded pipes throughout the City is shown in Figure 8-6.

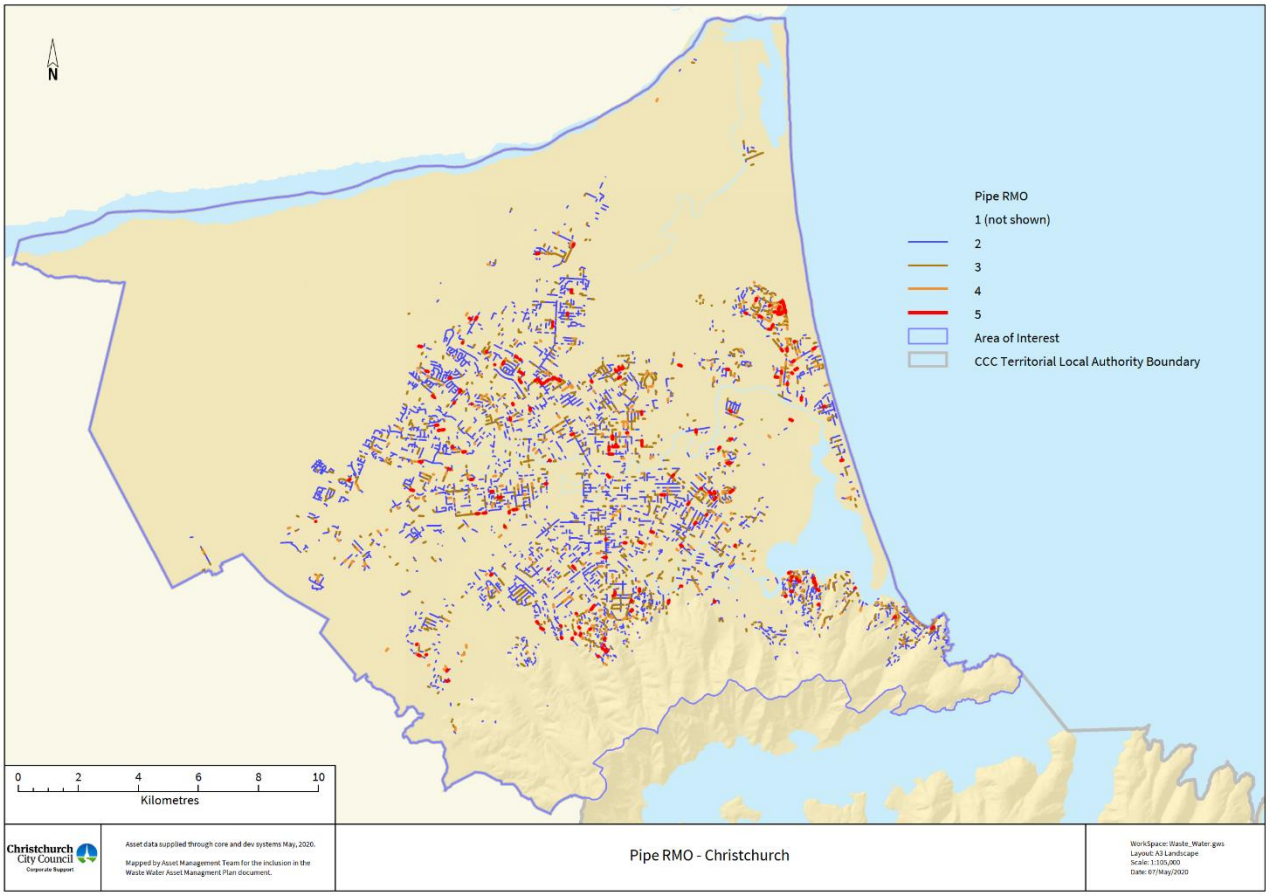


Figure 8-6: Wastewater pipe RMO Map

8.1.4 Degradation

The degradation parameter is an AAIF 1-5 score for identifying pipes likely to deteriorate faster or slower than average.

Degradation scores for wastewater reticulation depend on these parameters:

1. Exposure of the pipe to pressure spikes. Pressure spikes from pump starts and stops correlate to early failures.
2. Exposure of the pipe to groundwater. Corrosive groundwater leaches lime from cementacous pipe materials and accelerates corrosion on ferrous pipe materials.
3. Exposure of the pipe to hydrogen sulphide gas. Hydrogen sulphide transforms into sulphuric acid which damages the pipes.
4. Exposure of the pipe to tree roots. Plants seek water and roots crack or break pipes to access the water inside.

Degradation grades are used to adjust the theoretical useful lives of pipes to estimate condition and prioritise renewal.

8.1.5 Reticulation Consequence of Failure

For reticulation assets the concept of criticality is covered under the title of "consequences of failure". The consequence of failure AAIF schema is aligned with the Council risk policy and is covered in more detail in the Lifecycle Management Manual (TRIM ref 16/212372).

Some pipes have a unique consequence of failure due to being so old that they are archaeologically significant sites requiring special attention if exposed and renewed. Pipes falling into this category are typically the larger brick and rock constructed pipes.

Figure 8-7 shows the consequence of failure profile for wastewater reticulation.

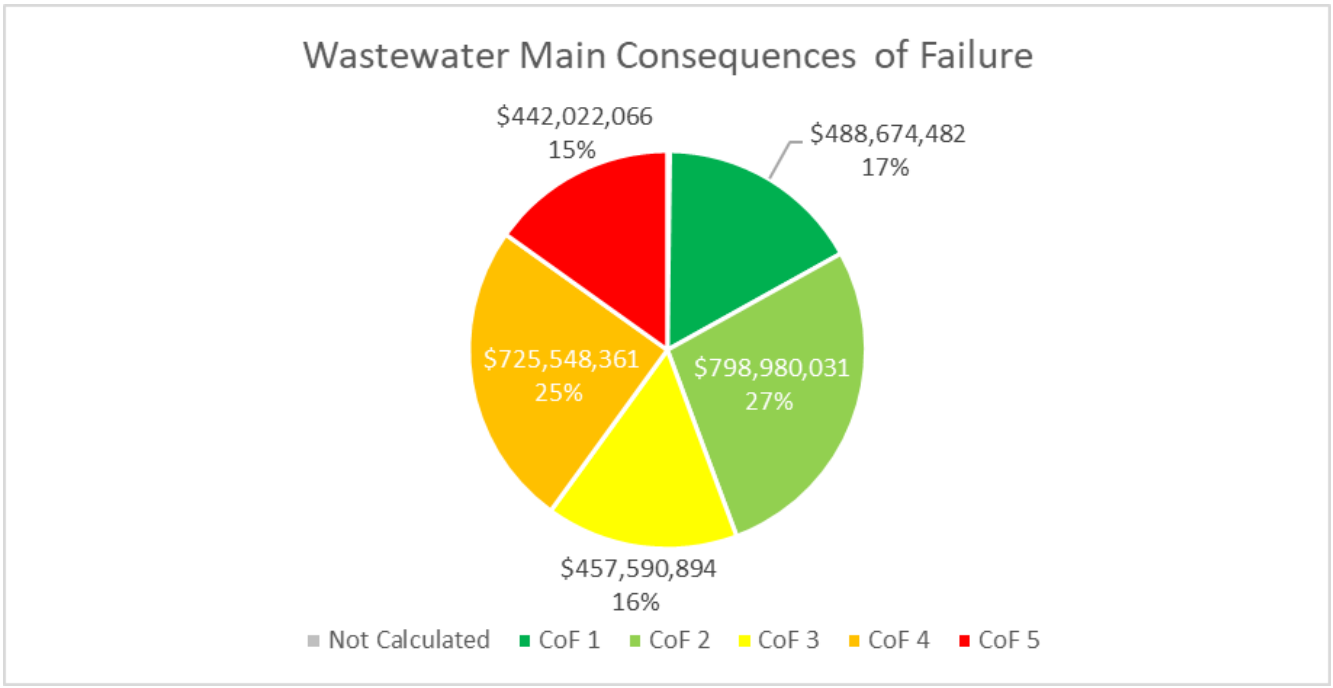


Figure 8-7: Consequence of failure profile for wastewater reticulation

Pipe consequence of failure grades are shown by location for Christchurch City in Figure 8-8.

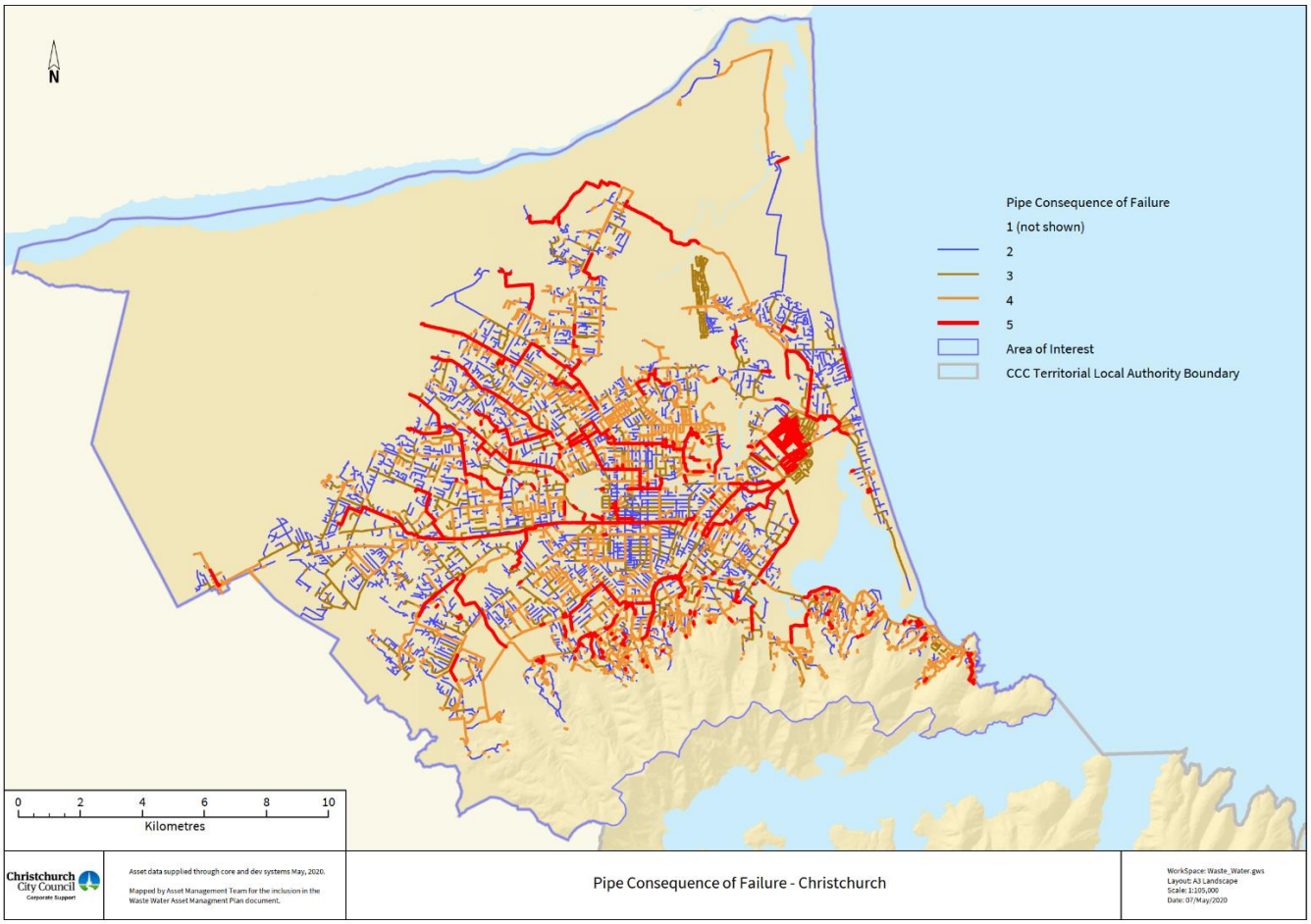


Figure 8-8: Pipe Consequence of Failure Map

8.1.6 Reticulation Renewals Plan

Completion of this AMP included calculation of three options for renewals budgets. Definitions of these budget options are:

- Required renewals budget: Capital budget required to keep providing the water supply service with no OPEX cost increases and no decrease in levels of service.
- Recommended renewals budget: Capital budget required to keep providing the water supply service while minimising OPEX cost increases and returning to current levels of service as quickly as possible. This option provides a sustainable level of investment.
- Proposed renewals budget: Maximum capital investment we can afford to spend while minimising rates increases and not cutting funding to other activities.

Parameters Applicable to All Budgets

Council's AAIF tool provided budgets for all three options; this tool optimises renewals and reduces risk.

Consequences of failure of existing pipes are difficult to change, but risk minimisation is possible by reducing the likelihood of failure. Applying a condition assessment programme focussing on high consequence of failure pipes as per section 7.2.2 will provide an accurate estimate of failure year. Budgets assume a median level of risk mitigation by programming renewal of very high consequence of failure pipes six years before and high consequence of failure pipes three years before the estimated failure year. Attempts at other levels by changing the three and six years showed insufficient risk mitigation with lower values and significant cost increases with higher values.

The AAIF tool calculates a priority score for each individual pipe renewal using consequence of failure grades, RMO grades, break history, degradation grades and other data. Where the recommended and proposed budgets allow less expenditure than the required budget the lowest priority pipes are deferred until later years.

Council and market resource to deliver projects is a consideration for the recommended and proposed budgets. Large budget changes will mean that budget exceeds resource so not all renewals can be completed or that resource exceeds budget potentially resulting in companies closing and loss of resource for future years where budgets increase again. Discussions with project managers suggest limiting budget change between years to 15% and a minimum 5-year plateau at peak budget is a sustainable level of budget change.

Required Renewals Budget

Figure 8-9 shows the reticulation renewals required to maintain the current level of service and prevent operational cost increases. Each column of the figure is total expenditure over a three-year period. Colours in each column show the consequences of failure of the pipes proposed for renewal.

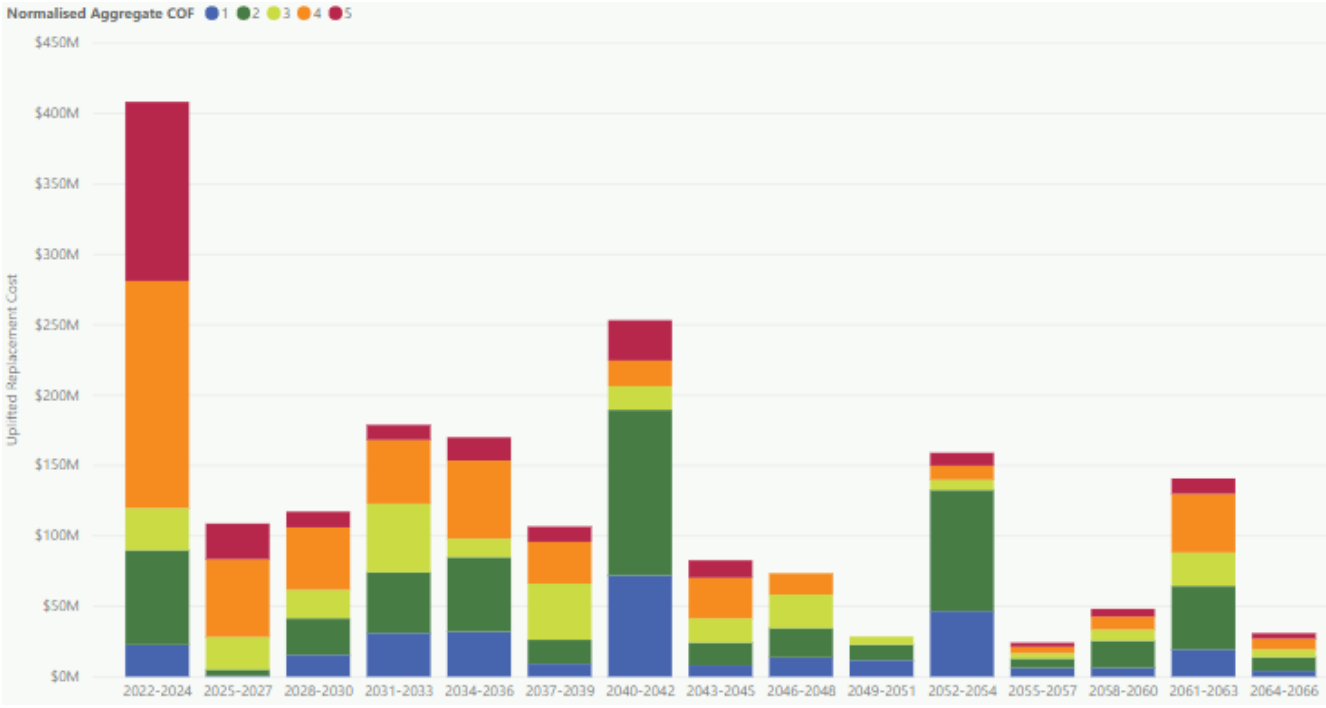


Figure 8-9: Required Wastewater Reticulation Renewals Budget

Although each column in Figure 8-9 covers a three-year period, even allowing for annual expenditure one third of each column the costs are neither affordable nor sustainable for the contracting market. As this level of investment is undeliverable, there is no choice except spreading renewals over a longer period and allowing a level of service decrease in the meantime.

Recommended Renewals Budget

Figure 8-10 shows the recommended budget to return to current levels of service as soon as possible with minimal additional operational costs. Each column of the figure is total expenditure over a three-year period. Colours in each column show the consequences of failure of the pipes proposed for renewal.

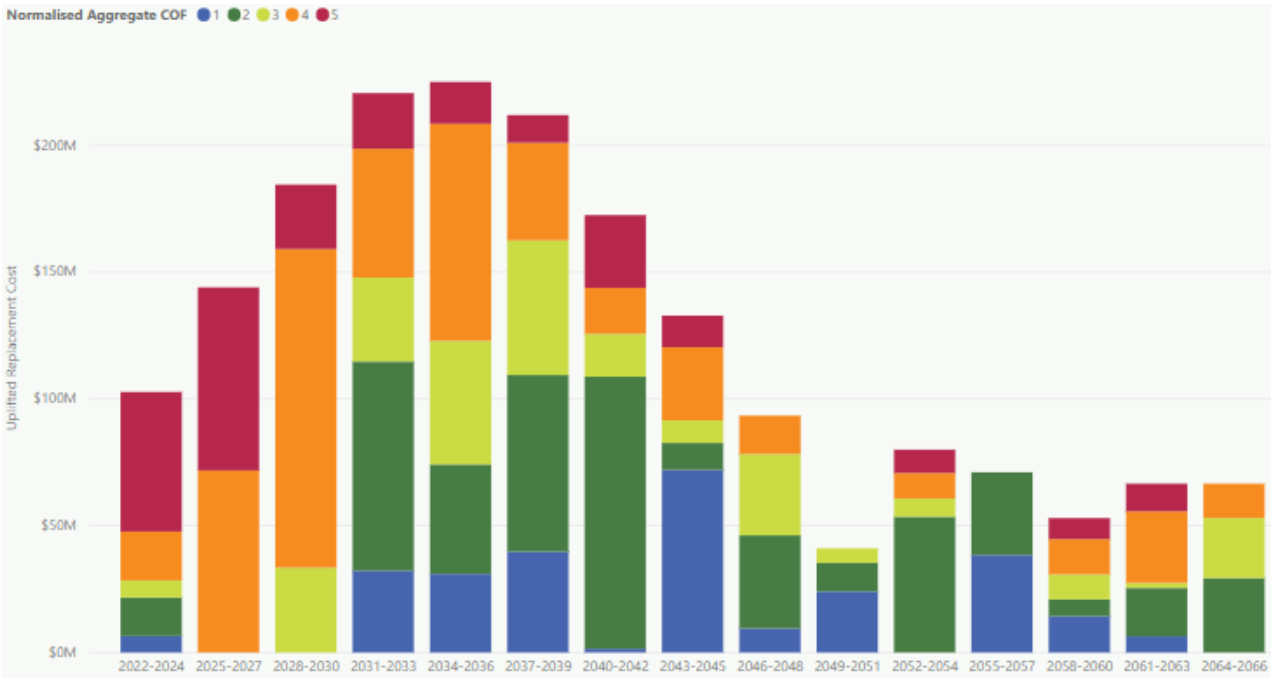


Figure 8-10: Recommended Wastewater Reticulation Renewals Budget

The recommended budget provides a sustainable market for delivery of the projects and allows for return to current levels as soon as possible with minimum additional blockages and overflows. This budget has high costs out to 2045 that may require rates increases or reduction of Council expenditure on other activities to achieve.

Fitting the required renewals to a budget requires deferral of any projects where the required renewals exceed the recommended renewals. Of the $289 million of very high and high consequence of failure wastewater reticulation identified for renewal in the 2022-24 period under the required renewals option, the recommended option only has $74 million over the same period. This means deferral of $215 million of very high and high consequence of failure wastewater reticulation is occurring. These deferrals reduce the effects of risk mitigation and increase the risk of blockages and overflows of large volumes or to sensitive areas.

Proposed Renewals Budget

Figure 8-11 shows the proposed budget minimise rates increases and maintain funding to other Council activities. Each column of the figure is total expenditure over a three-year period. Colours in each column show the consequences of failure of the pipes proposed for renewal.

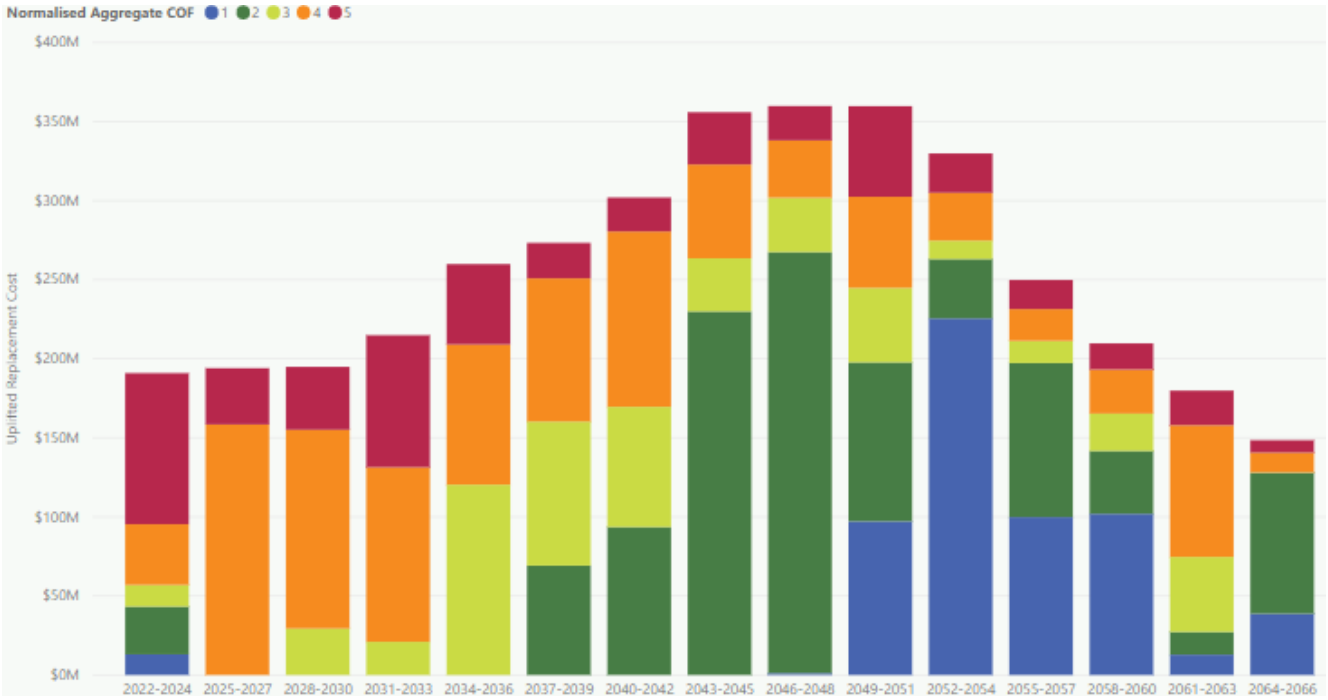


Figure 8-11: Proposed Wastewater Reticulation Renewals Budget

The proposed budget fits within Council's financial strategy for no or minimal rates rises and no funding cuts to other Council activities and is sustainable for the market to deliver.

The proposed budget requires more deferrals than the recommended budget with only $68 million of very high and high consequence of failure wastewater reticulation remaining in 2022-24 compared to $289 million under the required budget. This means deferral of $221 million of very high and high consequence of failure wastewater reticulation is occurring.

These deferrals further reduce the effects of risk mitigation and increase the risk of important facilities such as hospitals and lifeline facilities losing wastewater service. Very high consequence of failure pipes are highest priority so deferral of any very high consequence of failure pipes means there is also significant deferral of low consequence of failure pipes. While deferral of low consequence of failure pipes does not have the same risks in term of essential facilities, it does increase the risk of customer satisfaction dropping.

Implications of Budget Choices

Table 8-2 summarises the three budget options.

Financial Year	Required Budget	Recommended Budget	Proposed Budget
2022	$225.4	$30.0	$32.0
2023	$225.4	$34.5	$32.5
2024	$225.4	$39.0	$32.5
2025	$77.1	$43.5	$32.5
2026	$77.1	$48.0	$32.5
2027	$77.1	$52.5	$32.5
2028	$136.5	$57.0	$32.5
2029	$136.5	$61.5	$32.5
2030	$136.5	$66.0	$32.5
2031	$123.5	$70.5	$32.5
10 Year Total	**$1,440.5**	**$502.5**	**$324.5**
30 Year Total	**$4,265.2**	**$1,568.4**	**$1,355.5**

Table 8-2: Reticulation Renewals Budgets (millions of dollars, uninflated).

The inability to afford or deliver the required renewals budget means that there will be a reduction in level of service and increase in failures and the operational cost to repair them irrespective of the actual final budget. A balance is required to ensure the final budget is affordable yet remains sufficient to maintain an acceptable level of service, does not cause an unacceptable operational cost increase and does not permit the network to fall to a poor condition that cannot be recovered from. Figure 8- shows the thirty-year projections for additional operational cost (columns) and network condition (lines) for the recommended and proposed budgets.

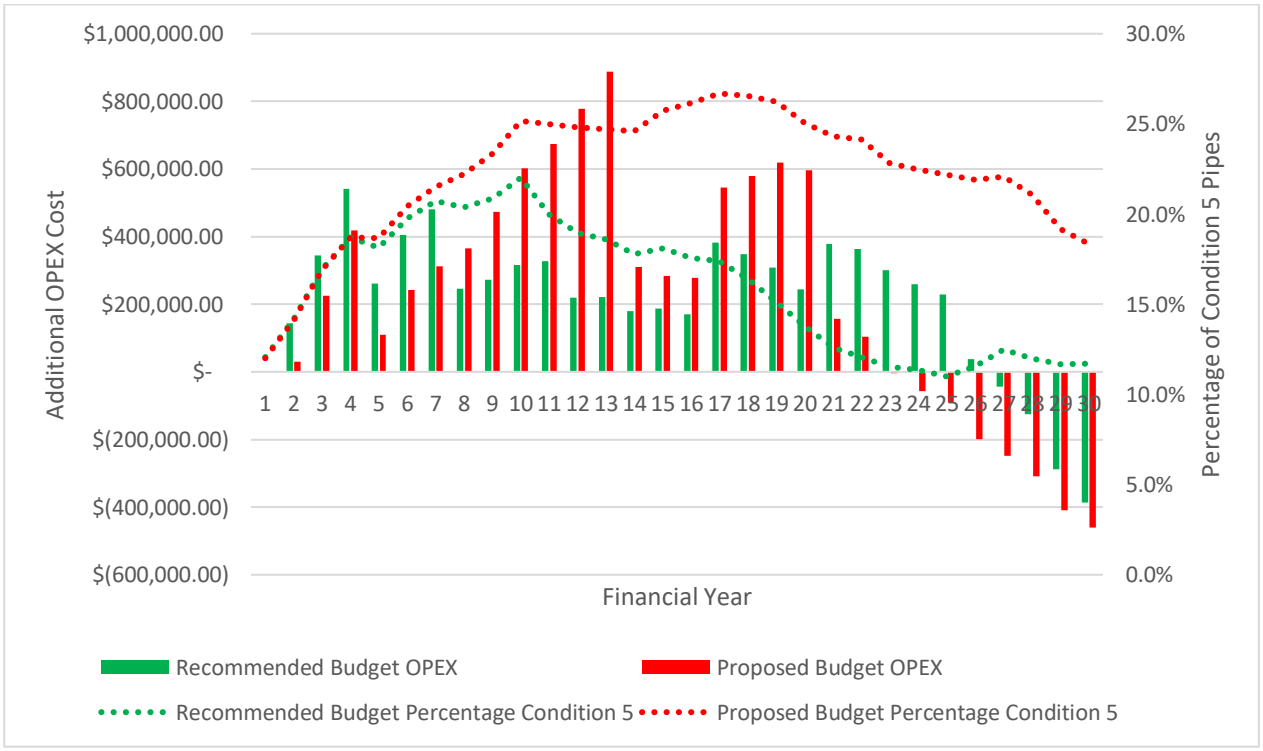


Figure 8-12: Effects of Budgets on OPEX and Network Condition

Examining Table 8-2, both the recommended and proposed budgets have similar thirty-year totals for CAPEX and return back to the current level of interruptions per thousand properties within thirty years. The ten-year totals show the proposed budget is lower in the first ten years than the recommended budget indicating the proposed budget defers expenditure into the later twenty years. Deferring renewal of failing pipes will result in additional operational costs and a decrease in network condition. Selecting the proposed option will add an additional $6.8 million operational cost over the next thirty years compared to $6.3 million for the recommended budget. More significantly, the proposed option shows a significantly worse network condition for a longer period. This will likely result in more overflows and blockages. Modelling for additional overflows and blockages is inconclusive and forecasts for these outcomes cannot be prepared.

Reticulation Renewal Scheduling by Year for the First Three Years

Individual pipe renewal projects are finalised three years prior to their expected construction date. This scheduling assigns the LTP budgets into funding for the individual projects.

Renewals scheduling introduces further considerations:

- Packaging of renewals into projects by location and type to achieve economies of scale.
- Deconfliction to ensure wastewater renewals occur first, then water supply, then stormwater followed lastly by road reconstruction or resealing.
- Further prioritisation of renewal to account for any new condition related failures.

This is a time-intensive process for the asset engineers, and is therefore performed after LTP budgets are finalised.

Other Reticulation renewals Budgets

Financial Year	Lateral Renewals (millions)	Manhole Renewals (millions)	Reactive Renewals (millions)	Transport Related Renewals (millions)	Local Pressure Sewer Renewals (millions)
2022	$ 2.5	$ 0.3	$ 0.5	$ 3.3	$ 0.1
2023	$ 1.2	$ 0.5	$ 1.9	$ 3.6	$ 0.2
2024	$ 0.7	$ 0.6	$ 2.4	$ 3.0	$ 0.6
2025	$ 0.7	$ 0.5	$ 2.6	$ 3.0	$ 1.4
2026	$ 0.6	$ 0.5	$ 2.7	$ 3.0	$ 3.5
2027	$ 0.5	$ 0.5	$ 2.8	$ 3.0	$ 1.3
2028	$ 0.2	$ 0.5	$ 2.9	$ 3.0	$ 1.4
2029	$ 0.2	$ 0.7	$ 2.9	$ 3.0	$ 1.6
2030	$ 0.2	$ 0.7	$ 2.9	$ 3.0	$ 1.8
2031	$ 0.2	$ 0.7	$ 2.9	$ 3.0	$ 2.1

Table 8-3: Other Reticulation Renewals Budgets

In addition to the budgets for wastewater reticulation renewals there are additional budgets for other elements of the reticulation network. Table 8-3 lists these budgets.

Renewals models exclude those pipes with a low or medium consequence of failure that are not currently experiencing failures. The reactive renewal budget is an emergency fund to cover pipes that are not in the renewals plan but begin to fail repeatedly and cause significant and frequent problems for customers.

Reticulation renewals typically include renewal of manholes, laterals and other fittings. Concrete is the predominant material for manholes, even when the pipes are an inert material. In areas of high hydrogen sulphide concentrations, plastic pipes do not corrode but manhole corrosion is an issue, the manhole renewal budget permits renewal of these manholes.

Renewal of pipes in newly resealed roads is a significant aggravation to residents. A budget for transport related renewals allows for early renewal of reticulation under newly renewed roads without causing deferral to wastewater reticulation renewals.

Local pressure sewer system pumps and control systems have theoretical useful lives of 25 years but these are an average life and actual lifetimes follow a distribution. Increases in local pressure sewer system renewals budgets from 2025 onwards permit the early renewal of failing assets.

8.1.7 Renewal Process Improvement

- Improved process for collecting and handling failure and maintenance data so that decisions based on RMO are more informed
- Further condition assessment and condition management to maintain currency of CCTV data used to inform intervention for poor condition pipes
- Embedding a process of condition analysis with renewal/rehabilitation option selection as part of early design
- Formalise maintenance strategy, including the interaction with the renewal strategy

8.1.8 Reticulation Operations and Maintenance Plan

O&M Historic Trends

Operations and maintenance performed under contract CN4600000778: Christchurch City Council Maintenance of City Water and Wastewater Network includes the following functions for reticulation assets:

- Cleaning wastewater mains and syphons
- Root removal from designated mains
- Flushing sewers and syphons
- Maintenance and cleaning of scour valves
- Maintenance and cleaning of air valves
- Inspection and maintenance of flap valves
- Inspection and maintenance of flush tanks
- Cleaning manhole vents
- Emergency response maintaining a 24 hour per day sewer repair, blockage cleaning, and overflow clean-up service.

Historic maintenance contract costs specifically for reticulation assets are shown in Figure below. Maintenance or reactive renewal requirements are identified following inspections carried out as part of the maintenance contract or following customer service requests or complaints.

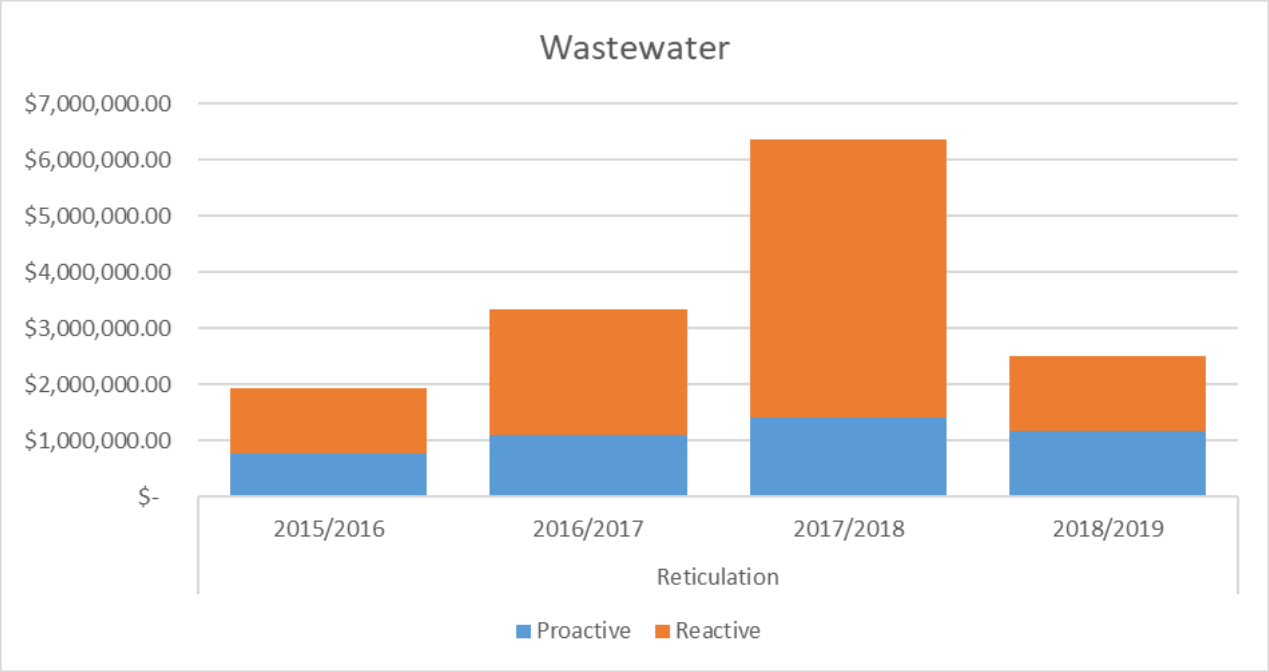


Figure 8-13: Historic maintenance costs

Reactive Maintenance

Maintenance on the reticulation network is predominantly reactive and includes both repairs and the reactive renewal of low criticality assets. Proactive maintenance typically consists of camera inspection to determine if reactive intervention is needed.

Wastewater reticulation assets can be reactively renewed under the maintenance contract. These renewals are when assets are no longer cost effective to maintain or where a major failure has been detected or is imminent. The reactive renewals are generally small in scope; for example replacing a manhole, or a shorter section of pipe.

For wastewater laterals the maintenance work and reactive renewal is handled by the 3W&W Maintenance Unit through direct engagement with approved contractors.

Where identified any reactive renewals are now categorised as capital works and are funded from the capital renewal programme budget.

Further work has been identified to formalise the maintenance strategy and desired split between proactive and reactive works. This is particularly important for wastewater reticulation to optimise what is spent on camera inspection, cleaning, flushing, and root cutting.

Summary of future operations and maintenance expenditure

Some condition 5 pipes will be deferred rather than proactively replaced in the renewal programme. This is expected to increase reactive maintenance and operational costs into the future. Also, current maintenance requirements are being reviewed and the existing maintenance contract is up for renewal. Changes in maintenance spend is dependent on the outcome of the current Section 17A review and the subsequent structure of the new contract.

Additional OPEX is expected where pipe renewal is deferred due to pipes continuing to be operated in poor condition. Table 8-4 provides a modelled estimation of increased OPEX due to condition related performance issues across the network.

Financial Year	Recommended Budget OPEX (thousands)	Proposed Budget OPEX (thousands)
2022	$-	$-
2023	$144.5	$29.5
2024	$344.2	$225.0

2025	$540.7	$418.6
2026	$261.4	$108.9
2027	$404.8	$241.4
2028	$481.4	$311.9
2029	$246.6	$364.4
2030	$272.1	$473.7
2031	$316.6	$602.6
10 Year Total	**$3,012.3**	**$2,776.2**
30 Year Total	**$6,325.0**	**$6,809.7**

Table 8-4: Estimate of Additional OPEX from Deferrals

There is also additional OPEX required relating to areas that sit outside of the maintenance contract failure costs and include:

- Data standards and collection
- Surcharge monitoring
- Condition assessment and condition management
- Asset failure and disposed asset post-mortem

Estimates for these costs are discussed alongside the future OPEX projections within Section 9 Financial.

8.1.9 Reticulation Disposal plan

Wastewater reticulation assets only require disposal on renewal or where entire streets are closed such as in the red zone or for large redevelopments. Final red zone disposal requirements remain unknown and large redevelopments typically remove the decommissioned assets on their own.

Disposal of renewed wastewater reticulation assets is typically included in the renewals project. Renewal on the same alignment is one common renewal method and includes disposal of the old pipe as a matter of course; however, if the decommissioned pipe is AC additional costs are incurred for disposal of the hazardous waste. Where lift and relay is not required, abandonment in place is the most cost effective method of disposal; however in hillside or unstable land the old pipe may need to be filled and sealed to prevent ground disruptions in rainfall events also incurring additional costs.

At present there are specific individual projects for disposal of wastewater reticulation assets.

8.2 Stations Lifecycle Management Plan

8.2.1 Stations Issues and Priorities

Key Issue	Priority for this Plan
Aging assets and deferred renewals. Station assets have been “sweated” over extended periods rather than renewed which has increased reactive works and operational risk	Addressing renewal of assets operating well beyond theoretical useful lives
Several old “bunker-style” wastewater stations have concrete or internal pipework performance issues. Further failures are likely at this type of station	Performing condition assessment of “bunker-style” stations to gauge the full extent of the issue. Refurbishment and replacement of these assets where required. Several priority repairs are already identified at PS0057 and PS0034

Select network control equipment is obsolete and not possible to repair or directly replace. Older assets are currently running on spares gifted from other councils	Increased funding for control equipment replacement to keep up with the growing number of stations and the short useful lives of this asset type
Communication infrastructure (SCADA) needs upgrading. Full replacement is needed at older sites	Selection and pilot testing of replacement design and hardware, followed by a full scale roll out
Asset data for stations is poor. Current O&M data is not easily useful for long term decision-making	Resourcing to: a) collect and update inventory data that supports asset management planning, b) refine and update valuation process and how costs are applied, c) collect O&M data that can be analysed network-wide to determine strategy for proactive/reactive split
New equipment needed at critical terminal pump stations	PS0001 and PS0015 are terminal pump stations (highly critical) and need pump replacement. PS0001 also needs flow monitoring as part of the renewal

Table 8-5: Stations key issues and priorities

Wastewater stations include assets under the categories:

- civil and structures (including wells)
- mechanical
- electrical
- instrumentation, automation and control (IAC)

Civil and structural assets are fewer in number, high in value and in asset life, compared to electrical and IAC assets that are greater in number, lower in value and short in asset life.

Different asset management approaches are used across the categories; for example, there is high benefit in condition assessing civil and structures assets prior to renewal. Whereas electrical and IAC assets can be effectively managed using network-wide rather than individual assessment.

8.2.2 Stations Age and Condition

Asset Condition

To address specific issues, targeted condition assessments are periodically carried out. A recent wet well survey of specific sites identified internal pipework and wet well structures in very poor condition.

At a portfolio level, the condition data held in the database for station assets is poor compared to reticulation assets. The high-level condition assessments rely on asset age as a proxy for condition.

Asset condition is measured on a 1-5 scale based on remaining useful life as presented in Section 7.2.2.

Figure 8-12 below shows the condition grading profile of the station assets by replacement value.

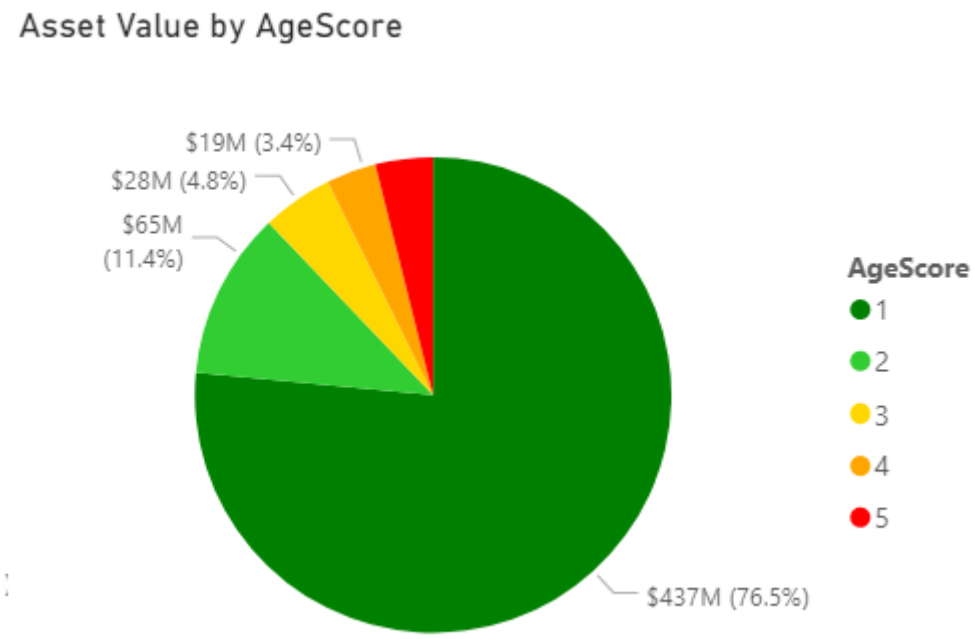


Figure 8-12: Station asset condition by value

8% of the total station asset value have a condition grade of 4 or 5.

Figure 8-13 below show which categories make up the worst assets i.e. where the condition score is 4 or 5. The first graph shows the split by number of assets and the second graph in Figure 8-16 shows the split by replacement value.

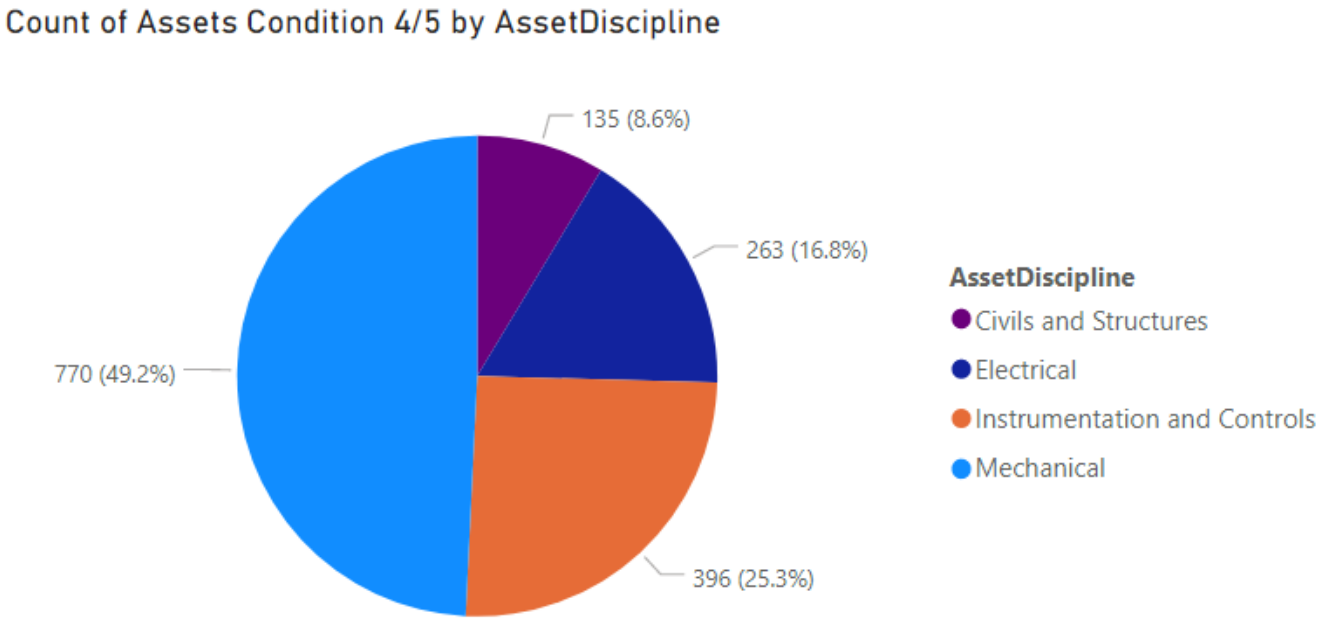


Figure 8-13: Types of assets in poor or very poor condition (by number)

Types of assets in poor or very poor condition (by number)

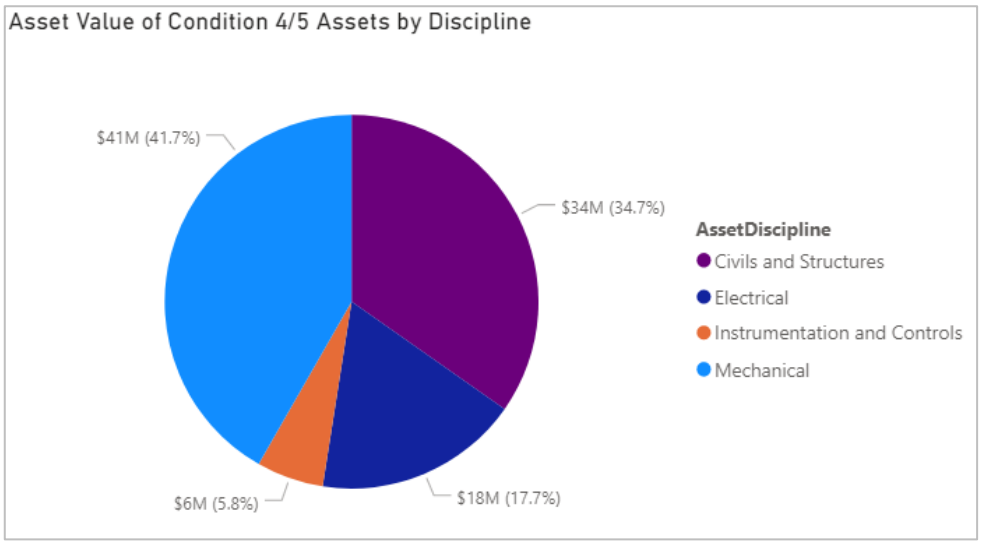


Figure 8-14: Types of assets in poor or very poor condition (by value)

The worst category is mechanical assets that represent approximately half of the poor condition assets. There are a small number of civil and structures assets that are relatively expensive to replace. 7% of the poor condition assets represent 28% of the value.

The poor condition IAC assets that are relatively inexpensive to replace. IAC makes up 21% of these poor condition assets but just 6% of the value.

To increase confidence in this age-based condition profiling, future condition assessment effort is focussed on civil and structures assets, then mechanical, electrical and IAC in that order.

Despite current data limitations, the condition profiles shown above agree with operation and maintenance observations:

- The SCADA system has a backlog of assets that are obsolete and beginning to fail. Some of these assets are running on spares gifted from other councils. This SCADA system underpins the wastewater collection activity.
- Mechanical assets at terminal stations are old, have been overhauled several times and require reactive repair and renewal. These are high value assets where renewal includes a long lead-in time for design and construction. Funding provision and condition assessment is needed in the short term as several sites are likely to require significant renewal in the next 10 years. Priority intervention is needed at pumping stations PS0001 and PS0015.
- Initial assessments of “bunker style” stations found that internal pipework and concrete well structures are in very poor condition and need intervention. Priority intervention is needed at pumping stations PS0057 and PS0034.
- Some pumping stations are degrading rapidly due to hydrogen sulphide gas (H2S). A new H2S monitoring programme is proposed in this AMP so that the right interventions are made.

8.2.3 Stations Repairs and Maintenance Performance

Field teams have communicated to asset owners that station assets have required a higher level of reactive repair and emergency works. This has put increased demand on reactive capital budgets. Failures include several motor, switchboard, instrument and control assets in the 2019/2020 year and now a focus on internal pipework and wet wells.

This AMP promotes greater proactive renewal funding to reduce the impact of reactive replacement on customers and to avoid the increased costs of completing works under emergency response.

On this basis, increased proactive renewal funding is needed and is expected to reduce overall cost and impact.

Improved failure data recording, processing and handling behaviour is also part of the plan to track repair and maintenance performance more effectively across the stations asset class.

As well as keeping up with failure rates, increased reactive budgets are needed due to a change in funding definition. Prior to this change reactive work that increased an assets life wasn't specifically identified and was covered under operational expenses. This is now required to be funded as a capital expense from a reactive renewal budget.

8.2.4 Stations Criticality

Criticality criteria is still being developed for station assets. Current criticality criteria is based on the sum of electric motor power as shown in Table 8- below.

Score	Size (kW)
1	Up to 5kW
2	Up to 22kW
3	Up to 60kW
4	Up to 150kW
5	Over 150kW

Table 8-6 : Stations Criticality criteria

Additionally, stations with generators are criticality 5.

Smaller monitoring sites and lift stations are criticality 1. Lift stations have bypasses that mean flows are still contained within the network if the lift station is not working.

The criticality profile is shown in Figure 8-15: Station asset criticality (by number) which shows the profile by number of station assets.

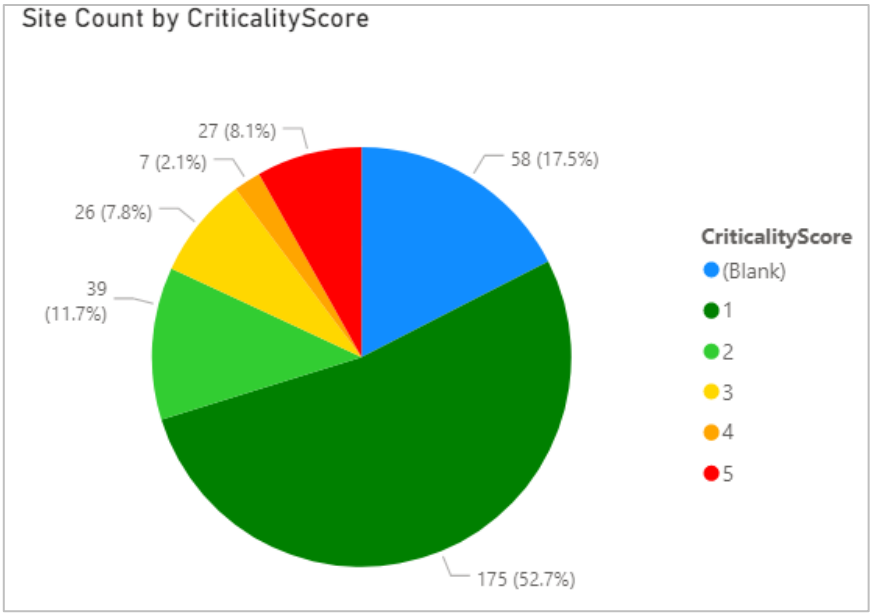


Figure 8-15: Station asset criticality (by number)

10% of all wastewater station sites are criticality 4 or 5.

Looking at both condition and criticality at the same time shows that a large number of the poor condition assets have high criticality. Figure 8-16 below shows the criticality profile of those assets with a condition score of 4 or 5.

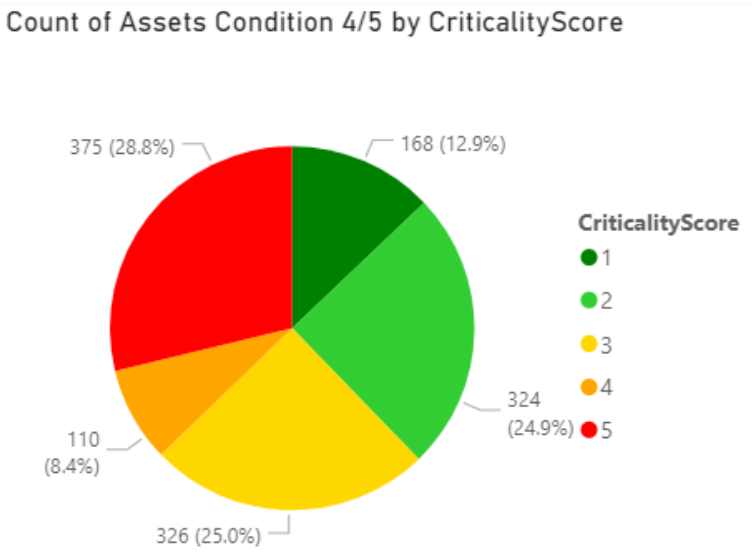


Figure 8-16: The criticality of poor and very poor condition station assets

The high criticality of the poor condition assets supports the strategy to increase the condition assessment and renewal of wastewater station assets.

8.2.5 Stations Renewals Plan

Renewal forecasting begins with the age-based condition and remaining life. This is adjusted for the near term (years 1 – 3) where candidates are selected for inclusion as renewal projects based on the empirical criteria in Table 8-5 below.

Activity	Approach Used	Criteria
Renewals for the long term forecast (4-30 years)	Age-based condition estimation	Renewals for the long term forecast (4-30 years)
Renewals for the short term forecast (1-3 years)	Selection based on operations and maintenance feedback, obsolete assets and owner knowledge to identify short list of renewal sites. Site inspection of shortlist sites to better understand the scope of replacement required.	• Equipment and service failures • High operational cost • Obsolete or failing models • Safety hazards
Replacement Cost Estimates	Standard rates applied based on valuation data and staff knowledge base. Contingency based on recent projects is added to account for data gaps and other unknowns	Replacement Cost Estimates

Table 8-5: Stations Renewals Criteria

Summary of future renewal and replacement expenditure

The raw data forecast of asset renewals is presented in Figure .

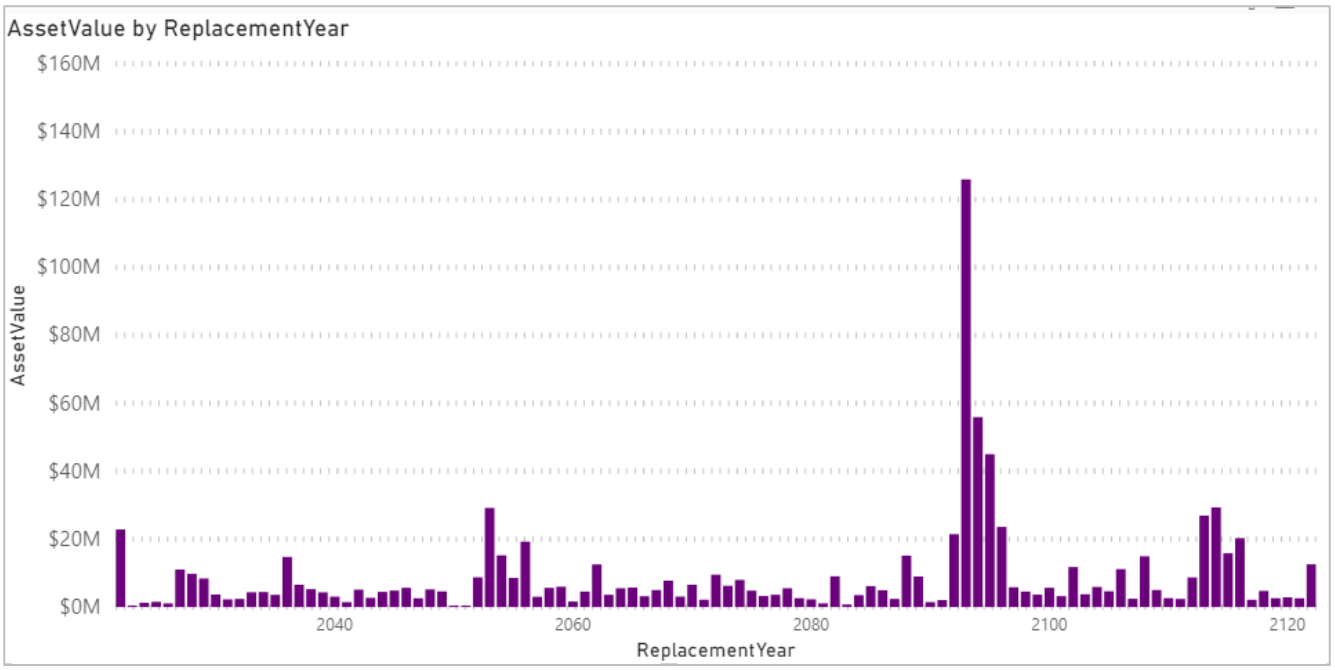


Figure 8-19: Raw data forecast of renewal expenditure

The renewal forecast shows several features:

- The large spike in 2021 reflects assets within the database that have exceeded their theoretical useful life. It is not expected that renewal of all of these assets can happen in one single year, but the forecast reflects that there is a build-up of assets in very poor condition
- The very large spike around 2095 is the result of the new pump station infrastructure constructed following the 2010/2011 earthquakes
- There is an additional $55M of assets without installation dates that are not included in the forecast graph above. This is addressed through the data collection improvement programme.

Financial Year	Required Renewals Budget (millions)	Recommended Renewals Budget (millions)	Proposed Renewals Budget (millions)
2022	$22.85	$6.13	$0.31
2023	$0.18	$11.34	$3.29
2024	$1.24	$8.33	$7.53
2025	$1.53	$14.90	$8.91
2026	$1.08	$22.15	$8.87
2027	$11.04	$17.00	$10.47
2028	$9.76	$7.33	$11.49
2029	$8.41	$7.69	$15.41
2030	$3.69	$7.91	$7.62
2031	$2.26	$8.17	$5.45
10 year total	**$62.05**	**$104.83**	**$79.03**
30 year total	**$250.02**	**$324.47**	**$419.24**

Table 8-6: Stations annual capital programme in millions

Table 8-6 lists the three station renewal budget options.

The budgets set out in the recommended option looked at the historical under spending in these areas and looked to reduce the backlog as soon as possible whilst still remaining deliverable both at a council and private contracting business level as the backlog is now too large to be effectively and efficiently caught up on in a short time frame. The changes in the proposed option will continue to increase the backlog and further reduce the ability to recover from the slow degradation of assets. Continued low investment is going to make it increasingly difficult to maintain current levels of service.

The required budgets calculated from the asset database in this activity are lower than the recommended budgets for two main reasons. (1) Inaccuracies or missing data for assets resulting in a more optimistic forecast and (2) due to identified poor condition assets from operational staff and inspection that is showing several larger civil assets that are not going to meet their design lives without investment to restore them to design live condition. These are predominately around the state of several of the stations wet wells.

Delays in the several major project budgets will maintain existing risks around the degradation of concrete wet wells, very old pumps that are now several asset lives past their design lives. This will maintain the current level of risk and will increase the likelihood of reactive renewals and of more catastrophic failure events that may impact public health should raw sewage overflow to the environment affecting private and public property and the cities river systems. We have already observed several of these events and expect them to become more frequent.

Significant reductions in health and safety budgets and asbestos removal budgets will increase the risk of prosecution due to serious harm injuries and exposure to asbestos found at many of our pumping stations. Furthermore, several of our installations currently fail to meet New Zealand health and safety regulation laws, particularly around working at heights and confined spaces. We are also seeing an increase in the risk of failure to working platforms within the council's larger pumping stations.

Reductions in programme budgets around civil, mechanical works will result in further maintenance and increasing risks with wet well H2S damage and concrete degradation. Several of the largest most critical stations are now encountering failures of key pieces or infrastructure with long asset replacement times. Whilst the funding is present in the long term, many of these assets are now in critical states that will likely not remain operational for the duration of the delays in funding. Delays in funding in this area will increase the risk of the council failing to meet ECAN consenting obligations and likely cause further damage to the assets, perhaps beyond repair.

Reductions in the Electrical, Instrumentation, Controls and Automation programmes will increase the risk of failure to meet the safe conveyance of waste water creating service disruptions. In addition to this, new risks are emerging with obsolete and failing electronic assets such as motor starters which will continue to erode our ability to reliably and safely convey waste water to treatment plant facilities. Several of the largest most critical stations are now encountering failures of key pieces or infrastructure with long asset replacement times. Whilst the funding is present in the long term, many of these assets are now in critical states and may not remain operational, take time to restore service and require reactive funding to address.

Reduction in the Software programmes will continue to increase the business risk to reliable control, monitoring and will likely make it increasingly difficult to meet regulatory requirements for ECAN. In addition to this the continued neglect in this area will continue to cause operational issues, maintaining or increasing the risk to operational budgets. Furthermore as the software in this area ages and the hardware in the Instrumentation, Controls and Automation areas continue to age the risk of cyber security attacks will continue to increase as the business falls further behind in maintaining a professional system. Several of the stations will now only be able to be repaired with second hand equipment sourced from upgrades, with the assets now entering their third design life cycle. As all of the spares are also second hand and failures are becoming more common. The risk profile in this area is now dire.

In addition to the afore mentioned programmes, the reactive renewals budget adjustments to cope with the much higher failure rates being encountered, remain at historically low levels. This will result in an increased risk of the business not being able to repair failures in a timely fashion, or at all. Over time this will potentially reduce the infrastructures ability to convey sewage to the treatment plant facilities, particularly in winter.

8.2.6 Stations Capital Development Plan

Financial Year	PS20 Capacity Improvements (thousands)	Belfast Northern PS Installation (thousands)	LPSS Monitoring & Control (thousands)	PS Flow Meter Installation (thousands)	New Stations for Growth (thousands)
2022	$ -	$ -	$ -	$ -	$ -
2023	$ -	$ -	$ -	$ 96.0	$ -
2024	$ -	$ -	$ -	$ 320.0	$ -
2025	$ -	$ -	$ 100.0	$ 320.0	$ -
2026	$ -	$ -	$ 200.0	$ 352.0	$ -
2027	$ 104.5	$ -	$ 100.0	$ -	$ -
2028	$ 1,869.9	$ -	$ -	$ -	$ -
2029	$ -	$ -	$ -	$ -	$ 750.0
2030	$ -	$ 150.0	$ -	$ -	$ 750.0
2031	$ -	$ 350.0	$ -	$ -	$ 750.0

Table 8-7: Wastewater Station Development Projects

Table 8-7 lists the wastewater station development projects funded in the LTP.

8.2.7 Renewals Process Improvement

- Improved process for collecting and handling stations failure data and reactive renewal interventions
- Further condition assessment and condition management of high value critical assets, beginning with station pipework and wet wells
- Formalise maintenance strategy, including the interaction with the renewal strategy
- H2S monitoring at targeted pump station and chamber sites to inform intervention strategy

8.2.8 Stations Operations and Maintenance Plan

O&M Historic Trends

Operations and maintenance performed under contract CN4600000778: Christchurch City Council Maintenance of City Water and Wastewater Network includes the following functions for station assets:

- Wastewater pump maintenance, servicing, testing and repairs;
- Regular cleaning of wet wells;
- Removal, replacement, unblocking and maintenance of submersible and end suction pumps;
- Pump performance tests;
- Condition assessment by vibration analysis of pump sets;
- General (minor) structural metal work fabrication/repairs (handrails, ladders, safety equipment, etc.);
- Standby diesel servicing maintenance and testing;
- Standby generator testing, maintenance and overhaul;
- Maintenance, repair and testing of pipes and valves;
- Electric motor repairs, servicing and testing;
- Motor starter servicing and repair;
- Switchboard servicing and repair;
- Battery maintenance and testing;
- General electrical work within facilities;

- Upkeep of cathodic protection systems;
- Supply of all consumables excluding electricity and diesel fuel; and
- All other maintenance, servicing, repairs and renewals (except those items specifically excluded) required to ensure that the City's wastewater system performs within the Council's KPIs.

SCADA equipment including radios and RTUs, level controllers, flow meters, pressure transducers, level transducers, float switches, earthquake sensors, instrumentation and data loggers are excluded from the maintenance contract and maintained directly by Council.

The contract cost for the last four years is shown in Figure 8-17 below.

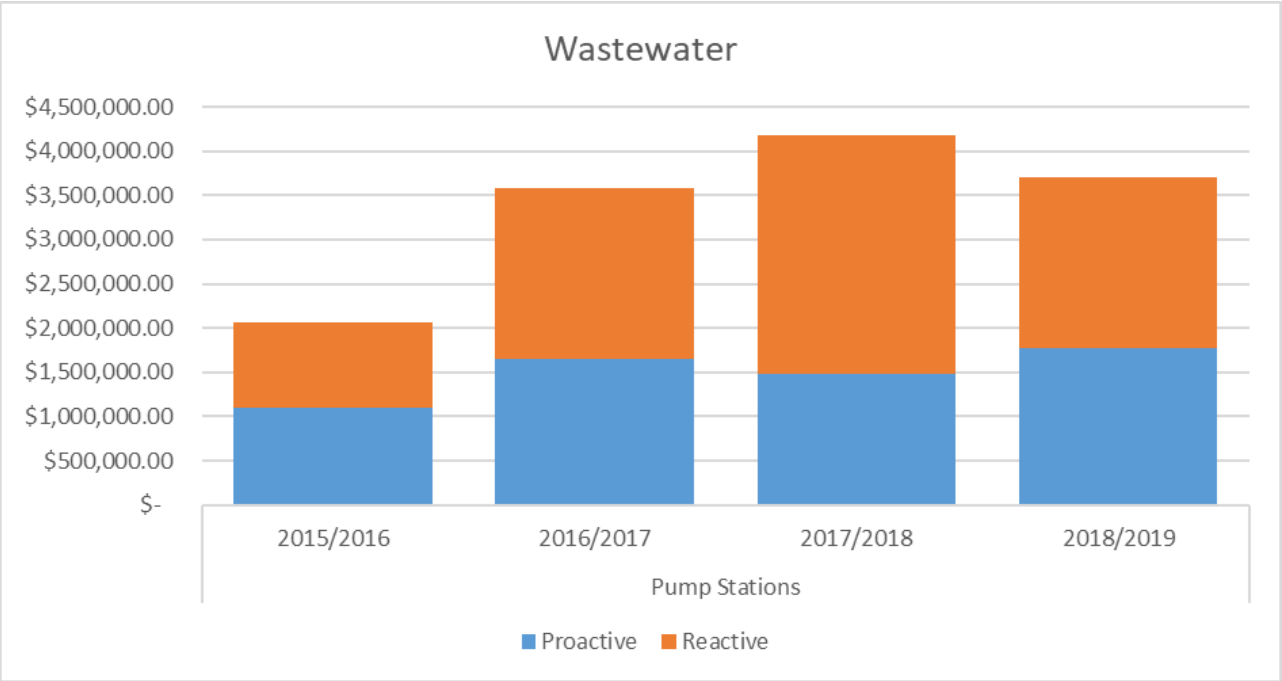


Figure 8-17: Historic contract cost (Wastewater Stations)

Operational costs such as the cost of electricity and functions performed by internal Council staff are not included in the figure above.

Reactive Maintenance

Maintenance on the station assets is split between proactive and reactive. Proactive work is carried out to improve reliability and to maintain asset condition and service levels.

Where identified, station asset reactive renewals are now categorised as capital works and are funded from the capital renewal programme budget.

Further work has been identified to formalise the maintenance strategy, basic maintenance requirements, categorisation of maintenance costs and the desired split between proactive and reactive works.

Summary of future operations and maintenance expenditure

The existing maintenance contract is up for renewal and changes in maintenance spend is dependent on the outcome of the current Section 17A review.

There is also additional OPEX required relating to areas that sit outside of the maintenance contract costs and include:

- Data standards and collection
- Condition assessment
- Asset failure and disposed asset post-mortem

8.2.9 Stations Disposal Plan

There are three wastewater pump stations located in the red zone that are historic buildings. Disposal of these assets requires transfer to another Council department for preservation as heritage assets.

Several stations have been decommissioned but not yet disposed of. These now require separate OPEX to fund demolition and disposal. New programme funding is sought as part of this plan to dispose of assets in cases where the disposal wasn't part of a related capital project.

The following wastewater stations need disposal:

- PS0093 Pumping Station
- PS0004 Pumping Station
- PS0005 Pumping Station
- PS0008 Pumping Station

PS0003 is a significant heritage asset in the Christchurch District Plan. PS0004 and PS0005 are identical designs as PS0003 so may need special attention in the disposal plan.

8.3 Treatment Lifecycle Management Plan

8.3.1 Treatment Issues and Priorities

Key Issue	Priority for this Plan
Communication infrastructure (SCADA) needs upgrading	Selection and pilot testing of replacement design and hardware, followed by a full scale roll out
Asset data for stations is poor. Supplementary report is being used for Bromley WWTP renewals. Current O&M data is not easily useful for long term decision-making	Resourcing to: a) integrate data from supplementary report, collect and update inventory data that supports asset management planning, b) refine and update valuation process and how costs are applied, c) collect O&M data that can be analysed network-wide to determine strategy for proactive/reactive split
Instrumentation renewal needs to account for increased regulatory monitoring requirements	Replacement and upgrade of instrumentation to latest regulatory standards
Plant upgrades are coming	Identify which renewals can be specifically excluded based on assets that are part of future upgrades

Table 8-10: Treatment Issues and Priorities

8.3.2 Treatment Assets Age and Condition

Asset Condition

At a portfolio level, there is limited condition data held in the database for treatment assets. Additionally, the majority of treatment assets do not have a start-up date so are not able to have an age-based condition score applied.

Renewal needs are estimated using both the Council core asset database and a supplementary condition assessment report carried out on the Bromley WWTP assets in 2017. The information from the Bromley WWTP condition assessment report has not been entered into the Council's core database.

Further resourcing is needed to fill data gaps, verify existing data and collect new data. The greatest need is to verify the asset inventory and add appropriate start up dates so that database analysis methods can be used.

Operation and maintenance observations on treatment asset conditions are:

"Council has IAC software that has not been well funded or identified over its history and has simply been expected to be resolved through other budgets. This has led to a deficiency in the standards and quality of the systems in place that is taking some time to resolve."

8.3.3 Treatment Repairs and Maintenance Performance

Improved failure data recording, processing and handling behaviour is part of the plan to track repair and maintenance performance more effectively across the treatment asset class.

Predicting timely renewal is difficult due to data gaps for this asset class, so a balanced approach between proactive and reactive renewal is adopted.

8.3.4 Treatment Criticality

By definition all wastewater treatment plants are critical. No criticality criteria has been used to differentiate assets within the Treatment asset subcategory.

8.3.5 Treatment Renewals Plan

Renewal forecasting is primarily based on the Bromley WWTP condition assessment report. A secondary forecast is prepared as a reality check using the age-based condition and remaining life of the assets in the main Council database. This is adjusted for the near term (years 1 – 3) where candidates are selected for inclusion as renewal projects based on the empirical criteria below shown in Table 8-11.

Activity	Approach Used	Criteria
Renewal primarily based on the Bromley WWTP report	Condition assessment	
Renewals for the long term forecast (4-30 years)	Age-based condition estimation	Industry guideline theoretical asset age and dates of installation
Renewals for the short term forecast (1-3 years)	Selection based on operations and maintenance feedback, obsolete assets and owner knowledge to identify short list of renewal sites. Site inspection of shortlist sites to better understand the scope of replacement required.	• Equipment and service failures • High operational cost • Obsolete or failing models • Safety hazards
Replacement Cost Estimates	Standard rates applied based on valuation data and staff knowledge base Contingency based on recent projects is added to account for data gaps and other unknowns	

Table 8-8: Treatment Assets Renewal Criteria

Summary of future renewal and replacement expenditure

The renewal strategy has three key parts.

- Continuation of Bromley WWTP renewal plan on the basis of the condition assessment report
- Including renewal funding for software as an asset class. Software can have a significant replacement cost and short asset life and warrants inclusion in future asset renewal planning
- Reduce decision-making uncertainty – through condition assessment, data improvements, asset management processes
- Given the uncertainty, allowing for both proactive and reactive renewal programmes
- Deferring renewals for assets at treatment sites where large scale replacement or upgrades works are planned (e.g. Akaroa WWTP, Duvauchelle WWTP)

Financial Year	Required Budget (millions)	Recommended Budget (millions)	Proposed Budget (millions)
2022	$25.77	$7.77	$0.35
2023	$1.60	$13.84	$2.19
2024	$0.52	$14.15	$5.87
2025	$27.69	$12.92	$12.17
2026	$6.22	$12.91	$14.10
2027	$2.45	$12.27	$18.54
2028	$4.66	$9.61	$13.15
2029	$0.20	$12.48	$11.90
2030	$0.93	$11.49	$10.63
2031	$1.49	$7.34	$6.39
10 Year Total	**$71.53**	**$107.00**	**$94.94**
30 Year Total	**$193.41**	**$272.35**	**$262.15**

Table 8-9: Wastewater Treatment Renewals Budget Options

The current asset data on the wastewater treatment plants is very poor, and as such, required budgets being generated from the asset database are not deemed to be reflective of the actual asset state. As such, planned renewal are largely based on identified problems with a larger amount of reactive renewals funding to offset any unforeseen breakdowns or works becoming evident as better data is collected.

Table 8-6 lists the three renewal budget options for Wastewater Treatment. Recommended budgets for wastewater treatment renewals are based on condition assessments by operational staff and programmed inspections showing several larger civil assets are likely to fail before their design lives without investment for refurbishment or identified asset replacement and refurbishment projects planned for future years. This is why the recommended budgets exceed required budgets based on theoretical data.

Deferring biogas engine replacements at the CWTP will increase the risk of failure and operational expenditure increases at the Christchurch Waste Water Treatment Plant. Operational costs will increase with further failures of the engine.

Reductions in programme budgets around civil and mechanical works will increase maintenance costs and risks with the smaller and older wastewater treatment plants on Banks Peninsula. This will also increase the risk of overflows in this area. There is also an increase in identification of mechanical assets in particular at the CWTP that are showing signs of aging, increasing their failure risk profile.

Reductions in the Electrical, Instrumentation, Controls and Automation programmes will increase the risk of failure of the operational controls of the Christchurch Waste Water Treatment Plant. The plant now has several aging and obsolete PLC's that are no longer repairable or easily replaced. These assets need replacement in the short term due to their low asset design lives. Reducing the recommended budget to the proposed budget for electrical, instrumentation, controls and automation assets increases risk of failure, overflows and nor meeting ECAN consent limits and potentially increases operational expenditure.

In addition to the afore mentioned programmes the reactive renewals budget adjustments to cope with the much higher failure rates being encountered remain at historically low levels. This will result in an increased risk of the business not being able to repair failures in a timely fashion, or at all. This will slowly reduce the infrastructures ability to effectively treat sewage, particularly in winter.

8.3.6 Treatment capital development plan

Financial Year	Christchurch WwTP Renewals (millions)	Banks Peninsula WwTP Renewals (millions)	Laboratory Renewals (millions)
2022	$20.5	$0.9	$0.2
2023	$22.8	$1.0	$0.5
2024	$24.0	$1.1	$0.4
2025	$43.9	$1.0	$0.4
2026	$16.9	$0.8	$0.5
2027	$17.6	$0.8	$0.5
2028	$39.7	$1.2	$0.5
2029	$24.1	$0.8	$0.2
2030	$22.8	$0.8	$0.2
2031	$14.3	$0.9	$0.2

Table 8-10: Wastewater Treatment Improvement Projects

Table 8-10 lists the wastewater treatment improvement projects funded in the LTP.

8.3.7 Treatment Renewal Process Improvements

- Improved process for collecting and handling treatment asset failure data and reactive renewal interventions
- Further data inventory, install date estimation and condition assessment of assets, beginning with the high value asset types.
- Formalise maintenance strategy, including the interaction with the renewal strategy

8.3.8 Treatment Operations and Maintenance Plan

O&M Historic Trends

Operation and maintenance of the wastewater treatment plants in Banks Peninsula is carried out under contract CN4600000778: Christchurch City Council Maintenance of City Water and Wastewater Network.

Under the maintenance contract Council retains responsibility for the maintenance and renewal of the Bromley WWTP, SCADA, RTU and radio assets. All operations and maintenance required in Banks Peninsula to meet the resource consents and KPIs is the responsibility of the maintenance contractor. The Contractor is required to maintain the plant and assets at or above condition grade 3 as assessed using the NZ Infrastructure Guidelines.

Operation and maintenance cost history for the maintenance contract for the last four years is shown in Figure 8-18 below.

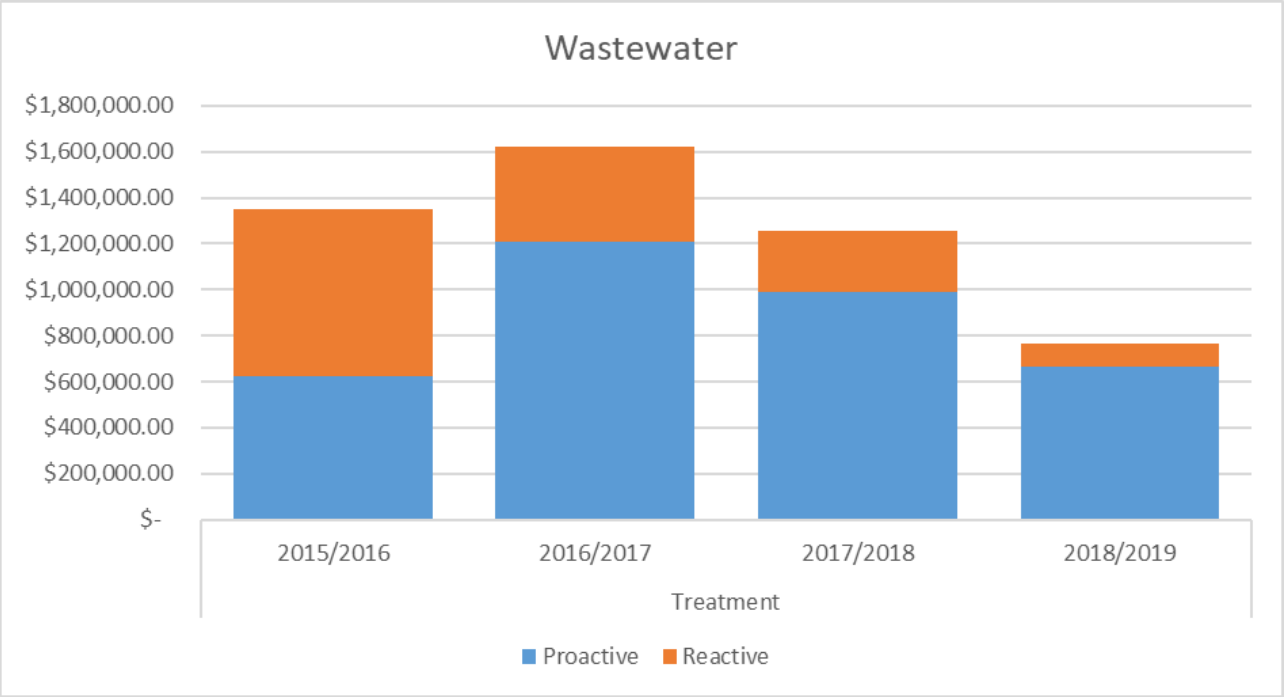


Figure 8-18: WW Treatment Operation and maintenance cost history for the maintenance contract

Costs for the Bromley WWTP and operational costs for functions performed by internal Council staff are not included in the figure above.

Reactive Maintenance

A portion of the maintenance work is reactive to fix issues that arise. Where identified, treatment asset reactive renewals are now categorised as capital works and are funded from the capital renewal programme budget.

Further work has been identified to formalise the maintenance strategy, basic maintenance requirements, categorisation of maintenance costs and the desired split between proactive and reactive works.

Summary of future operations and maintenance expenditure

The existing maintenance contract is up for renewal and changes in maintenance spend is dependent on the outcome of the current Section 17A review.

There is also additional OPEX required relating to areas that sit outside of the maintenance contract costs and include:

- Data standards and collection
- Condition assessment
- Asset failure and disposed asset post-mortem

8.3.9 Treatment assets disposal plan

On completion and commissioning of the new Akaroa wastewater treatment plant the old plant must be decommissioned and the site remediated. This is a high priority project given the significance of the site to local Iwi.

Disposal of existing Lyttleton Harbour Basin treatment assets will be required on completion of the Lyttleton Harbour basin wastewater scheme diversion.

Disposal of treatment assets removed due to renewal under the regular operation and maintenance of the treatment plants is the responsibility of the maintenance staff.

9 Financial projections and trends

This section outlines the long-term financial requirements for the activity based on the long-term strategies and tactics described earlier in the Plan.

9.1 Financial Statements & Projections

The financial statements are in 2020 dollars excluding inflation.

The recommended capital costs presented at the time of writing are based on the requirements of lifecycle asset management, growth and demand drivers, and levels of service. Large scale capital programmes in response to disruptors such as climate change are not included in the projections. The strategy to address these is to provide sufficient budget for detailed optioneering and benefit analysis so that these projects can be promoted in the next LTP. The projected costs do not include financial responses to the immediate and long term effects of Covid-19.

Impacts of Covid-19 – short and longer term

Early forecasting advice from economic commentators (e.g. the Treasury, ChristchurchNZ, financial institutions) signals significant economic impacts locally, nationally and internationally. This advice is being updated regularly and is likely to change over time (the Treasury's economic scenarios released on 14 April caution that economic impacts are "highly uncertain").

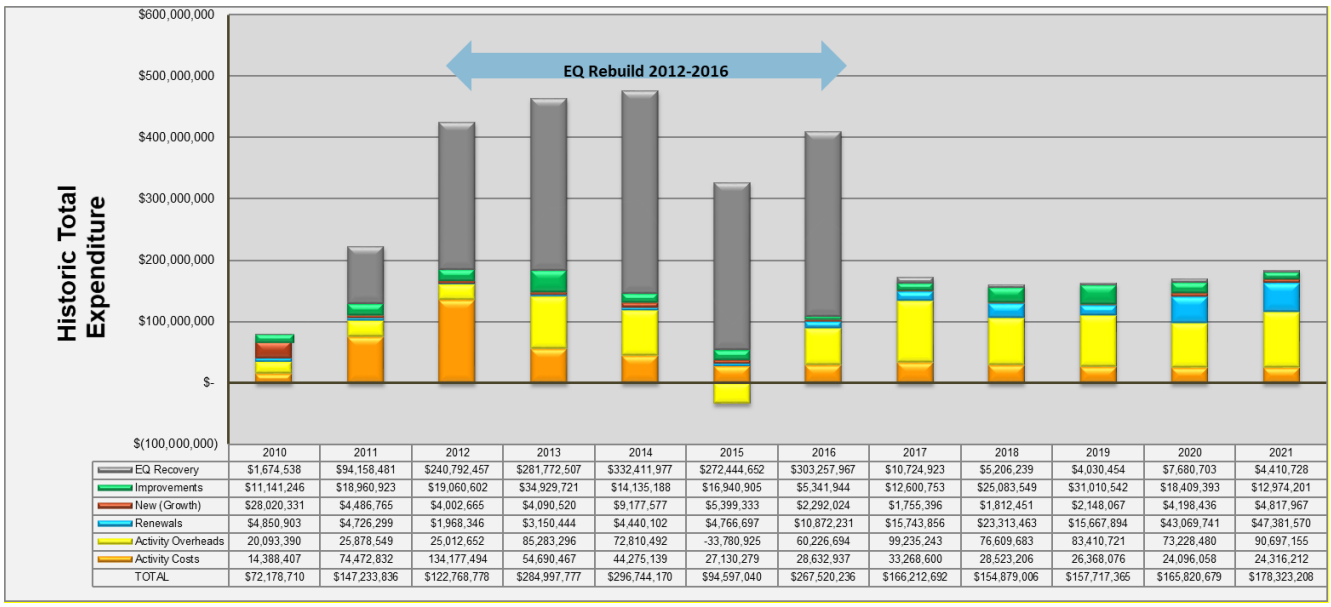
The AMP has been prepared without a prediction of how the Covid-19 crisis will impact the activity. The future response is uncertain, but will undoubtedly be significant for the wastewater activity.

Some of the high level possibilities are briefly listed below:

- An initial focus on infrastructure that supports Covid-19 economic recovery and delivers projects critical to the capital programme or identified as part of a central government stimulus package, and completing committed projects.
- Short-term (now, and LTP years 1-3): possible delays in scheduled capital programme works, potential issues with workforce availability/contractor viability following lifting of restrictions; uncertainty about materials supplies; changing priorities for work programming and methodologies (e.g. accommodating the norm of physical distancing). Opportunities for bringing forward 'shovel ready' work and increased financial pressure on Council budgets.
- Medium term (LTP years 4-6): Further consideration of capital works programme in light of the emerging Financial Strategy and Infrastructure Strategy response.
- Longer term (LTP years 6 – onwards): Uncertain at this stage; potentially dealing with the effect of any deferred expenditure due to the above factors.

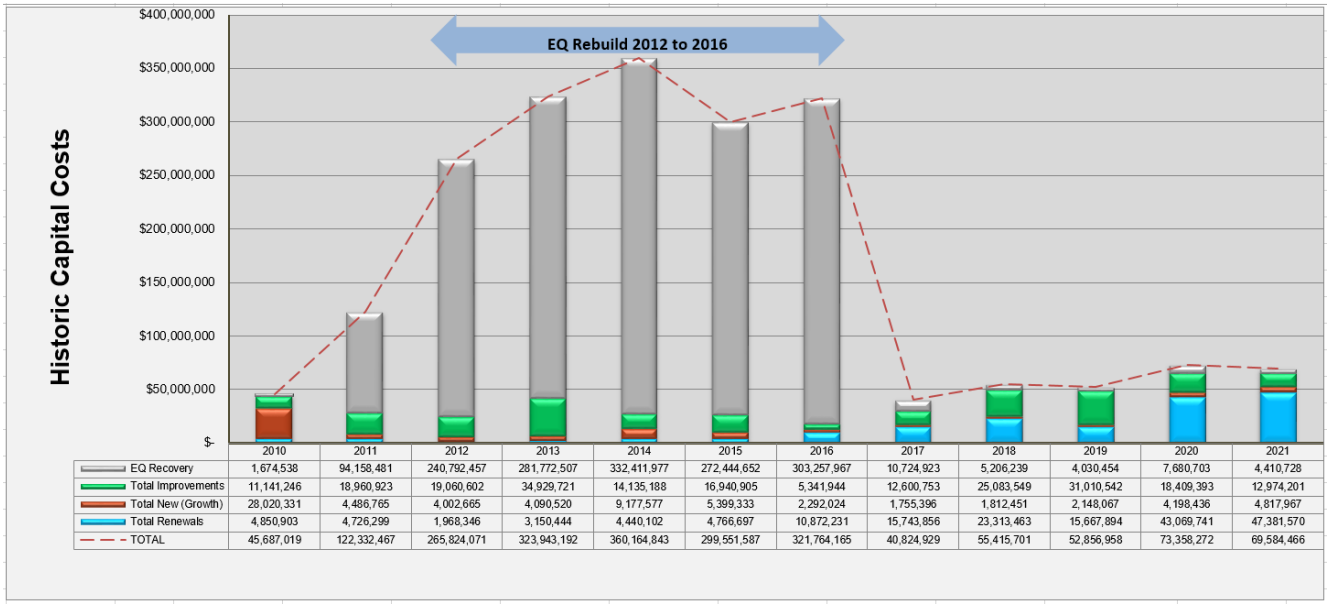
9.1.1 Historical Expenditure

The historic wastewater activity expenditure is shown in Figure 9-1. Figure 9-2 and Figure 9-3 show the expenditure split by CAPEX and OPEX respectively.



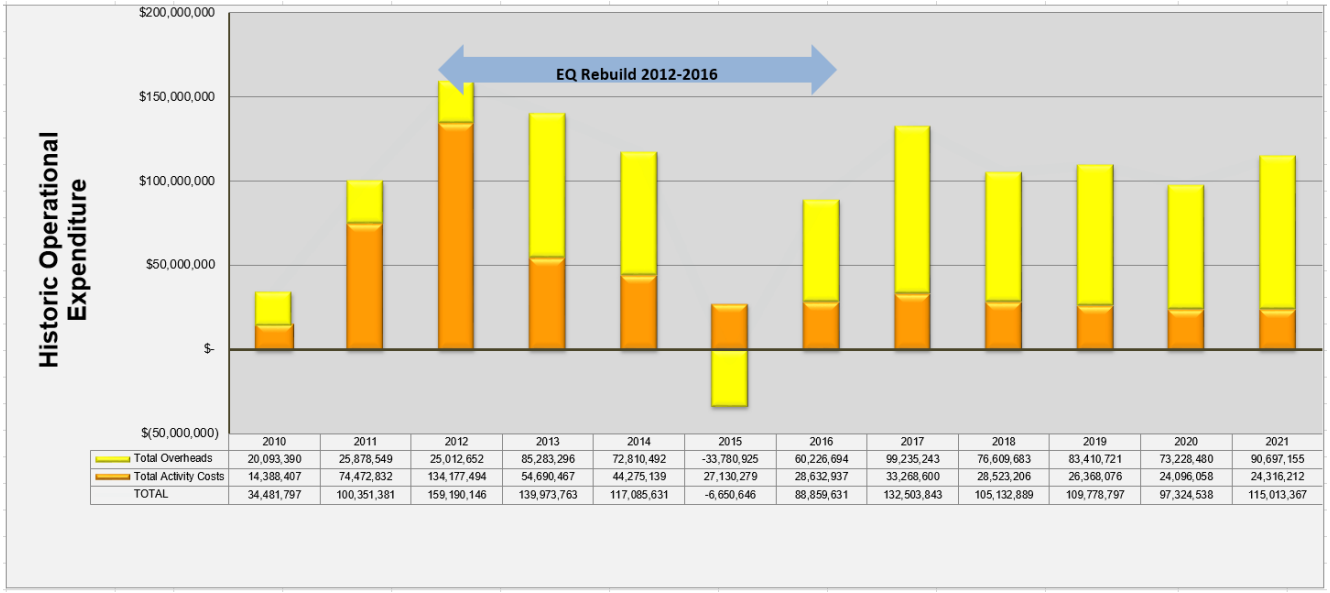
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
EQ Recovery	$1,674,538	$94,158,481	$240,792,457	$281,772,507	$332,411,977	$272,444,652	$303,257,967	$10,724,923	$5,206,239	$4,030,454	$7,680,703	$4,410,728
Improvements	$11,141,246	$18,960,923	$19,060,602	$34,929,721	$14,135,188	$16,940,905	$5,341,944	$12,600,753	$25,083,549	$31,010,542	$18,409,393	$12,974,201
New (Growth)	$28,020,331	$4,486,765	$4,002,665	$4,090,520	$9,177,577	$5,399,333	$2,292,024	$1,755,396	$1,812,451	$2,148,067	$4,198,436	$4,817,967
Renewals	$4,850,903	$4,726,299	$1,968,346	$3,150,444	$4,440,102	$4,766,697	$10,872,231	$15,743,856	$23,313,463	$15,667,894	$43,069,741	$47,381,570
Activity Overheads	20,093,390	25,878,549	25,012,652	85,283,296	72,810,492	-33,780,925	60,226,694	99,235,243	76,609,683	83,410,721	73,228,480	90,697,155
Activity Costs	14,388,407	74,472,832	134,177,494	54,690,467	44,275,139	27,130,279	28,632,937	33,268,600	28,523,206	26,368,076	24,096,058	24,316,212
TOTAL	$72,178,710	$147,233,836	$122,768,778	$284,997,777	$296,744,170	$94,597,040	$267,520,236	$166,212,692	$154,879,006	$157,717,365	$165,820,679	$178,323,208

Figure 9-1: Historic total expenditure for Wastewater



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
EQ Recovery	1,674,538	94,158,481	240,792,457	281,772,507	332,411,977	272,444,652	303,257,967	10,724,923	5,206,239	4,030,454	7,680,703	4,410,728
Total Improvements	11,141,246	18,960,923	19,060,602	34,929,721	14,135,188	16,940,905	5,341,944	12,600,753	25,083,549	31,010,542	18,409,393	12,974,201
Total New (Growth)	28,020,331	4,486,765	4,002,665	4,090,520	9,177,577	5,399,333	2,292,024	1,755,396	1,812,451	2,148,067	4,198,436	4,817,967
Total Renewals	4,850,903	4,726,299	1,968,346	3,150,444	4,440,102	4,766,697	10,872,231	15,743,856	23,313,463	15,667,894	43,069,741	47,381,570
TOTAL	45,687,019	122,332,467	265,824,071	323,943,192	360,164,843	299,551,587	321,764,165	40,824,929	55,415,701	52,856,958	73,358,272	69,584,466

Figure 9-2: Historic CAPEX for Wastewater

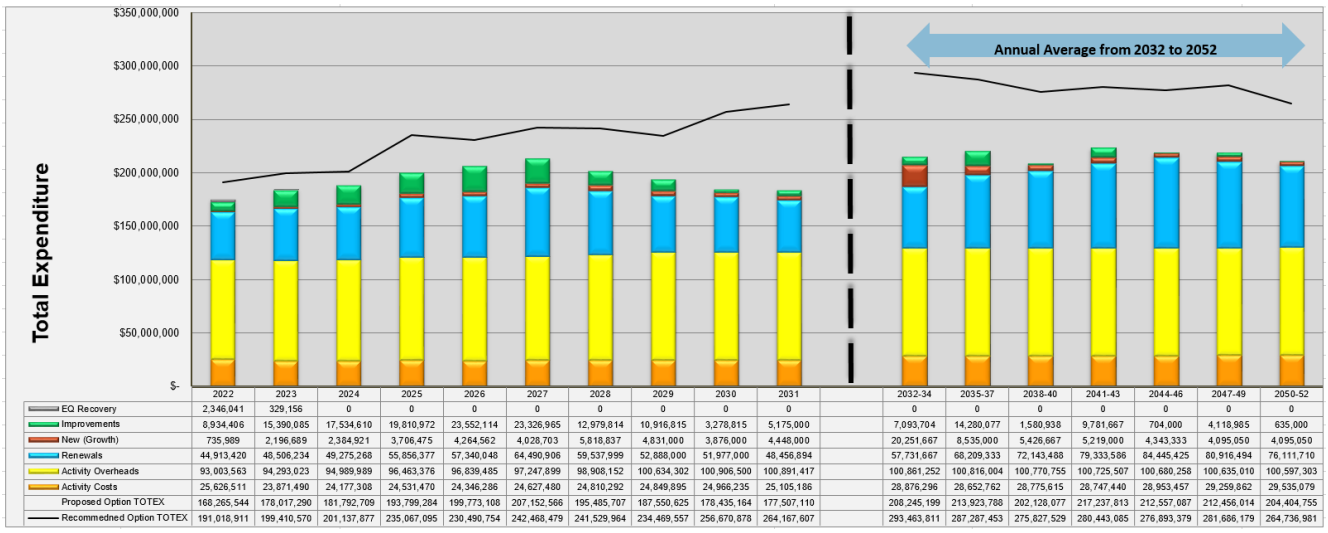


	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total Overheads	20,093,390	25,878,549	25,012,652	85,283,296	72,810,492	-33,780,925	60,226,694	99,235,243	76,609,683	83,410,721	73,228,480	90,697,155
Total Activity Costs	14,388,407	74,472,832	134,177,494	54,690,467	44,275,139	27,130,279	28,632,937	33,268,600	28,523,206	26,368,076	24,096,058	24,316,212
TOTAL	34,481,797	100,351,381	159,190,146	139,973,763	117,085,631	-6,650,646	88,859,631	132,503,843	105,132,889	109,778,797	97,324,538	115,013,367

Figure 9-3: Historic OPEX for Wastewater

9.1.2 Forecast Expenditure

Future expenditure is forecast in Figure 9-4 below. This provides a breakdown of expenditure based on the categories listed. The solid bars represent the proposed total option and combines the programmes from the various sections of this AMP.

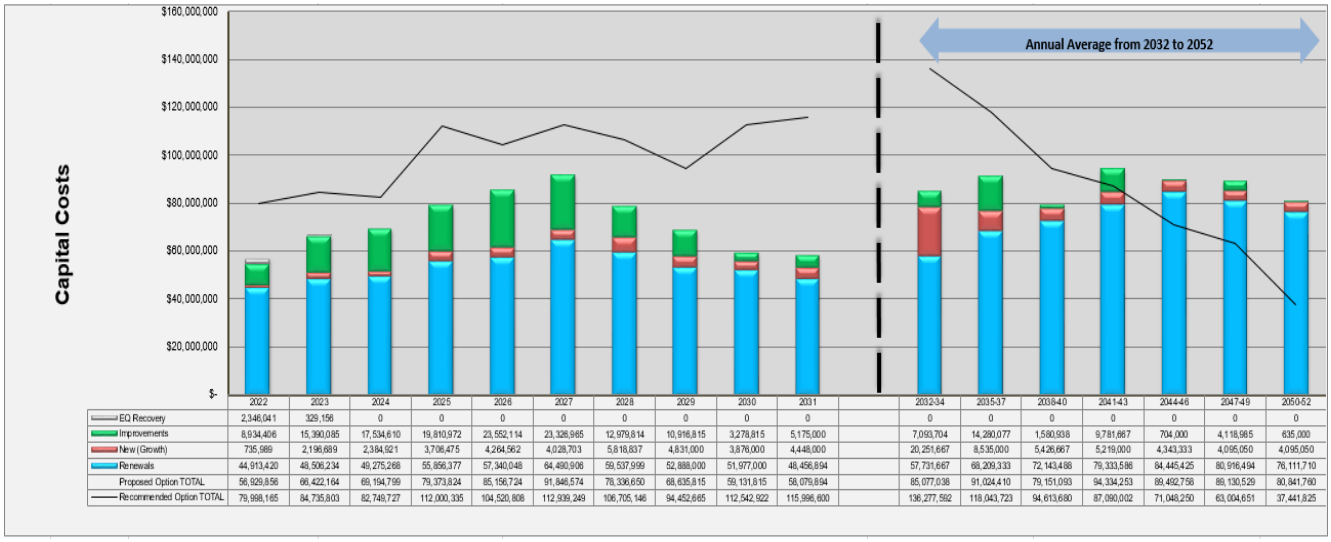


	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
EQ Recovery	2,346,041	329,156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Improvements	8,934,406	15,390,085	17,534,610	19,810,972	23,552,114	23,326,965	12,979,814	10,916,815	3,278,815	5,175,000	7,093,704	14,280,077	1,580,938	9,781,667	704,000	4,118,985	635,000
New (Growth)	735,989	2,196,689	2,384,921	3,706,475	4,264,562	4,028,703	5,818,837	4,831,000	3,876,000	4,448,000	20,251,667	8,535,000	5,426,667	5,219,000	4,343,333	4,095,050	4,095,050
Renewals	44,913,420	48,506,234	49,275,268	55,856,377	57,340,048	64,490,906	59,537,999	52,888,000	51,977,000	48,456,894	57,731,667	68,209,333	72,143,488	79,333,586	84,445,425	80,916,494	76,111,710
Activity Overheads	93,003,563	94,293,023	94,989,989	96,463,376	96,839,485	97,247,899	98,908,152	100,634,302	100,906,500	100,891,417	100,861,252	100,816,004	100,770,755	100,725,507	100,680,258	100,635,010	100,597,303
Activity Costs	25,626,511	23,871,490	24,177,308	24,531,470	24,346,286	24,627,480	24,810,292	24,849,895	24,966,235	25,105,186	28,876,296	28,652,762	28,775,615	28,747,440	28,953,457	29,259,862	29,535,079
Proposed Option TOTEX	168,265,544	178,017,290	181,792,709	193,799,284	199,773,108	207,152,566	195,485,707	187,550,625	178,435,164	177,507,110	208,245,199	213,923,788	202,128,077	217,237,813	212,557,087	212,456,014	204,404,755
Recommedned Option TOTEX	191,018,911	199,410,570	201,137,877	235,067,095	230,490,754	242,468,479	241,529,964	234,469,557	256,670,878	264,167,607	293,463,811	287,287,453	275,827,529	280,443,085	276,893,379	281,686,179	264,736,981

Figure 9-4: Forecast total expenditure for Wastewater

The solid line in Figure 9-4 above shows the recommended option to account for deliverability. It includes a provision to accelerate the renewal of assets with a high consequence of failure.

Figure 9-5 below shows the forecast of just the capital costs for the activity.

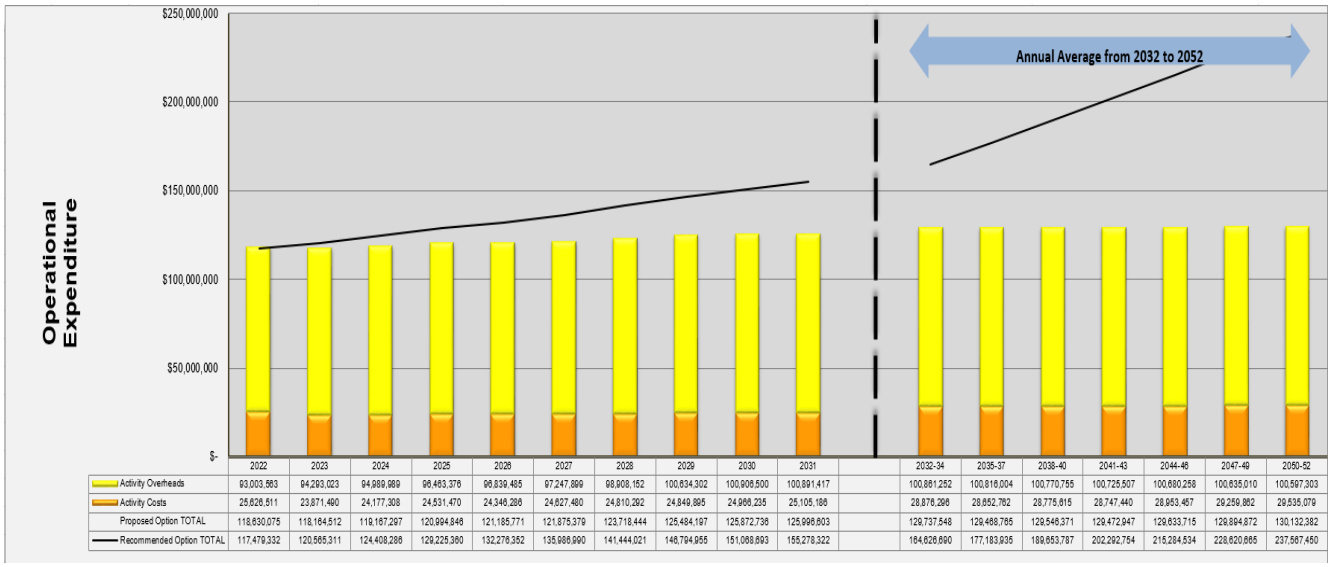


	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
EQ Recovery	2,346,041	329,156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Improvements	8,934,406	15,390,085	17,534,610	19,810,972	23,552,114	23,326,965	12,979,814	10,916,815	3,278,815	5,175,000	7,093,704	14,280,077	1,580,938	9,781,667	704,000	4,118,985	635,000
New (Growth)	735,989	2,196,689	2,384,921	3,706,475	4,264,562	4,028,703	5,818,837	4,831,000	3,876,000	4,448,000	20,251,667	8,535,000	5,426,667	5,219,000	4,343,333	4,095,050	4,095,050
Renewals	44,913,420	48,506,234	49,275,268	55,856,377	57,340,048	64,490,906	59,537,999	52,888,000	51,977,000	48,456,894	57,731,667	68,209,333	72,143,486	79,333,586	84,445,425	80,916,494	76,111,710
Proposed Option TOTAL	56,929,856	66,422,164	69,194,799	79,373,824	85,156,724	91,846,574	78,336,650	68,635,815	59,131,815	58,079,894	85,077,038	91,024,410	79,151,093	94,334,253	89,492,758	89,130,529	80,841,760
Recommended Option TOTAL	79,998,165	84,735,803	82,749,727	112,000,335	104,520,808	112,939,249	106,705,146	94,452,665	112,542,922	115,996,600	136,277,592	118,043,723	94,613,680	87,090,002	71,048,250	63,004,651	37,441,825

Figure 9-5: Forecast CAPEX for Wastewater

Significant renewal funding is required in the first ten year period. This is in response to the poor condition of assets and is exacerbated by the large cohort of assets that were installed at the same time, and where renewals have been historically underfunded.

Figure 9-6 below shows a forecast of the activity operational costs. This projection assumes that current operational expenditure remains at a similar levels. Projected depreciation is included. The projection also includes an allowance for the future operational and maintenance costs of new infrastructure to be delivered in the proposed capital programme. Operational expenditure to fund the various improvement programmes identified in this AMP are not included in the forecast at this stage.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
Activity Overheads	93,003,563	94,293,023	94,989,989	96,463,376	96,839,485	97,247,899	98,908,152	100,834,302	100,906,500	100,891,417	100,881,252	100,816,004	100,770,755	100,725,507	100,680,258	100,635,010	100,597,303
Activity Costs	25,626,511	23,871,490	24,177,308	24,531,470	24,346,286	24,827,480	24,810,292	24,849,895	24,966,235	25,105,166	28,876,296	28,652,782	28,775,815	28,747,440	28,953,457	29,259,882	29,535,079
Proposed Option TOTAL	118,630,075	118,164,512	119,167,297	120,994,846	121,185,771	121,875,379	123,718,444	125,484,197	125,872,736	125,996,603	129,737,548	129,468,785	129,546,571	129,472,947	129,633,715	129,894,872	130,132,382
Recommended Option TOTAL	117,479,332	120,565,311	124,408,286	129,225,360	132,276,352	135,988,990	141,444,021	146,794,955	151,088,893	155,278,322	164,626,690	177,183,935	189,653,787	202,292,754	215,284,534	228,620,865	237,587,450

Figure 9-6: Forecast OPEX for Wastewater

Financial indicators

In order to provide information, financial indicators are provided in Table 9-1: Financial Indicators for Wastewater. These are based on the IPWEA recommendations and are intended to provide an overview of short, medium and long term implication of funding decisions.

9.1.2.1.1 10 year average funding ratio and shortfall

The 10 year average funding ratio (Ref A) shows the percentage of the total CAPEX and OPEX costs (ie those associated with the recommended option) that will receive LTP funding. It is assumed that the recommended option is funded.

9.1.2.1.2 Rate of annual asset consumption and renewal

The rate of annual asset consumption (C) shows how much of the asset stock is being used up each year and is 1.28%.

The rate of annual asset renewal (D) shows how much of the asset stock is being renewed/replaced in a year and this has been calculated based on the average annual renewal expenditure over the first three years of the LTP. The rate of asset renewal is 0.67%, which is 52% the rate of consumption (F). Historically the wastewater rate of asset renewal has been lower than the rate of consumption i.e. 'sweating the asset', which yields the current situation where renewal rates are playing catch-up. This is shown in the historic ratio of renewals to depreciation (H2) which is 29.0% for the last ten years.

9.1.2.1.3 Rate of annual asset upgrade

The rate of annual asset creation and improvement, or upgrade (E) shows how much is being added to the asset stock each year and is 0.31%

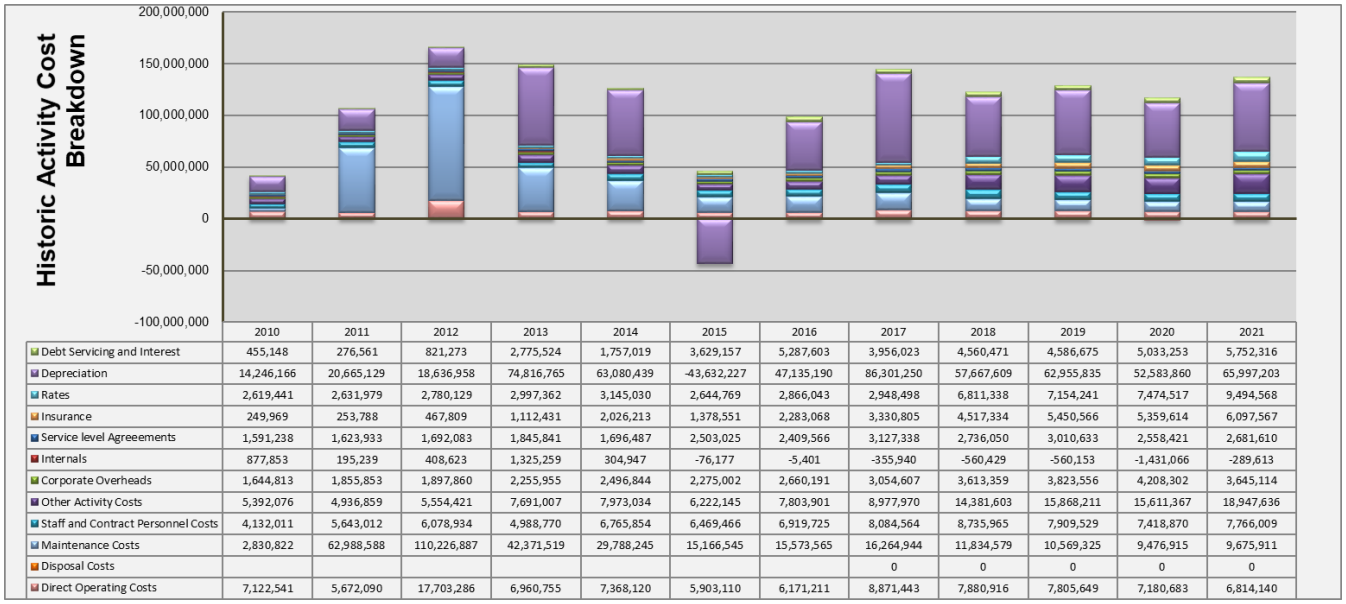
Summary				
Ref	Indicator	Calculation	Description	$ or %
	10 year total **cost**	Projected 10yr total OPEX, CAPEX renewal & CAPEX upgrade costs		$ 2,296,431,691
	10 year average **cost**			$ 229,643,169
	10 year total LTP budget **expenditure**	2021 LTP 10yr total OPEX, CAPEX renewal & CAPEX upgrade budgets		$ 1,842,318,637.5
	10 year average LTP **expenditure**			$ 184,231,863.8
A	10 year total average funding ratio	10yr total average expenditure / 10yr total average cost	Shows percentage of total recommended cost that will be funded	80.23%
B	10 year total average funding shortfall	10yr total average cost - 10yr total average expenditure	Quantifies overall underfunding	$ 454,113,053.5
Value				
	Current optimised replacement cost (ORC)			$ 5,104,255,000.0
	Depreciable amount	ORC - RV (residual value) - Assumed same as ORC (ie RV -= 0)		$ 5,104,255,000.0
	Optimised depreciated replacement cost (ODRC)			$ 2,794,189,000.0
	Annual depreciation expense (AD)			$ 65,418,000.0
C	Rate of annual asset consumption (AD / ODRC)	Annual depreciation / depreciated replacement cost	How much of the asset stock is being used up each year	1.28%
D	Rate of annual asset renewal (FY2022-2024)	Average FY2022-2024 renewal expenditure / annual depreciable amount	How much of the asset stock is being renewed / replaced each	0.67%
E	Rate of annual asset new+upgrade (FY2022-2024)	Average FY2022-2024 new+upgrade expenditure / annual depreciable amount	How much is being added to the asset stock each year	0.31%
	Rate of asset upgrade (including contributed assets)			
F	Asset renewals as a percentage of consumption	Rate of renewal / rate of consumption	How much asset stock is being renewed vs how much is being	52.00%
Sustainability				
	Asset renewal funding ratio			
G1	10 yr asset renewal funding ratio	10yr renewal expenditure / 10yr renewal cost	What percentage of the 10yr recommended renewal cost will be	48.2%
G2	5yr asset renewal funding ratio	5yr renewal expenditure / 5yr renewal cost	What percentage of the 5yr recommended renewal cost will be	54.6%
G3	3yr asset renewal funding ratio	3yr renewal expenditure / 3yr renewal cost	What percentage of the 3yr recommended renewal cost will be	54.6%
H1	10yr forecast renewals to depreciation ratio	10 yr renewal expenditure / 10 depreciation expenditure		118.6%
Historic trends (2011 to 2020)				
Ref	Indicator	Calculation	Description	2011-2020 $ or %
	Historic 10 year total **expenditure**	Historic 10yr total OPEX, CAPEX renewal & CAPEX upgrade costs (actual)		$ 1,858,491,578.4
	Historic 10 year average **expenditure**			$ 185,849,157.8
	Historic 10yr average depreciation			$ 44,021,080.8
	Historic 10yr average renewals expenditure			$ 12,771,907.2
H2	Historic 10yr forecast renewals to depreciation ratio	2011-2020 average renewal expenditure / 2011-2020 average depreciation		29.0%

Table 9-1: Financial Indicators for Wastewater

9.1.3 Expenditure by Service Group

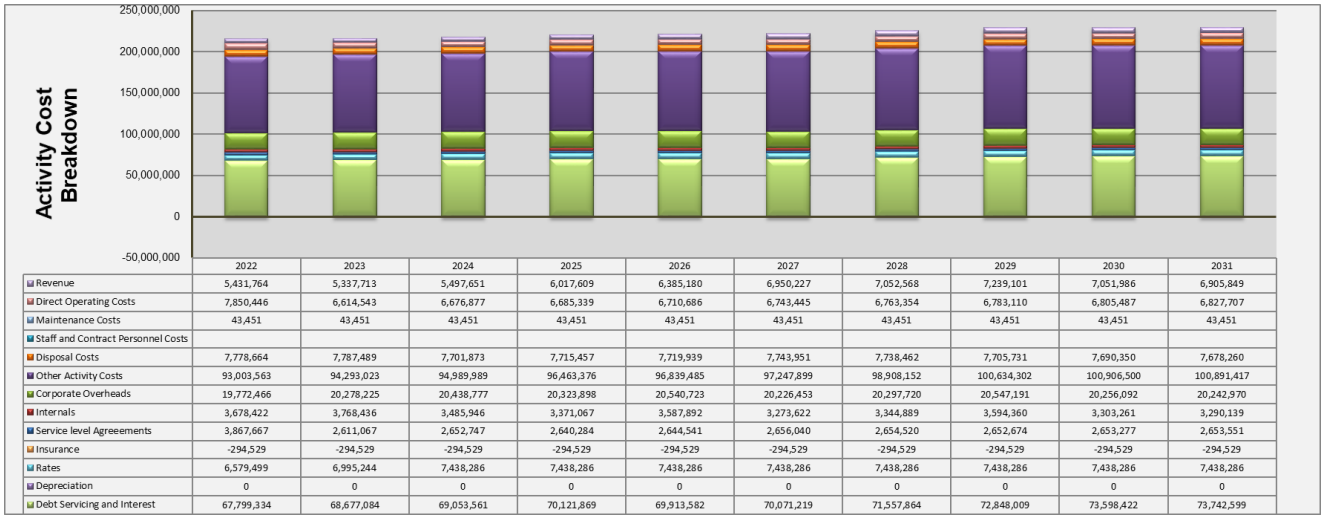
Operations & maintenance expenditure

A more detailed breakdown of the historic and forecast operational expenditure is provided in Figure 9-7 and Figure 9-8 below. The assumptions, inclusions and exclusions within the OPEX breakdown is as discussed at the start of Section 9.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Debt Servicing and Interest	455,148	276,561	821,273	2,775,524	1,757,019	3,629,157	5,287,603	3,956,023	4,560,471	4,586,675	5,033,253	5,752,316
Depreciation	14,246,166	20,665,129	18,636,958	74,816,765	63,080,439	-43,632,227	47,135,190	86,301,250	57,667,609	62,955,835	52,583,860	65,997,203
Rates	2,619,441	2,631,979	2,780,129	2,997,362	3,145,030	2,644,769	2,866,043	2,948,498	6,811,338	7,154,241	7,474,517	9,494,568
Insurance	249,969	253,788	467,809	1,112,431	2,026,213	1,378,551	2,283,068	3,330,805	4,517,334	5,450,566	5,359,614	6,097,567
Service level Agreeements	1,591,238	1,623,933	1,692,083	1,845,841	1,696,487	2,503,025	2,409,566	3,127,338	2,736,050	3,010,633	2,558,421	2,681,610
Internals	877,853	195,239	408,623	1,325,259	304,947	-76,177	-5,401	-355,940	-560,429	-560,153	-1,431,066	-289,613
Corporate Overheads	1,644,813	1,855,853	1,897,860	2,255,955	2,496,844	2,275,002	2,660,191	3,054,607	3,613,359	3,823,556	4,208,302	3,645,114
Other Activity Costs	5,392,076	4,936,859	5,554,421	7,691,007	7,973,034	6,222,145	7,803,901	8,977,970	14,381,603	15,868,211	15,611,367	18,947,636
Staff and Contract Personnel Costs	4,132,011	5,643,012	6,078,934	4,988,770	6,765,854	6,469,466	6,919,725	8,084,564	8,735,965	7,909,529	7,418,870	7,766,009
Maintenance Costs	2,830,822	62,988,588	110,226,887	42,371,519	29,788,245	15,166,545	15,573,565	16,264,944	11,834,579	10,569,325	9,476,915	9,675,911
Disposal Costs								0	0	0	0	0
Direct Operating Costs	7,122,541	5,672,090	17,703,286	6,960,755	7,368,120	5,903,110	6,171,211	8,871,443	7,880,916	7,805,649	7,180,683	6,814,140

Figure 9-7: Historic OPEX details for Wastewater



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Revenue	5,431,764	5,337,713	5,497,651	6,017,609	6,385,180	6,950,227	7,052,568	7,239,101	7,051,986	6,905,849
Direct Operating Costs	7,850,446	6,614,543	6,676,877	6,685,339	6,710,686	6,743,445	6,763,354	6,783,110	6,805,487	6,827,707
Maintenance Costs	43,451	43,451	43,451	43,451	43,451	43,451	43,451	43,451	43,451	43,451
Staff and Contract Personnel Costs										
Disposal Costs	7,778,664	7,787,489	7,701,873	7,715,457	7,719,939	7,743,951	7,738,462	7,705,731	7,690,350	7,678,260
Other Activity Costs	93,003,563	94,293,023	94,989,989	96,463,376	96,839,485	97,247,899	98,908,152	100,634,302	100,906,500	100,891,417
Corporate Overheads	19,772,466	20,278,225	20,438,777	20,323,898	20,540,723	20,226,453	20,297,720	20,547,191	20,256,092	20,242,970
Internals	3,678,422	3,768,436	3,485,946	3,371,067	3,587,892	3,273,622	3,344,889	3,594,360	3,303,261	3,290,139
Service level Agreeements	3,867,667	2,611,067	2,652,747	2,640,284	2,644,541	2,656,040	2,654,520	2,652,674	2,653,277	2,653,551
Insurance	-294,529	-294,529	-294,529	-294,529	-294,529	-294,529	-294,529	-294,529	-294,529	-294,529
Rates	6,579,499	6,995,244	7,438,286	7,438,286	7,438,286	7,438,286	7,438,286	7,438,286	7,438,286	7,438,286
Depreciation	0	0	0	0	0	0	0	0	0	0
Debt Servicing and Interest	67,799,334	68,677,084	69,053,561	70,121,869	69,913,582	70,071,219	71,557,864	72,848,009	73,598,422	73,742,599

Figure 9-8: Forecast OPEX details for Wastewater

An improvement programme item has been identified to focus on greater categorisation of operational expenditure. This is expected to provide a basis for greater analysis, tracing of significant costs, and increase confidence when forecasting trade-offs between OPEX and CAPEX under different investment scenarios.

Additional OPEX is needed to fund the various improvement programmes identified within this AMP. These are needed to support levels of service, demand, risk and resilience, lifecycle asset management, and financial tracking to ensure value is added through a proactive asset management planning process.

9.2 Funding Strategy

9.2.1 Expenditure Funding Strategy

Funding for wastewater activities is sourced from rates, developer contributions (for growth projects) and borrowing. Details of how the activity will be funded are included in the Financial Strategy.

9.3 Assumptions, Risk and Confidence Levels

9.3.1 Key Assumptions and Risk

Assumptions relating to each asset group have been identified under the Lifecycle Management asset group sub-sections.

Valuation data quality is variable. The 2020 asset valuation has been used wherever possible, however the forecasting of asset replacement costs has required some input from quantity survey professionals and asset engineers to ensure that forecast budgets are sufficient to deliver each identified project. These are described in Section 8 for the three primary asset classes; reticulation, station assets, and treatment assets.

The financial forecasting relies on Council's core asset management system database. The database confidence is generally strong for reticulation assets, lower confidence for station assets and very low confidence for treatment assets. Improvement programmes have been identified to increase the confidence of basic asset data held for stations and treatment assets. Failure data and analysis is also an identified improvement area where improvements will yield a greater evidence base to support future forecasts.

The financial analysis relies on accurately categories costs that can be easily accessed for asset management decision making. This data has been prepared from numerous sources for the purposes of this AMP. The risk of erroneous or incomplete data can be mitigated if data is held centrally and is accessible in real time by decision-makers. An improvement programme has been identified to enable better financial tracking, forecasting and analysis of relationships between CAPEX and OPEX.

10 Continuous Improvement

10.1 Overview of the Improvement Programme

Council has made a strong commitment to the improvement of asset management practices and seeks to further improve the approach. Council acknowledges the need to focus efforts to further asset management practices over the next 2-3 years to an appropriate level of capability.

Council's overall AM improvement process is outlined in the SAMP. This section details the wastewater improvement programme.

10.2 Current Asset Management Maturity

An independent assessment of current asset management practice was undertaken in October 2020. Asset Management Maturity Assessments (AMMA) are carried out once every two years.

The baseline maturity assessment was predominantly achieved through onsite interviews, with a good cross-section of participants. Future maturity level was also set based on appropriate best practice and considering the agreed business drivers. Strength and opportunities for improvement are summarised alongside the results to acknowledge the baseline achievements.

The appropriate level of AM practice for this Activity has been defined in our AM Policy as 'Intermediate or advanced level for most functions'. Summarised scores are shown in Figure 10-1.

A summary of the assessment results and improvement activities required to achieve greater maturity in asset management systems, culture and decision making is provided within section 10.4.

Figure 10-1: Asset Management Maturity Assessment 2020 - Wastewater results[9]

The maturity assessment shows that:

- Small improvements have been made between 2018 and 2020
- Areas of improvement have been in:
    - Management Systems
    - Asset Information Systems
- No progress has been made in:
    - Asset register data
    - Decision making
    - Operational planning and reporting
    - Financial strategies
    - Service delivery models

- Progress in the stagnant categories such as Asset Register Data, Decision Making, Operational Planning and reporting can be made with additional resourcing and effective problem solving regarding data issues. A systematic approach would consider data definition, capture, handling, storage, ownership and specified end use. The end goal would be improving decision making (both current operational and future life-cycle needs), presenting useful financial reporting and forecasting, and quality assurance.

[9] Sourced from Trim: 20/1391890 - Final Maturity Assessment report Nov 2020. Ref. Figure 5-3 on page 29

10.3 Review of Progress against Previous Plan

The last improvement plan was developed as part of the 2018 AMP update. The indicative term of the improvement programme was three years. Table 10-1 provides an update on the status of the improvement programme items as at January 2021.

In addition to the items within the improvement programme, the following improvements have been made to the activity since the last AMP:

- 3 Waters maintenance tracking dashboard
- Maintenance contract improvement programme (service information overhaul)
- A Quality management Framework (QMS) has been produced. A tool using Sharepoint has been produced to deliver thee Document Record System component of the QMS System.
- The Asset Assessment Intervention Framework (AAIF) for reticulation assets; Further development of decision-making processes and data capture will leverage the work completed so far within the AAIF project.

Task ID	Action/Task	Timeline	Progress
2-1	Formalise and document the process for developing levels of service. The process needs development, sign-off and documentation into ProMapp. Following documentation dates for levels of service sessions and workshops should be added to the corporate calendar as part of the AMP and LTP processes.	TBC	Not complete
2-2	Develop systems to effectively monitor real-time performance in relation to approved service plans. This may include developing dashboards to show progress in the year to date.	TBC	Not complete
2-3	Develop and document procedures for reconciling levels of service, price projections and demand projections.	FY19 improvement plan.	Not complete
3-1	Development of a hydraulic modelling strategy that aligns Council with New Zealand best practice standards in three-waters modelling, with a view on how modelling can be better delivered now and in the future to improve efficiencies and to drive cost-saving benefits.	FY19 improvement plan.	Complete
3-2	Implement the actions from the hydraulic modelling strategy. Depending on the contents of the strategy this may include: 1. Update the Christchurch City wastewater network model; 2. Create a Banks Peninsula wastewater network model; and 3. Calibrate all models.	TBC	Started
4-1	Document the process to Improve data capture for repairs to 3-Waters networks, including how data is captured by the contractor and how it is stored and accessed in current systems. In order to enable automation of validation consider FME as middleware with the B2B.	TBC	Started
4-2	Develop and document a process to transfer asset condition assessment information from Contractor systems into the AMIS via the B2B interface. The process will ensure all condition and performance assessment scores are stored against the correct assets and allow for transfer and storage of associated inspection documentation.	TBC	Started
4-3	Asset Assessment Intervention Framework – Stage 1 Develop a multi-criteria decision making framework for renewals planning including determining when an asset should be renewed and the priority of each project. 1. Determine criteria for the decision making framework based on chosen schema from the NZ Metadata Standards. Schema to be chosen based on relevance to the network, availability of information, ease of implementation and cost effectiveness. 2. Develop and implement a methodology for calculating scores for each criteria. Depending on the criteria this may involve review of failure modes, causes of failure, deterioration curves, number of customers affected, importance of individual customers 3. Develop a weighting multiplier for each criteria. 4. Create locations in the AMIS for the individual criteria scores, overall score and planned renewal dates to be retained and displayed. 5. Document all steps 1 to 5.	Timeline to be calculated in re-planning sessions 29/08/2018 and 05/09/2018.	Complete and working Further refinement ongoing
4-4	Asset Assessment Intervention Framework – Stage 2 Apply AAIF criteria from Improvement Item 4-3 to transport assets. This may include re-development of schema criteria or inclusion of different schema.	TBC. Follows item 4-3.	Not complete
4-5	Asset Assessment Intervention Framework – Stage 3 Apply AAIF criteria from Improvement Item 4-3 to facilities and parks assets. This may include re-development of schema criteria or inclusion of different schema.	TBC. Follows item 4-4.	Not complete
4-6	Asset Assessment Intervention Framework – Stage 4 Apply AAIF criteria from Improvement Item 4-3 to three waters and waste station and headworks assets. This may include re-development of schema criteria or inclusion of different schema.	TBC. Follows item 4-5.	Not complete
4-7	Asset Assessment Intervention Framework – Stage 5 Expand on previous AAIF stages to include additional schema, refine existing schema, refine weightings, improve reporting and rectify any other issues identified.	TBC. Follows item 4-6.	Not complete

4-8	Integrate operational data from SCADA systems into the AMIS. Integration may occur via Water Outlook or another system. 1. Identify what data from SCADA would be useful to a wider audience (e.g. pump run hours, motor start numbers, power usage, etc.); 2. Identify which historical SCADA alarms would be useful to a wider audience; 3. Create measurement points in SAP for the operational data and alarms; and 4. Migrate data from SCADA to SAP; Requirements are/shall be documented in TRIM 15/212387 AMT - CCC SCADA Data Governance Standards - Business Needs & Data Standards - Rev 1.	FY19 improvement plan.	Started
4-9	Resilience Modelling & Earthquake Event Network Analysis. Investigate which stations are fitted with flexible joints, earthquake valves or other resilience promoting assets. Model the Likely Effects of Earthquake Events on Current Network and Impact to LOS. This may include incorporating the results of external earthquake models from consultants such as the BECA snapshot. Models will need to be reviewed against actual results from the 2011 earthquake events.	FY19 improvement plan.	Started
4-10	Develop a 3W Project Renewals Standard Operating Procedure (SOP) and Checklist. The business requires a quality assurance framework to ensure that all of the information and requirements utilised to generate the LTP Capital Programme are based on current data and meet Council requirements. It will ensure all aspects have been taken into account when compiling renewal programme project briefs to inform the LTP. These need to ensure the future horizon is accounted for.	FY19 improvement plan.	Partially complete using AAIF and Infonet
4-11	Renewal Decision Improvements. Ongoing support and engagement across new technologies and projects which link to improved renewal decisions and insights, e.g. UC Quake Centre; AAIF; Resilience Programme; Transient Flow Meters; Pipe Sonar Technology. Continue supporting and working with UC Quake centre to deliver the evidence based investment decision making for 3 waters pipe networks. i.e. Network resilience assessment and improvement opportunities; National pipe database.	FY19 improvement plan.	On-going. National pipe database POC completed. Transient monitors installed across part of network. COP for some asset types compiled at National level
4-12	Develop a process for identifying and recording assets that potentially are health and safety risks. This will enable planning for health and safety improvement budgets.	TBC.	Not complete
4-13	CWW Treatment Plant Efficiencies. To develop and implement improved maintenance management and inventory (stores) work-flow processes supported by SAP for effective asset management within WTPs and WWTPs. There is a significant amount of upskilling required in SAP usage, process application and data management quality.	TBC	Not complete
5-1	Develop and document a process for defining risk scoring for individual wastewater assets following the corporate risk policy. Risk scores for each asset to be entered and stored in appropriate Council systems.	FY19 improvement plan.	Completed for reticulation pipe assets as part of AAIF project
5-2	3W AAIF Risk Assessment of Critical Assets 1. Perform risk assessment of 3W critical assets / infrastructure in alignment with corporate risk prioritisation tools and store the risk value ascertained within the appropriate system (Promapp). 2. Develop risk mitigation strategies for all critical assets and infrastructure with elevated risks as determined in 1. 3. Ensure staff responsible for completing the risk mitigation strategies in 2 are aware of requirements. Implement KPIs and reporting for high risks.	TBC	Completed for reticulation pipe assets as part of AAIF project

6-1	Develop procedures for reconciling Levels of Service and Price Projections with Demand Projections. (1) Document current method of determining cost of providing each Group of Activity (GOA) (2) Produce reports and or dashboards for unit costs at activity level and also key facilities level.	TBC	Not complete

Table 10-1: Progress against 2018 Improvement Plan

10.4 Improvement Plan

The starting point for the 2021 Improvement Plan is the recent Asset Management Maturity Assessment 2020whichidentifed priority areas for improvement for 2021 through to 2024. Summary of the AMMA 2020 is provided in Table 10-2 below.

Section	Current/ Target		Reason for scores 2020	Improvement actions planned or underway
AM Policy and Strategy	**85**	**95**	Corporate AM Policy and Strategic AM Plan in place, provides key principles, objectives, corporate AM improvement path, framework for AM planning. Strategic context analysis is thorough and documented in Water Strategy, IS, AMP and Activity Plan. Strategic priorities are well embedded with good alignment through to AMP and Activity Plans.	Advancing asset management programme. Continue to build strategic alignment into AMP programmes. Update AM Policy and Objectives.
Levels of Service	**85**	**90**	The levels of service and performance framework is aligned to strategic objectives and customer expectations and well measured, reported, and benchmarked. There is a general understanding of customer and stakeholder needs, and there is engagement with Council over level of service and cost trade-offs. There is reliance on the community satisfaction survey and LTP/IS consultation as the means of customer engagement. It has been many years since there was wider community engagement over levels of service and willingness to pay. The ability to link key levels of service and cost is strengthening as modelling (both capacity and condition) progresses. There are some improvements needed to operational performance measures, but that aspect is covered under 'operational planning'.	Re-engage with community around level of service options (beyond 'document submissions' processes). Advancement of network models and AAIF will support ongoing improvements in level of service and cost discussions.

Section	Current/ Target		Reason for scores 2020	Improvement actions planned or underway
Forecasting Demand	85	95	Wastewater model recently updated and calibrated following a 4 months flow monitoring programme. Re-running wastewater optimisation process to identify wastewater constraints and optimisation software to evaluate solutions to achieve outcomes (environmental, cultural, etc), last done in 2016/17. A reduction in Inflow and infiltration, in combination with buffering, are the main demand management techniques to maximise value from the existing treatment facilities and delay growth expenditure.	Ongoing improvements to network modelling and supporting information.
Asset Register Data	80	95	There is a robust core dataset for reticulation assets, with data quality improvements for reticulation recently being driven by AAIF. WW PS data capture has been trialled on a pilot dataset with an intention to roll this out across the network. Data quality dashboards are being established to be able to monitor data quality and easily identify remaining gaps. There is several years of lifecycle cost information captured in SAP (though only at facility level for pump stations). Data management processes are developed, but more work needs to be done to manage and enforce data quality coming into the organisation. Assignment of data owner/steward responsibilities has been a good step. Quality and timeliness of data for vested assets has improved.	Asset information improvements for non-reticulation data. Continue development of data quality monitoring/data improvements through data quality dashboards (e.g. laterals update). Review/audit processes for incoming data streams and implement improvements.
Asset Performance /Condition	75	90	A significant condition information base was inherited for SCIRT (over half pipes CCTV assessed) though this information value is decreasing without progressing an ongoing CCTV programme (beyond reactive inspections). Budget pressure on the CCTV programme and modelling may reduce the reliability of information over time. Performance of the network is monitored (actual data) and modelled (models are well validated). Condition of stations and treatment plants has not been assessed, but performance is known. Council is in the process of implementing alternative communication and control technologies to provide improved accuracy in planning and responding to changes in demand. There is a well-established history of reactive maintenance performance and cost and an improved process for transferring performance, works and cost data from contractor data Council systems. Dashboards have been developed to support performance monitoring, including contract KPIs.	Implement pipe CCTV programme (AAIF). Pump station condition and performance assessment programme. Ongoing management and update of network models. Implementation of updated communication and control technology.
Decision Making	80	90	Formal decision-making processes are applied to major projects and programmes - business cases are used to justify the financial and non-financial benefits of projects. Options are evaluated using a Council framework. CAPEX projects are captured and prioritised against decision criteria (aligned to Council priorities) in the CPMS. See also CAPEX planning re: AAIF/ renewal decisions.	See capital planning.
Managing Risk	80	90	The Council risk policy and framework is well established and regularly updated. Regular risk reporting on 'management-level risks' in Promapp, reported to the Audit and Risk Committee. Resilience section of AMP is new with stronger coverage of 'shocks/disruptors' risks and GIS hazard mapping is being used to improve understanding of hazard-related risks. The AMP Risk section summarises high risks and mitigation measures.	Review alignment/links from strategic Promapp risks to operational risk mitigations (water supply safety plan approach). Complete assessment of 'resilience' against disasters for earthquake, tsunami, coastal, storm (risk analysis, mitigation programmes).

Section	Current/ Target		Reason for scores 2020	Improvement actions planned or underway
			Criticality and risk ratings have been applied to reticulation assets and used to prioritise renewals (AAIF).	Noted that Risk team are also progressing other recommendations from Deloitte risk review 2019.
Operational Planning	**85**	**95**	Operations, inspections and maintenance schedules have been developed over many years. AAIF will assist with refining risk-based inspection frequencies. A significant review of pump station maintenance schedules and performance monitoring is underway with a pilot just completed. The wastewater network is remotely monitored, intervention levels are defined and corrective actions implemented. There has been a focus on getting better monitoring and control of contractor operational activities and costs. Emergency management plans, and procedures for specific operations events (e.g. overflows) are in place but the emergency plan needs ongoing review and exercising.	Develop, implement 'Smart Network' strategy to support optimisation of network operations. Continue AAIF programme to inform 'optimised' inspections/ maintenance programmes. Emergency management plan review and exercise programme. Review operational KPIs.
Capital Works Planning	**85**	**95**	See decision making, plus. Capital projects and programmes managed in accordance with CPDF and projects tracked in CPMS. A 10-year (AMP/LTP) and 30-year (IS) CAPEX programme is in place. Renewal programmes for reticulation are based on age, condition, life, performance and cost (AAIF). Wastewater optimisation modelling supports development of investment scenarios across a wide range of objectives (environmental, service, etc).	AAIF enhancements and expansion to non-reticulation assets.
Financial Planning	**80**	**90**	10- and 30-year financial forecasts are developed with supporting data confidence information to inform reliability of forecasts. A good financial overview is provided in the AMP, supported by detailed programmes in the lifecycle section covering how the finances were developed and the key assumptions/ risks. Revaluations occur regularly - the most recent one seeing a significant increase in value (partly arising from application of actual rather than contracted rates). Funding/level of service scenarios are being presented to Council as part of LTP process. There has been more focus given to unit rates-based development of OPEX forecasts and calculation of 'consequential OPEX', however these still get 'disconnected' from CAPEX discussions for LTP budgeting. A 3-waters financial data framework project aims to better align financial and asset data structures to provide better lifecycle cost analysis and asset financial reporting.	Ongoing improvements to data confidence will improve the quality of revaluations and financial forecasts. Continue three-waters financial data framework to support asset lifecycle cost analysis and financial reporting.
AM Leadership and Teams	**85**	**90**	The organisational structure for asset management has embedded. AMU lead the consistent approach to AM across Council. There are council wide AM communications on AM through SharePoint and forums such as the Delegates Liaison Group and AMP workshops and this has been an area of improvement. Generally, AM practice is becoming more standard Council language and culture.	Continue to use opportunities to grow understanding and improve 'AM System' - i.e. how various Council teams work together to deliver good AM outcomes. Continue AM working group/s to support shared learnings and knowledge. Review staff/team capabilities against AM competence framework to identify capability development needs (training, mentoring, etc).
AM Plans	**85**	**95**	The AMP is a significant improvement on the one presented for the last review (which was incomplete). It is supported by strong data and analysis noted in other	Review relative content, timing and scope of AMP and Activity Plan prior to the next LTP.

Table 10-2: Asset Management Maturity Assessment 2020 Summary for Wastewater

A combination of existing 2018 improvement tasks and new improvement tasks from Asset Management Maturity Assessment make up the 2021 Improvement Plan as shown in tables below. These have been grouped into 6 focus areas. These tasks will be worked on over the next three years and focus specifically on the most critical areas. For practicality, these tasks are designed to address several issues concurrently and allow logical progression towards the 3–year target.

The improvement focus areas are:

1. Asset inventory, condition assessment and failure data improvement programme
2. Financial tracking, forecast and relationships improvement programme
3. Demand management improvement programme
4. Integrated master planning improvement programme
5. Climate change response improvement programme
6. Level of service and customer engagement improvement programme

Improvement programme	Asset inventory, condition assessment and failure data improvement programme
Scope	Targeted data capture strategy for vertical assets to improve completeness and confidence of asset inventory, with a specific focus on treatment assets. Condition assessment of critical or high value assets for stations and treatment plants to inform renewal programmes. Condition assessment of pipes where evidence will help refine AAIF criteria for applying condition scores (CCTV records). Asset failure and disposed asset post-mortem to understand failure mechanisms and verify condition grading. Improve maintenance activity and failure data capture to strengthen the connection between network performance and proactive renewal/maintenance strategy.
Issues addressed	Incomplete asset register, particularly for vertical assets with many treatment assets missing from the register or without installation dates. Poor information on the condition of vertical assets, which presents a risk particularly for critical or high value assets. Condition assessment relies on ongoing CCTV inspection. Failure data and maintenance events are not always captured in a way that can be analysed across the portfolio to aid decision-making.
Benefits	Increased confidence in decision making around risk management, maintenance strategy, condition management and renewal intervention.
Resourcing	1 x FTE with skillset engineer/asset manager/analyst for system improvements Condition assessment experts for both vertical and horizontal assets to carry out the targeted inspection programme.
Budget	$100,000 (1xFTE) for system improvements and programme overview; $60,000 per year for wet well inspection (target 5 sites per year), expand programme for pipe condition testing and failure post mortem, $150,000 data collection.
Timeline	Intensive 2 years, then ongoing

Table 10-3: Asset inventory, condition assessment and failure data improvement programme

Improvement programme	Financial tracking, forecast and relationships improvement programme
Scope	Require TOTEX (combined CAPEX and OPEX) estimation at all stages of a project. Provide templates for generating these TOTEX estimates Overhaul how OPEX costs are categorised to allow greater analysis of decision making impacts Develop a live and “BAU” method for the financial reporting that carried out as one-off as part of the AMP writing process. Create tools to make financial analysis more accessible and reliable for asset managers
Issues addressed	OPEX impacts are not always taken into account when projects are promoted and then put into service.

	Poor visibility on where OPEX is being directed and how effective it is over the long term to achieve desired outcomes. The financial analysis and reporting that is required as part of the AMP process is pulled together for a one-off process, is inefficient and lacks clarity.
Benefits	Measuring the combination of CAPEX and OPEX together to support effective financial decisions. Give decision-makers the visibility of clear financial data as evidence to support asset management strategy. Reduce the inefficiency and risk of error when pulling together financial data for AMPs.
Resourcing	Change programme champion (internal): staff time. Staff buy in from City Services, Finance, IT and PMO. Potential: (external) advisors, analyst, project manager
Budget	$200,000 (2xFTE)
Timeline	12 months

Table 10-4: Financial tracking, forecast and relationships improvement programme

Improvement programme	Demand management improvement programme
Scope	Proactive demand management, beginning with strategy and quantifying the most useful areas to target. Determine the off-set cost of infrastructure that is not needed if demand is reduced. Determine options and benefits for inflow and infiltration reduction. Identify new bulk metering sites required to support accurate demand calculation and management.
Issues addressed	Infrastructure costs can be reduced by lowering flows through demand management. There is no overarching demand management strategy that sets clear goals, and tactics. Effort is needed to determine where the most cost effective demand management techniques can be applied. Inflow and infiltration is a diffuse source of additional wastewater flow and is difficult to target, however the cumulative impact has a high impact on the capacity of downstream infrastructure and contributes to overflow likelihood.
Benefits	A strategy for demand management provides a starting point and clear direction. Quantifying the need for demand management sets out the costs and benefits. Reducing demand can defer new infrastructure that would otherwise be needed to meet capacity Reducing demand can reduce running costs for pumping and treatment Demonstrate demand management leadership prior to targeting private infrastructure I&I issues Monitor flows more accurately to enable system improvements. Reduce overflow likelihood.
Resourcing	1 x FTE with skillset engineer/asset manager/analyst
Budget	$100,000 per year for 4 years ($400,000 total)
Timeline	4 years

Table 10-5: Financial tracking, forecast and relationships improvement programme

Improvement programme	Integrated master planning improvement programme
Scope	To create a high level infrastructure master plan that sets out strategy for, conveyance, treatment and disposal zones. To make clear which long term infrastructure solutions are preferred. To integrate master plan priorities when projects are promoted for other reasons, such as renewals.
Issues addressed	Projects can be promoted in isolation which misses out on delivering co-benefits or helping address long term issues.
Benefits	Combine growth, level of service and renewal needs into one integrated master plan
Resourcing	Freeing up time and providing support labour to Team Leader Asset Planning WWW
Budget	$100,000 (1xFTE) to support planning team who is the owner of this programme
Timeline	12 - 24 months

Table 10-6: Integrated master planning improvement programme

Improvement programme	Climate change response improvement programme
Scope	Develop and begin to implement a strategy to mitigate and adapt to climate change specifically for the wastewater activity. Set clear goals, identify options and identify the costs and benefits. Develop a long term strategy for supplying wastewater service to areas exposed to rising sea and groundwater level.
Issues addressed	Council has declared a climate change emergency however a clear strategy is needed to ensure that the most significant impacts to the wastewater activity can be planned for. Decisions regarding climate change require financial support and have long term service impact so require a robust decision-making process. The strategy and planning needs to be done now so that the any specific responses that require CAPEX support can be promoted in the next LTP.
Benefits	Clear direction to meet Council's climate change commitments. Ensure quality decisions are made responding to climate change mitigation and adaption impacts to the wastewater activity. Get the groundwork complete so that any specific responses can be promoted.
Resourcing	1 x FTE with skillset engineer/climate change impact
Budget	$100,000 (1xFTE) to support planning team and asset management team
Timeline	12 months

Table 10-7: Climate change response improvement programme

Improvement programme	Level of service and customer engagement improvement programme
Scope	To engage with customers to ensure that levels of service expectations align with community values. To determine and then carry out various methods of engagement; e.g. customer stakeholder group, survey, workshop, level of service training, representation.
Issues addressed	The last detailed customer research that was carried out for wastewater levels of service was over 20 years ago. Informed perspectives of wastewater customers are essential for setting levels of service targets and long term programmes.
Benefits	To ensure alignment between the views of wastewater customers and the decisions made regarding wastewater costs and levels of service
Resourcing	1 x FTE with skillset in community engagement/customer relations. Internal support from asset management/planning
Budget	Combine with water supply activity, part time staff commitment from asset management/planning
Timeline	Ongoing

Table 10-8: Level of service and customer engagement improvement programme

Table 10-9 below provides a summary of the improvement programme.

Project / Task	AM Maturity Gaps	Priority (H, M, L)	Responsibility	Resources (teams, $)
Asset inventory, condition assessment and failure data improvement programme	Data, lifecycle asset management	H	Asset management	Up to $1M / yr
Financial tracking, forecast and relationships improvement programme	Data, lifecycle asset management, financial	H	Asset management	$200k / yr
Demand management improvement programme	Demand, data	M	Planning	$100k / yr
Integrated master planning improvement programme	Demand, lifecycle asset management	M	Planning	$100k / yr
Climate change response improvement programme	Risk and resilience	M	Planning	$100k / yr
Level of service and customer engagement improvement programme	Levels of service, financial	L	Service delivery	Combine with water supply activity

Table 10-9: Asset Management Improvement Programme Summary

10.5 Resourcing the improvement programme

The activity requires resources and budget to deliver the improvement plan tasks. To date commitment has not been made which is demonstrated in the level of progress made to the improvement items from the 2018 AMP. For any significant improvement to be achieved in the activity to improve the data quality and confidence as recommended as well as improve the business structure to increase the level of maturity, a greater commitment (change in existing workloads, increase in FTE's, change to corporate priorities etc.) is required to meet the indicative completion dates shown in the improvement programme.

In an effort to drive these business improvements, a project has been created within the CPMS system which is to be funded by OPEX to deliver the costs items contained in **Error! Reference source not found.** above.

Given the pressures on Council to deliver a zero rates increase coupled with the economic effects of the Covid-19 emergency, it is likely that across Council, a prioritisation will be required for the delivery of all the improvement items. The prioritisation exercise will be required to ensure the highest priority items are delivered first and that future delivery costs are understood, and sufficient budgets allocated within the LTP.

The LTP process will determine budgets for delivering the improvement tasks. The process to prioritise improvement items is coordinated by the AMU.

10.6 Monitoring and review

The improvement programme will be reported to the AMU and either included within the advancing asset management improvement programme (corporate) or within the continuous improvement programme (unit based). All improvement items will be monitored by the AMU and tracked through the Council's Asset Management Governance Board and the PDP tool.