Asset Management Plan Summary

Waterways and floodplain management

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 the infrastructure needed to drain stormwater and to protect Christchurch from flooding.

The stormwater network collects and carries stormwater during wet weather and is designed to work with secondary flow paths, such as roads.

The flood protection and control work involves managing floodplains and associated infrastructure to reduce flood risk. It also aims to improve the quality of surface water prior to discharging into water bodies, to comply with the Comprehensive Stormwater Network Discharge Consent.

We plan, build, operate and maintain stormwater and flood protection and control assets across Christchurch and Banks Peninsula.

Our investment horizon differs depending on the asset type, from 10 years for pump station components to 30-50 years for treatment facilities and up to 120 years for concrete pipeline/manhole assets.

Our assets are managed in line with our 30-year Infrastructure Strategy and our 10-year Long Term Plan.

Some Council-owned stormwater and flood protection assets are not covered by this plan because they are covered under another asset management plan.

Transport is responsible for street drainage assets such as sumps and pipes. Parks and Foreshore is responsible for assets such as sea walls.

Why we do it

We aim to ensure agreed levels of service are met through:

- Maintaining and renewing our assets
- Investing capital in response to increasing demands for growth (greenfield and infill)
- Improving the quality of stormwater discharges to address waterway degradation.

Our work is guided by our Strategic Framework, which details how we plan to ensure the city develops resilience, and other strategic documents.

We operate under resource consents approved by Environment Canterbury.

Christchurch City Council

Where we've come from

The city's first known stormwater drainage was through a sewer discharging into Ihutai-Avon-Heathcote Estuary via an outfall at Linwood Avenue. The main stormwater outfall, built between 1871 and 1874, has served the city since.

The Christchurch Drainage Board, formed in 1876, decided to keep the city's stormwater and sewage disposal systems separate.

A complex system of drains, both open and piped, was created to carry stormwater from the city to the Linwood Avenue outfall. Natural streams and creeks were used, with many becoming boarded drains.

Early on, Christchurch had the country's highest rates of water-borne diseases but was later said to have the country's "first comprehensive, effective drainage system" one historian wrote.

In 1868 Christchurch was flooded by the Waimakariri River. This prompted the construction of flood protection works that started in the 19th century and continued well into the second half of the 20th century.

Christchurch remains vulnerable to surface flooding from large rainfall events, rivers spilling over their banks, and major storm events associated with high tides.

This was exacerbated by the Canterbury earthquakes of 2010 and 2011, substantially altered ground levels in parts of the city and flooding affected Mairehau, Richmond, St Albans and properties along the lower reaches of the Ōpawaho-Heathcote River.

In 2012 the Land Drainage Recovery Programme was established to assess the effects of the earthquakes on the land drainage network and prepare a programme of works to address them.

After a series of floods, a Mayoral Taskforce was set up in 2014 to grapple with this problem in the most vulnerable areas. It prioritised funding for mitigation projects , particularly in the Flockton area and the Heathcote catchment. The Land Drainage Recovery Programme was absorbed back into 'business as usual' works at the end of 2019.

Historically, work on Banks Peninsula focused on enclosing hillside streams for safety and land stability, and to improve drainage to the sea from Lake Forsyth to reduce the risk of flooding.

Our assets

We own, plan, build and manage the city's stormwater disposal network and flood protection and control assets.

Stormwater Drainage

Asset category	Quantity
Reticulation	935 kilometres pipes 25,662 nodes
Waterway lining	297,417m^2
Open waterways	187,291 metres
Open waterway structures	419 debris rack/pole sites and weirs
Monitoring/ hydrometric equipment	70 sites (approximately)

Flood Protection and Control Works

Asset category	Quantity
Pump stations	50 (including tidal barrage)
Flood protection structures	12.1 kilometres stopbanks 470 valves
Treatment and storage facilities	292 swales 162 retention basins 65 detention basins 79 ponds 36 soak pits 65 rain gardens

Our issues and risks

In this asset management plan we provide a snapshot of the greatest risks recorded for land drainage 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 $109.8 million (total activity net cost of service plus capital spend for 21/22), with the net operational expenditure projected at $47.6 million (net cost of service) and capital expenditure at $62.8 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.

- Operating expenditure is funded by rates (targeted, general, separate and differential) and through fees and charges.
- Capital expenditure is funded by borrowing and repaying over several years.
- Private developer vesting – park assets are created in new subdivisions then 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

- Stormwater network and flood control operations, asset planning and management, project management
- Financial and legal advice

Contractors deliver

- General operations, scheduled and reactive maintenance and construction
- Monitoring/hydrometric equipment maintenance

Key delivery partners

- Technical Services Unit (Council)
- Transport Unit (Council)
- City Care Ltd
- Consultants Panel
- Land developers
- Selwyn District Council
- Environment Canterbury

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 we do 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.

Stormwater drainage
We promptly and effectively respond to flood events, faults and blockages and manage the network to minimise the risk of flooding, damage and disruption. We maintain waterway channels and margins to a high standard and manage the network in a responsible and sustainable manner.

Flood protection and control works
Through implementting the Floodplain Mitigation Programme and maintaining, repairing and renewing assets to key standards, we reduce the risk to residential buildings and property of flooding during extreme rain events. We ensure our waterways are clean and that pollution is minimised.

Asset maturity assessment

The maturity assessment for our assets shows we are performing at an intermediate level in most areas. The average score rose from 68 percent to 77 percent in the past two years, with the target being 88 percent. More detailed information about this is included in our asset management plan.

We showed improvement in the areas of policy, strategy, risk, asset management planning, service delivery and quality management.

We need to address deficiencies in the areas of storing and updating asset data, using data for forecasting in operational and capital spending and modelling to allow for demand forecasting.

Little progress was made on business improvement items identified in the 2018 Asset Management Plan.

Land Drainage Asset Management Plan

January 2021

Christchurch City Council

Document Control

Version Control

Version numbering changes when a document is approved. Draft document numbering starts at 0.01. Released or approved numbering starts at 1.01.

Version	Date	Author	Description

Document Acceptance and Release Notice

This is a managed document. For identification of amendments each page contains a release number and a page number. Changes will only be issued as a complete replacement document. Recipients should remove superseded versions from circulation. This document is authorised for release once all signatures have been obtained.

Name	Role	Status	Signed	Date

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1 Summary of the Activity

1.1 Activity Description

1.1.1 What do we do?

This Asset Management Plan covers infrastructure assets that serve the Christchurch City and Banks Peninsula communities stormwater and flood protection needs. The Council activities covered are;

- Stormwater Drainage
- Flood Protection & Control Works

There are some Council-owned stormwater and flood protection assets that are excluded from this plan, for example, Transport stormwater assets such as sumps and pipes, which are covered by the Transport AMP and foreshore assets such as seawalls which are covered by the Parks & Foreshore AMP.

The stormwater network collects and conveys stormwater during rainfall events. This is designed to work with secondary flow paths which can include roads in larger storm events.

The flood protection and control works activity delivers floodplain and stormwater management plan objectives to reduce the harm from flooding to our community and to improve the quality of the surface water.

1.1.2 Why do we do it?

In delivering this service the Council provides a balanced mix of

- maintenance and renewals to preserve the levels of service as well as
- capital investment to respond to increasing demands for growth (both greenfield and infill) and
- improved stormwater discharge quality to address waterway degradation.

Council has a Strategic Framework which details how we will ensure the city develops “Resilience into the 21st Century”. The framework is built around key Community Outcomes and Strategic Priorities commitments made by Council to which the Stormwater and Waterways activities are part of. These commitments are detailed in tables 1-1 and 1-2 below.

Table 1-1: Stormwater and Waterways Services Strategic Priorities

Strategic Priorities	
Enabling active and connected communities to own their future	Through works such as the "Community Waterways Partnership Charter" Council continues to engage with the community to increase local knowledge and empowering the community to improve the health of our waterways with Council.
Meeting the challenge of climate change through every means available	The stormwater and flood management systems are a crucial part of responding to climate-related hazards, which are projected to worsen with time. Through the use of focused investigation and intelligent design Council can make the best decisions to continue to manage flooding as it is exacerbated by the effects of climate change, whilst incorporating Council's 6-values approach[1].
Ensuring a high quality drinking water supply that is safe and sustainable	By ensuring that all stormwater and flood protection infrastructure is maintained and operated to the correct standard and renewed at the optimum time, then the quantity of urban run-off contaminants entering the surface water system will reduce the risk to the quality of the drinking water supply in shallow aquifers.
Accelerating the momentum the city needs	Councils Land Drainage Planning teams are working with appropriate Council Strategic documents (such as the Integrated Water Strategy and various Stormwater Management Plans) to ensure that stormwater pipe upgrades and the provision of treatment/storage facilities are planned and/or provided ahead of development to prevent any delays. Council plans for the required funding many years in advance to ensure the funding is available when it is required.
Ensuring rates are affordable and sustainable	To balance the needs of the community with the ongoing need to replace components of the network that are nearing the end of their useful life, options are considered at the major times of expenditure setting by Council. The Capital and Operation expenditure must be balanced to ensure the Levels of Service are met for the activity.

Table 1-2 - Stormwater and Waterways Services Community Outcome Themes

Community Outcome Themes	
Strong Communities	Council continues to improve the water quality and health of our waterways being degraded by the effects of urbanisation through capital works projects and key maintenance regimes. To mitigate the effects of flooding, the activity aims to address the physical constraints that cause inundation and plan for the effects of changing natural hazards through climate change.
Liveable City	Ensure that the city can respond and recovery quickly to natural hazard events.
Healthy Environment	Through the improvement of habitat, the increase of unique landscape and consistent improvement of asset base and maintenance activities, the city's health will improve and prosper over time.
Prosperous Economy	The work undertaken against this activity allows funds to enter the local economy, with a focus on local contractors utilising local resource and materials.

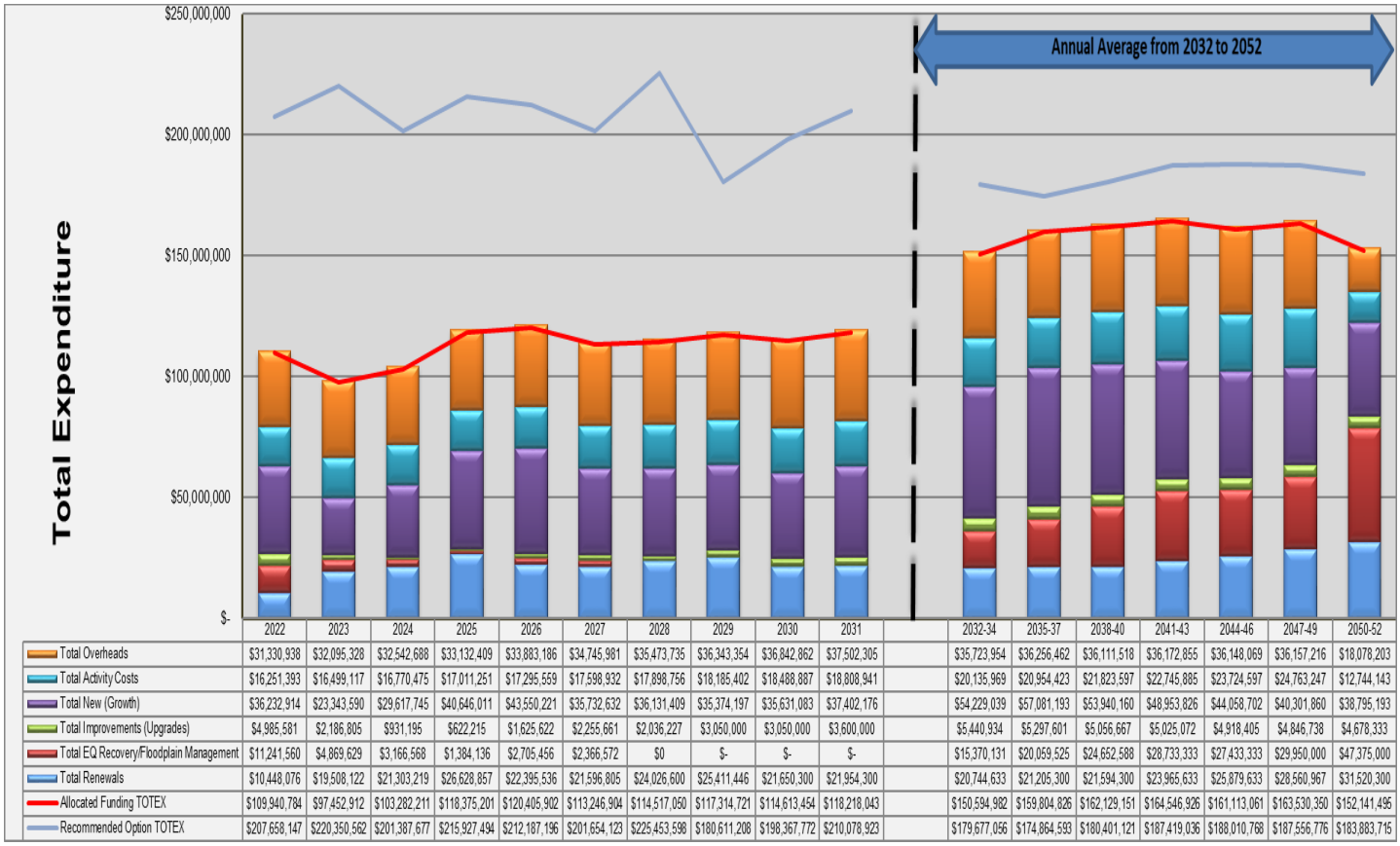
1.1.3 How much does it cost?

The projected cost of providing the necessary core services covered by this Plan, including operations, maintenance, renewal, upgrade and earthquake recovery over the first 10 years of the LTP planning period is **$2,073 million**. The Historic expenditure for the period FY2011 to FY2020 was $609 million. The significant increase is primarily due to the increase in capital works projects, in particular growth works to meet the requirements of the Comprehensive Network Stormwater Discharge Consent, to fund the stormwater infrastructure and ecological enhancements within the Otakaro Avon River Corridor, improvement works, and addressing a backlog of deferred renewals.

[1] Waterways and Wetlands Natural Asset Management Strategy 1999 TRIM://10/14605

The funding allocated to providing the necessary core services covered by this AMP over the first 10 years of the LTP planning period is **$1,126 million**. This is **54%** of the cost (as outlined above) to provide an optimised asset management at the lowest lifecycle cost.

The allocated funding leaves an annual average shortfall of **$947 million** over the first 10 years of the LTP. The projected cost and allocated funding are shown in Figure1-1 (all values exclude inflation).



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
Total Overheads	$31,330,938	$32,095,328	$32,542,688	$33,132,409	$33,883,186	$34,745,981	$35,473,735	$36,343,354	$36,842,862	$37,502,305	$35,723,954	$36,256,462	$36,111,518	$36,172,855	$36,148,069	$36,157,216	$18,078,203
Total Activity Costs	$16,251,393	$16,499,117	$16,770,475	$17,011,251	$17,295,559	$17,598,932	$17,898,756	$18,185,402	$18,488,887	$18,808,941	$20,135,969	$20,954,423	$21,823,597	$22,745,885	$23,724,597	$24,763,247	$12,744,143
Total New (Growth)	$36,232,914	$23,343,590	$29,617,745	$40,646,011	$43,550,221	$35,732,632	$36,131,409	$35,374,197	$35,631,083	$37,402,176	$54,229,039	$57,081,193	$53,940,160	$48,953,826	$44,058,702	$40,301,860	$38,795,193
Total Improvements (Upgrades)	$4,985,581	$2,186,805	$931,195	$622,215	$1,625,622	$2,255,661	$2,036,227	$3,050,000	$3,050,000	$3,600,000	$5,440,934	$5,297,601	$5,056,667	$5,025,072	$4,918,405	$4,846,738	$4,678,333
Total EQ Recovery/Floodplain Management	$11,241,560	$4,869,629	$3,166,568	$1,384,136	$2,705,456	$2,366,572	$0	$-	$-	$-	$15,370,131	$20,059,525	$24,652,588	$28,733,333	$27,433,333	$29,950,000	$47,375,000
Total Renewals	$10,448,076	$19,508,122	$21,303,219	$26,628,857	$22,395,536	$21,596,805	$24,026,600	$25,411,446	$21,650,300	$21,954,300	$20,744,633	$21,205,300	$21,594,300	$23,965,633	$25,879,633	$28,560,967	$31,520,300
Allocated Funding TOTEX	$109,940,784	$97,452,912	$103,282,211	$118,375,201	$120,405,902	$113,246,904	$114,517,050	$117,314,721	$114,613,454	$118,218,043	$150,594,982	$159,804,826	$162,129,151	$164,546,926	$161,113,061	$163,530,350	$152,141,495
Recommended Option TOTEX	$207,658,147	$220,350,562	$201,387,677	$215,927,494	$212,187,196	$201,654,123	$225,453,598	$180,611,208	$198,367,772	$210,078,923	$179,677,056	$174,864,593	$180,401,121	$187,419,036	$188,010,768	$187,556,776	$183,883,715

Figure 1-1 - Stormwater and Waterways Services Recommended and Approved Costs

The Financial Strategy[2] outlines Councils *"financial direction over the next 10 years and strikes a balance between providing reliable infrastructure networks, facilities and services and addressing the financial impacts of COVID-19. At the same time, we need to maintain financial prudence, and build long term financial resilience within affordable rates and charges".* It should be noted therefore that the original budgets proposed in the December 2019 draft AMP, the "Recommended Option", pre-date the Covid-19 pandemic and draft Financial Strategy and are no longer applicable in the current economic climate. The options provided at that time were based on meeting existing levels of service, supporting red-zone re-development and overall deliverability of the combined three waters capital programme.

For the Land Drainage Activity, the reduction in budget from the "Recommended Option" presented in the 2019 draft AMP has been managed by either, deferring projects to future years (in some cases to being outside of the Infrastructure Strategy period), reducing overall programme level budgets and cancelling projects.

The "Proposed Option" budget, presented within this AMP is based on the financial envelope informed by the financial strategy and agreed following several council briefings.

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.

[2] Financial Strategy 21-31 – Live Version TRIM://20/1244349

Council reviewed its revenue and financing policy as part of the development of the 2018 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 stormwater and waterway assets are created and vested with Council.

1.1.5 How is it delivered?

The delivery of the activity is carried out by multiple teams within the 3-Waters area. The teams, and their responsibilities in brief are:

1. Stormwater and Waterways Planning - manage all growth and improvement works, provide advice on resource and building consent matters relating to asset setbacks, flood hazard floor levels and infrastructure (pipe and treatment devices) requirements for development and the implementation and monitoring of the Comprehensive Stormwater Network Discharge Consent (CSNDC).
2. Stormwater and Waterways Operations – administer and oversee the delivery of the maintenance contract, resolve all customer queries, manage the network.
3. 3-water and Waste Asset Management – manages the renewal of the assets, carries out the preparation of all activity specific Long Term Plan documents (Asset Management Plan, Activity Management Plans) as well as input into the Infrastructure Strategy. Liaises with all other teams in the activity.
4. Stormwater and Waterways Delivery Team – responsible for the delivery of all CAPEX projects from the brief to hand over. This includes procuring design consultants, specialist services such as ecology, geotechnical, structural, arboreal and archaeological followed by tender preparation, award and overseeing the contract management. The team is responsible for monthly reporting on progress of the projects including any financial or delivery timeframe risks within Councils CPMS reporting tool.
5. Asset Management Unit – sets Asset Management policy, Strategic Asset Management Plans (SAMPs) and provides specialist assistance to the 3-waters business to drive asset management maturity improvements.

The maintenance and operation of the assets are provided by way of 3 contracts:

1. Maintenance of City Water and Waste Networks (CN4600000778) – to manage operate and maintain all pumping stations, mechanical, electrical, instrumentation and control assets.
2. Land Drainage Maintenance Contract (CN4600001064) – a two-part contract based around programmed works and reactive works to maintain the stormwater and land drainage assets.
3. Service Agreement for Maintenance of Hydrometric Equipment (CN4600001152) – maintenance of hydrometric equipment needed for flow monitoring of waterways and rain gauges.

1.1.6 What are the functions and services provided?

Services provided by the Stormwater Drainage activity:

- Council responds to flood events, faults and blockages promptly and effectively
- Stormwater network is managed to minimise risk of flooding, damage and disruption.
- Council maintains waterway channels & margins to a high standard
- Council manages the stormwater network in a responsible and sustainable manner

Services Delivered by Flood Protection activity:

- Manage the risk of flooding to property and dwellings during extreme rain events
- Major flood protection and control works are maintained, repaired and renewed to key standards
- Implement Land Drainage Recovery Programme works to reduce flooding
- Waterways are clean and pollution is minimised

There have been 2 main level of service performance measure changes between the 2018 (current) and the proposed 2021-2031 Plans. These are:

Stormwater Drainage Activity

"Council manages the stormwater network in a responsible and sustainable manner" - Targets have been reduced as it is anticipated that a lower level of funding than that recommended will likely affect reported resident satisfaction levels as the asset base continues to deteriorate and flood mitigation isn't addressed.

Flood Protection Activity

"Manage the risk of flooding to property and dwellings during extreme rain events" - Targets have been reduced to zero as funding for Flood Mitigation projects has been deferred and it is likely that the risk of habitual floor flooding will not be reduced to the modelled properties.

1.1.7 Overview of assets

The key physical assets (based on 2020 asset Valuation Tables[3]) used to deliver this activity are:

Table 1-3 - Assets Quantity

Service	Asset Group	Quantity
Stormwater Drainage	**Reticulation**	935 km Pipes
		25,662 nodes
	Waterway Lining	297,417m^2
	Open Waterways	187,291m
	Open Waterway Structures (excl lining)	419 debris rack/pole sites and weirs
	Monitoring Equipment / Hydrometric	Estimated 70 sites
Flood Protection & Control Works	**Pump stations**	50 Pumping Stations (inc Tidal barrage)
	Flood protection structures	12.1km Stop Banks 470 valves
	Treatment & Storage Facilities	292 swales 162 retention basins 65 detention basins 79 ponds 36 soak pits 65 rain gardens

- The underground conveyance networks (including pipes, manholes, sumps, inlets, outlets etc.)
- Open channels and overland flow path (including natural waterways such as rivers, streams and creeks, constructed drainage channels, in-channel structures, lining and retaining walls etc.)
- Pump stations and water flow control devices and structures such as valve stations, stopbanks, tide gates and basins.
- Water quality treatment devices such as basins, wetlands, tree pits, raingardens and filtration devices
- Hydrometric monitoring devices, measuring rainfall along with surface water, sea and groundwater levels.
- Basins and wetlands serve a dual purpose of providing Stormwater detention for reducing flood risk as well as providing water quality treatment.

[3] CCC Three Waters FINAL Valuation June 2020 TRIM://20/897727

1.2 Where have we come from and where are we heading

1.2.1 Background

The following events are relevant to historic management of land drainage assets;

- Local government amalgamation in 1989 meant that responsibility for the management of Land Drainage assets within Christchurch City moved from the Christchurch Drainage Board to the City Council
- Merger of the former Banks Peninsula District Council (BPDC) with Christchurch City Council in 2007 resulted in an increase in the asset base, which included the Lyttelton brick barrels (identified as requiring renewal over the following 30 years in the 1989 Banks Peninsula District Council Stormwater and Lakes Asset Management Plan. There was very little asset data handed over as part of the merger and the quantity and quality of the Banks Peninsula asset data remains below that of the City.
- Land Drainage assets were formerly managed alongside Parks assets rather than as part of three waters as they are now. This has led to some inconsistencies between the asset data structure and quality for Land Drainage assets compared to wastewater and water supply assets.
- The Stronger Christchurch Infrastructure Rebuild Team (SCIRT) was established in 2011 in response to network damage caused by the earthquakes. SCIRT work was primarily focussed on reticulation and pump stations assets only. SCIRT was disbanded in July 2017. The SCIRT Legacy Report[4] acknowledged that *"it will take many years and significant ongoing funding to address the remaining issues across the network".*
- The Land Drainage Recovery Programme (LDRP) was formed in 2012 to investigate the consequences of the earthquakes on the whole land drainage network, deliver capital works and develop processes to be included in normal operations.

1.2.2 Looking Forward

The Integrated Water Strategy (2019) document[5] sets out the pathway for Council to manage the water resources in Christchurch and Banks Peninsula. 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.

This high level document will assist with the future planning of the land drainage network to meet the requirements of future demand due to population and climatic changes and ensure that CCC has the infrastructure required to be a future resilient city that people will want to be part of.

Land drainage asset management strategies are expected to align with the Integrated Water Strategy objectives below.

Table 1-4 - Integrated Water Strategy objectives

Objective 1	**Awareness and engagement** Increase awareness and engage with the community and mana whenua regarding the multiple uses and values of water.

[4] SCIRT Legacy Report, CCC, October 2017 - TRIM://17/841599

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

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 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 overflows 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).

1.3 Successes, Issues, Opportunities and Risks

1.3.1 Success Factors

Success within the Land Drainage activities is measured through levels of service and customer satisfaction surveys.

Where things have gone well

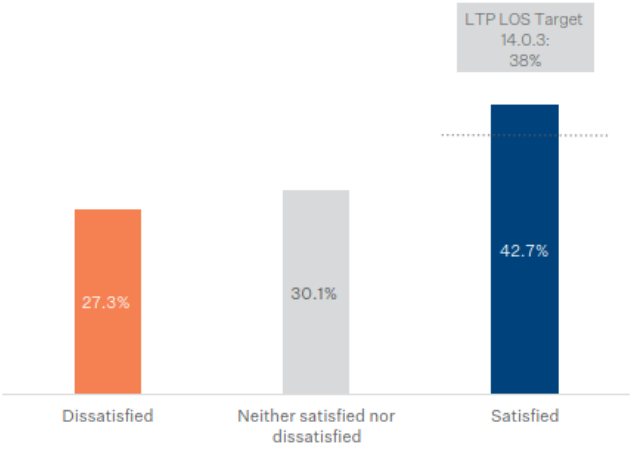
Based on the "Christchurch City Council 2020 General Service Satisfaction Survey" [6] report, Council is doing well on the maintenance and appearance of the waterway margins. Works that the general public are unlikely to be aware of is the large amount of flood prevention works constructed over the previous LTP period to minimise the amount of flooding in the low lying areas of the city as well as flood storage systems in the upper Heathcote.

The following figure is an excerpt from the Survey Report:

		Don't know/ not applicable	Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
Condition of waterways	n	7	90	201	245	170	58
	%		11.8%	26.3%	32.1%	22.3%	7.6%
Condition of waterway margins	n	14	55	112	225	279	86
	%		7.3%	14.8%	29.7%	36.9%	11.4%
Appearance of Christchurch´s waterway margins	n	12	40	116	214	298	91
	%		5.3%	15.3%	28.2%	39.3%	12.0%
Stormwater systems operate effectively to ensure that the risk of flooding is minimised	n	19	55	157	229	236	75
	%		7.3%	20.9%	30.5%	31.4%	10.0%
AVERAGE RATING			7.9%	19.3%	30.1%	32.4%	10.2%

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

3.21 Average level of satisfaction with waterways and the stormwater network



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

Figure 1-2 - Christchurch City Council 2020 Service Satisfaction Survey - Land Drainage Results

Where improvements can be made

There are many opportunities to improve on the activity going forward namely; climate change adaptation plans, renewal of "sweated" assets, expanding the network for growth, providing greater surety for residents against flooding and providing enhanced waterways and more green low impact design solutions. The funding model that is being proposed is likely to preclude many opportunities to improve the activity beyond meeting base levels of service requirements, meeting growth obligations, and ensuring compliance with the Comprehensive Stormwater Network Discharge Consent (CSNDC).

[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/

1.3.2 Strategic Issues and Risks

There are a number of strategic issues and risks that face the activity (as discussed in Section 5). The risks can be summarised under the following key issues:

Table 1-5 - Summary of Strategic Risks

Risk Title **There is a risk that/of:**	**Caused By:**	**Resulting In:**	**Controls and Mitigations**
Increased flooding of houses and businesses, that places the community at an unacceptable risk to their health and wellbeing, and their physical assets	• Due to failure of high consequence assets, stemming from a compounded lack of prioritised spending in this area • Due to increased failures of stop banks, pumping stations, stormwater pipes and waterway linings	• A risk to human life, particularly in the case of stop bank failure • Damage to and loss of usage of public and private infrastructure including lifelines with Council being liable for repairs • Increasing OPEX costs to support temporary repairs vs renewal/replacement costs • Reputational damage to Council • Possibility that residents and businesses will relocate out of Christchurch.	• Increase modelling resource application to identify specific risk factors and therefore required future OPEX (maintenance) and CAPEX (renewal) spending requirements • Increased comms and engagement with community through community boards
Potential non-compliance with the consent conditions of the Comprehensive Stormwater Network Discharge Consent, which Council has committed to delivering under its obligations as a territorial authority.	• The current funding level is constrained, with very limited flexibility for dealing with any changes to the consent listed 10 year projects • Cost over-runs or unknown site conditions may lead to non-conformance • Lack of technical resource time and personnel required to deliver timescales and documented evidence requirements	• Unable to deliver on water quality and quantity outcomes • Breach of consent conditions with ECAN leading to enforcement and prosecution of Council • Major reputational damage with ECan, Ngai Tahu/Iwi and the public.	• Provision of escalation structures in the event of any issues which may lead to non-compliance dealt with in accordance with the "Joint Christchurch City Council & Canterbury Regional Council Stormwater Management Protocol, Report U10/12 (the Protocol)" document. • Prioritise funding to meet consent obligations • Ongoing engagement with the Regulator (ECan) and stakeholder groups concerning compliance issues • Obtain appropriate expert advice (including legal regarding RMA)

Risk Title There is a risk that/of:	Caused By:	Resulting In:	Controls and Mitigations
Slow progress and development of a 21st century garden city, failure to make coordinated progress of Otakaro Avon River Corridor (OARC), which is part of the city's regeneration plan and commitment to the community.	• The majority of the funding for the Otakaro Avon River Corridor work development has been deferred by 10 or more years to meet the funding envelope. Only funding for 2 projects and concept design work has been provided • Only works that are required to meet statutory obligations and a limited level of network renewals remain in the initial 10-year financial envelope of the LTP, only the initial stages of the OARC are included in this • There is no ability for securing works to provide any infrastructure enhancements or surety around infrastructure being in place to support stormwater projects that address flood mitigation, water quality treatment, residential and commercial development • There is no clear end-date or timeline in place for development of the OARC	• This may lead to out of sequence works between various council activities (i.e. Parks and Transport) and reputational issues with council not delivering these works and undermining the garden city image • Compromised development of a 21st century garden city • Reduced expenditure will see contractors/consultants downscale or move to other cities/towns for work. This may lead to increasing unit rates for infrastructure works and decreased external development in Christchurch • Creating intergenerational debt through insufficient investment to resolve the current backlog of renewals or meeting current renewal rates which will merge into a predicted larger bow-wave of renewals in FY's 36-41 • Reduced support for new residential and commercial development as a result of capacity constraints • Reputational damage if Christchurch is perceived to be behind the times with investment in delivering green infrastructure.	• Implementation of the Councils Climate Change Strategy and the integration with the required works within the Avon river corridor • Review funding for OARC projects and concept design work, to assess future funding/resource requirement • Defined OARC end-date and related timeline, and project schedules to be development
Inability to put in place the adaptations to Council operations required to address the impacts of climate change, which include: • increased flooding • changes to groundwater • more frequent and more intense rain events.	• Lack of clarity regarding the implementation requirements of Councils' Climate Change Strategy and Policy • Timeliness of decision-making and prioritisation of resources and funding to address adaptation requirements, leading from the above cause • The activity projects nominated to provide Council with funding to begin to address the risks associated with climate change and the	• Maladaptation and sub-optimal renewal and planning investment • Councils response to the declared "Climate Emergency" is further delayed • Pushing the costs of carrying out mitigation works into later LTP periods, requiring a higher investment in a shorter time to meet adaptation requirements • Areas of high flood risk which flooded in March 2014 will not have risk reduced in next 10 years	Creation of a policy, while waiting for the Draft Climate Change Strategy to be approved by Council, to allow informed infrastructure renewal/new works and maintenance operations within the Coastal Hazard Adaptation Planning areas to be made.

Risk Title There is a risk that/of:	Caused By:	Resulting In:	Controls and Mitigations
	resulting coastal hazard adaptation work have all been deferred by 10 years • These works included groundwater management, lower river erosion and hill sediment deposition management and floodplain management works. Funding to carry out investigation works into the effects of climate change and proposals for adaptation have been greatly reduced.	• New flood prone areas maybe created due to the effects of climate change increasing a backlog of work for future generations through current underinvestment • Reputational damage as Council is seen to be not progressing at a fast enough pace and not able to react to adaptation requirements • Unable to support population movements as a result of climate change.	
Loss of unique landscapes and indigenous biodiversity, and deterioration of water body health, through Council failing to deliver: 1) waterway enhancements 2) treatment of water from: • brownfield/existing development – both commercial and council-owned • roading and transport projects	• The existing work programme for Waterway Ecology and Water Quality Improvement has had all funding deferred for 10 years • Specific (small) projects created for dealing with some known areas requiring improvement have been deferred for 3 years • Lack of financial provision for purchase of lands for long term ecological/environmental improvements by Council	• Inability to improve waterway health through investment in enhancement and biodiversity • Continued trends of loss of habitat in the city's waterways impacting indigenous invertebrates, aquatic and avian species • Failure in meeting obligations for protecting Maori values for freshwater including mahinga kai • Failure to meet council set community outcomes for Healthy Waterbodies	• Review waterway setback requirements in the District Plan to prevent encroachment and provide more space for enhancement. • Legislate changes to council requirements to require source control on industrial, commercial and residential properties • Creation of a planning document outlining a prioritisation of the waterways to focus on and the funding envelope which may be required for e.g. land purchase etc.

2 Introduction

2.1 Background

This asset and activity management plan (AMP) is the basis for Land Drainage 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 Land Drainage 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 Land Drainage 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 Land Drainage 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 Land Drainage 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 Land Drainage 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 contained in the 2020 Three Waters Valuation.

2.2 Scope of the Assets and Services Covered

The following assets and services are covered in this AMP.

Table 2-1 - Scope of Assets and Services Covered in this Plan

Activity	Asset group	Description (what the asset is)	Primary purpose (what the asset does)	Quantity (based on best available data)
Stormwater Drainage	Reticulation	Pipes and nodes (such as inlets, outlets, manholes and junctions), which make up the below ground reticulation network	Collection and conveyance of surface water runoff to point of discharge	935km of pipe 25,662nodes
	Waterway Lining	Structural or non-structural lining associated with the banks or bed of an open waterway	Stabilisation of vertical or steep banks. Scour and erosion protection. Structural support of roads or footpaths (retaining walls)	Estimated 297,417m^2 of bank lining (where lining is on either waterway bank)
	Open Waterways	The earthworks and natural channel bed, bank and margins of all open waterways including rivers, creeks, streams and drains. Also includes riparian planting where it serves a land drainage purpose	Collection, storage and conveyance of surface water runoff and groundwater flows. Environmental, heritage, culture, recreation, landscape values	Estimated 187,291m of (District Plan classified) open waterway
	Open Waterway Structures (excl lining)	Structures located within open waterway channels or margins that do not primarily perform a flood protection function	Control of upstream water levels, access to, over or through waterways etc.	Unknown – provisional estimate of 419 no.debris racks, debris pole sites and weirs
	Monitoring Equipment	Includes the monitoring sites and associated structures and instruments used to gather hydrometric information.	Monitoring and recording of rainfall, groundwater, and waterway levels and flows	Estimated 70 individual sites
Flood Protection & Control Works	Pump Stations (incl Woolston barrage)	Mechanical lifting of stormwater flows to allow discharge independent of downstream water levels	Pumping of stormwater at a rate and volume required to provide active flood protection and control where a gravity solution would not be feasible or would not provide sufficient capacity	50 No. pump stations
	Treatment & Storage Facilities	Facilities that provide storage, attenuation and controlled discharge to ground or receiving water body. Often also provide treatment. There may be associated components that are within other asset groups, such as field tiles that will be within reticulation	Mitigation of increased flood risk due to land development. Recharge or ground water. Removal of contaminants. Contribution to 5 values.	Including 292 swales, 162 retention basins, 65 detention basins, 79 ponds, 36 soakpits and 65 rain gardens
	Flood Protection Structures	Structures that protect land from flooding by providing a physical barrier	Passive protection against flood flows or levels that pose a flood risk.	12.1km stop banks and 470 valves

2.3 Relationship with other plans

Many of the asset 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[7]

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

which provides an overview of asset management planning at the Council, and an AMP document for each asset group 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.

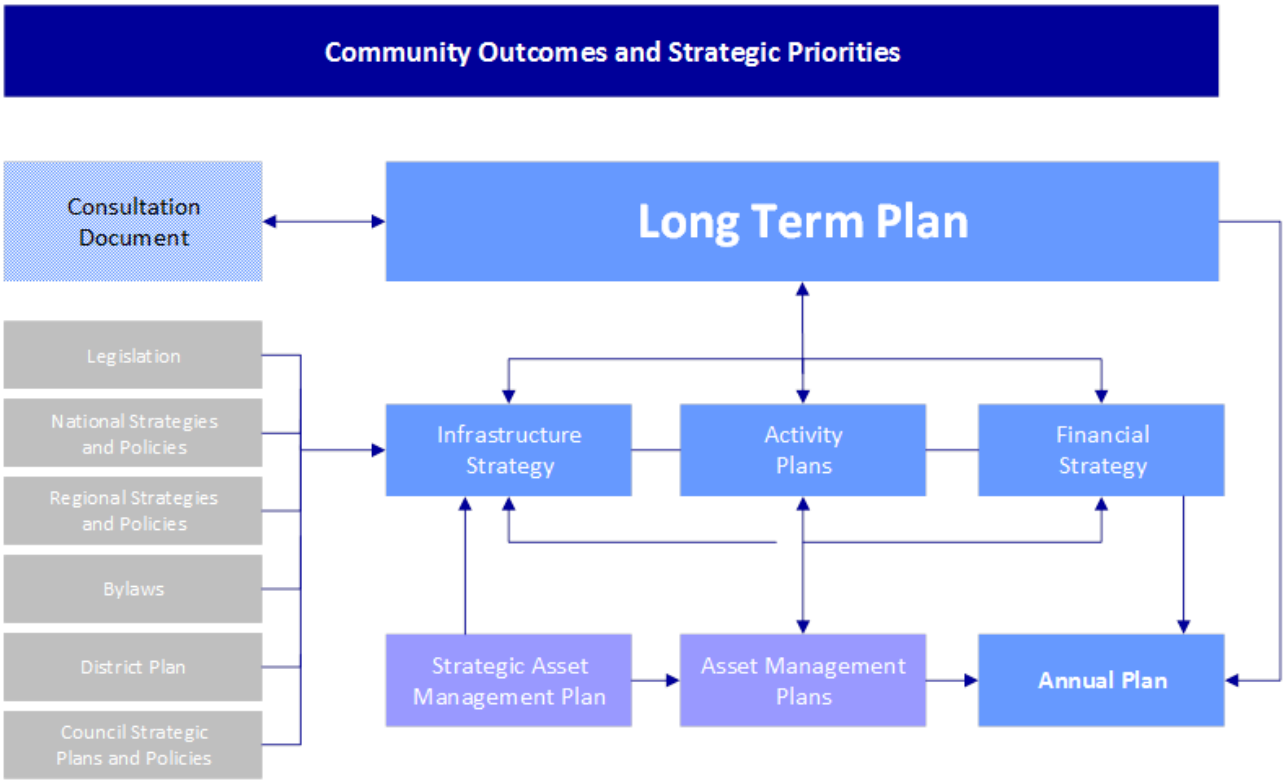


Figure 2-1 - Council's Planning Framework

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:

- Asset Management Policy & Strategy
- Long Term Plan
- Te Wai o Tane Integrated Water Strategy
- Service (Delivery) Plans
- Waterways, Wetlands & Drainage Guidelines
- Stormwater Management Plans

2.4 Delivering on Council's Strategic Framework

2.4.1 Alignment of Outcomes, Priorities and Activity Objectives

Council's strategic framework and general implications for the activities are presented in Council's SAMP. The table below summarises key responses by the activity to contribute to the community outcomes and strategic priorities within the available funding strategy.

Table 2-2 - Community Outcomes from the Stormwater Drainage & Flood Protection and Control Works Activity

Relevant Community Outcome	Outcome Discussion
Healthy waterways	Healthy waterways are an important part of a healthy environment. Growth and land use intensification can negatively impact on the water quality and the ecological health of our natural waterways. For water quality in our waterways, wetlands and estuaries to improve over time good stormwater management such as timely renewals, appropriate maintenance regimes and public education on "where stormwater goes" is required by everyone in the community. To mitigate the effects of flooding, the activity aims to address the physical constraints that cause inundation and plan for the effects of changing natural hazards through climate change. Based on the financially constrained funding model, Council will be meeting its requirements for offsetting the effects on waterway degradation due to growth and the treatment of existing urban discharges within 2 priority catchments. Council will not be making any serious inroads into improving waterway health from existing and brownfield development.
Modern and robust city infrastructure and community facilities	A key objective of this activity is to limit the effects of flooding on homes and Council infrastructure and ensure lifeline routes are available during an emergency response. This will mean that the stormwater system will need to adapt as the climate changes, the sea rises and more frequent, more intense storms and rainfall affect the city. Additionally, to meet the priority means that Christchurch is well prepared for the impacts and consequences of natural hazards and can respond and recover quickly, due to Council infrastructure being able to function following expected natural hazard events There is limited allowance within the 10 years of the Infrastructure strategy to carry out backlog floodplain mitigation works, with 5 projects funded within the first 3 years of the LTP, and an additional 9 projects commencing within the 10 years of the LTP from a list of 16 projects identified to be carried out. This will leave several areas identified by Council staff not able to meet Councils nominated levels of service and vulnerable to flooding within the coming 10-year period.
Safe and healthy communities	Around 30% of Christchurch residents live in areas at risk of flooding or coastal inundation. If this activity were not conducted then flooding could be expected to dramatically worsen across the city from ongoing wear and tear on existing networks, earthquake damage effects and climate change. Significant social harm and degradation could occur without flood protection and control works. There are thousands of homes and properties at risk of current and future flooding and coastal inundation across our low lying city. The ongoing health and wellbeing of our residents is supported by this activity using informed and proactive approaches to natural hazard risks.

	As discussed in the "Modern and robust city infrastructure and community facilities" section above, with the limited amount of funding within the 10-year infrastructure funding period identified to mitigate the backlog flooding areas, Council may find itself in the position that there is a "bow wave" of expenditure required to offset the effects of climate change induced flooding. With not funding the known sites within the 10-year strategy, Council may be creating intergenerational debt for resolving flooding in our communities. The Financially Constrained Option for the 10 years of the LTP of $1,126M will deliver approximately 54% of the $2,073M budget that was requested as the Recommended Option, translating into a reduced number of projects to address the effects of flooding on our communities.
Unique landscapes and indigenous biodiversity are valued	For an ecosystem to be healthy, there needs to be natural diversity in landscapes, waterways, flora and fauna species. Urbanisation and development has destroyed much of the natural landscape variability whether by heavily modifying and draining the swamps and estuarine areas, removing the native tree from the city areas or the Port Hills, and minimising the salt marsh areas. This combined with the pollution from urban run-off and industrial discharges into the rivers has drastically affected flora and fauna species. To regain a connection with a healthy environment and public well-being, it is essential that Council recognises that there are many unique landscapes needing to be protected, maintain and extended along with its indigenous biodiversity. This community outcome cannot be met just by this activity, it will require a cross-activity relationship with the Parks unit, Transport unit, Strategy and Transformation and the Biodiversity team. By conserving and improving our landscapes and biodiversity, which are taonga, mahinga kai, the waterway biodiversity will be enhanced. This can be achieved over time by ensuring that good stormwater management practice is carried out by everyone in the community. The importance of biodiversity is recognised as an important part of improving the quality of our water bodies. A number of new improvement projects, and increases to funding on existing improvement work programmes have been proposed under the Recommended Funding Option. The nominated projects are now not funded to occur until year 4 of the LTP, and a larger work programme will not be funded within the 10-year Infrastructure Strategy. This will result in Council not being able to provide the improvements to biodiversity to waterways as originally planned. There will still be benefits attained though some of the existing CAPEX projects for new treatment and flood mitigation works.

2.4.2 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 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.

Table 2-3 - Contribution of the Stormwater and Flood Protection & Control Works Activity to the Strategic Priorities

Strategic Priorities	How this activity support progress of each strategic priority
Enabling active and connected communities to own their future	As a member of the Community Waterways Partnership Charter, Council work with other members to improve waterways, through delivery of education and awareness programmes to get the wider community working together to protect and improve waterways. As part of the all activities that Council undertake, there is consultation at various levels (depending on the importance of the decision needed) for all of the strategic and financial directions that undertaken. The stormwater decisions are no different. The community has the opportunity to submit on all critical decisions to ensure they have their say ensure they own their futures. Engaging with the community for joint activities such as planting days and community education is essential. The more public willing to interact with the water ways running within their properties and communities, the more likely waterway encroachment trends will start to reverse, and habit protection and enhancement will become normal.
Meeting the challenge of climate change through every means available	This activity is critical to managing the effects of climate change for the district. While the Land Drainage teams have appreciation for the effects of some aspects of climate change, additional work is required to better understand the changing risks and what that means to the asset base in the future. Increased OPEX investment is required to gain a better understanding of risks and to better inform CAPEX decisions for the short, medium and long term. The asset base itself will be affected by ground water elevation, sea level rise, sand accretion and changes to rainfall patterns. Even if assets are perfectly maintained, LOS will be at risk in future due to insufficient capacity as a result of more intense rainfall, greater infiltration and decreasing hydraulic gradient across the city to the sea. Such understanding is essential in developing and implementing strategies which relate CAPEX investments in assets to the threats of climate change impacts such as the effects of rising sea level on coastal infrastructure. This will enable prudent levels of infrastructure investment in areas under threat, assist in adaptation planning and resilience building, and avoid wasted investment in assets which will become redundant through climate change effects well before the end of their economic life. Council is actively progressing the Coastal Hazard Adaptation Planning works which will provide a dynamic adaptive pathway for making decisions for the communities given the uncertainty of the magnitude and timing of the effects of climate change. Given the scope of the project, it is unlikely that the process will be sufficiently advanced to assist with providing any guidance for infrastructure decision making within areas affected by coastal hazards. Therefore, a suitable Council endorsed policy will be required to assist with asset renewal and maintenance decisions will be required to prevent wasting money through maladaptation or indecision. Designs to maximise the use of natural systems and minimise pumping are crucial. The challenge is designing all facilities and assets to benefit the six values approach for waterways while at the same time maximising their ability to minimise the extremes of climate change.

	The use of low impact and sensitive urban designs used in Auckland and internationally should be further investigated to ensure we are moving forward as a modern city in a way that greatly benefits the wellbeing of city residents. Using green infrastructure also has the advantage of mitigating greenhouse gas emissions and enhancing biodiversity as well as managing flood risk. For capital works, guidance on carbon costing is needed to inform cost-effective minimisation of embedded carbon in the council's assets. Considering the whole-of-life emissions of assets, and minimising embedded carbon at the construction stage, has the potential to significantly reduce the overall greenhouse gases attributable to council and will contribute towards meeting council and city emissions targets. The funding envelope limits the amount of climate change works that are implemented. The projects related to Coastal Hazard Adaption Planning have all been pushed out beyond the first 10 years of the LTP. Council will be unable to make any major inroads into adaptation planning and implementation.
Ensuring a high quality drinking water supply that is safe and sustainable	By ensuring that all stormwater and flood protection infrastructure is maintained and operated to the correct standard and renewed at the optimum time, then the quantity of urban run-off contaminants entering the surface water system which may risk the quality of the drinking water supply in the shallow aquifers.
Accelerating the momentum the city needs	Councils Land Drainage Planning teams are working with appropriate Council Strategic documents (such as the Integrated Water Strategy and various Stormwater Management Plans) to ensure that stormwater pipe upgrades and the provision of treatment/storage facilities are planned and/or provided ahead of development to prevent any delays. Council plans for the required funding many years in advance to ensure the funding is available when it is required. The proposed funding options will allow Council to meet the requirements of meeting development and growth unless there is any unforeseeable changes such as an increase in development costs, increased level of development etc. There will be limited opportunities to provide improvements to water body health or biodiversity. Climate change planning will progress for Coastal Hazard Adaptation, although the results of the project will not be realised in time to guide any works within the first 3 years of the LTP period.
Ensuring rates are affordable and sustainable	To meet the undertakings offered by Council to ensure that rates increases are minimised within the financially difficult times of the Covid-19 "fall-out", the funding available for the activity has been capped to meet this Strategic Priority. This results in a difficult balancing act to manage the needs of the community with the ongoing needs of the activity. To therefore meet this priority, there will be reductions to some Levels of Service and the creation of some longer term generational "debt" through delaying renewal works, flood mitigation projects and climate change mitigation/adaptation projects. There is a risk that that there will be an increase in OPEX expenditure to cover the shortfall in renewals funding i.e. the assets will need on-going repair rather than being replaced.

2.5 AMP Development Process

Figure 2-2 shows the broad timeline for AMP creation.

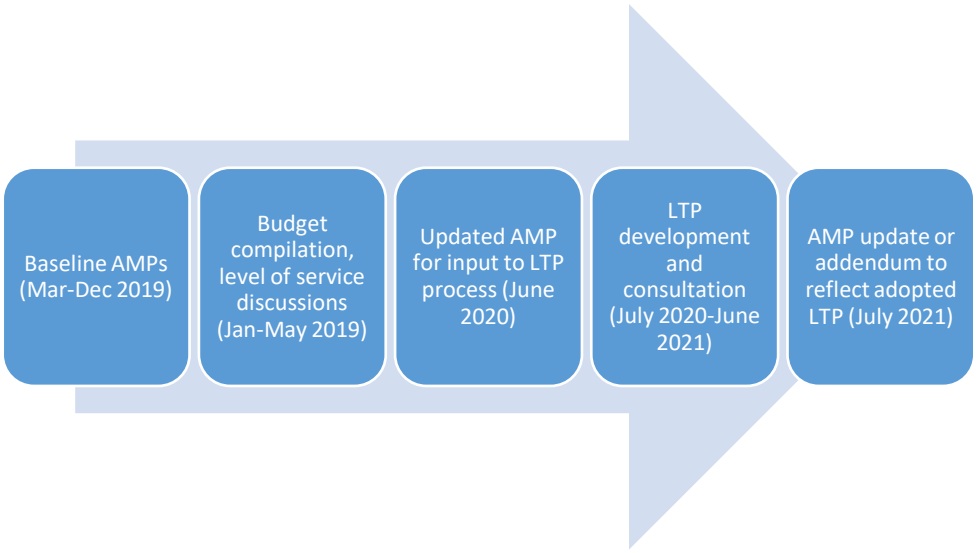


Figure 2-2 - AMP Development Timeline

Data from Asset Management Plans informs Activity Management Plans, the Infrastructure Strategy and greater LTP documents, with outcomes from these other documents feeding back in to the AMP.

2.6 Navigating the AMP

The AMP follows the general format for Asset Management 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.

Note, that while Council carries out annual surveys on General Services that are offered by Council, Council has not engaged directly with the community to set business LOS's for a number of years. Therefore, in-lieu of direct feedback (i.e. that gathered from community consultation, meetings etc.) the different anticipated customer/ stakeholder group and their varied service expectations are listed in table 3.1 above.

Table 3-1 - Customer Expectations

Category	Customer groups	Needs and expectations
The Community	Residents, ratepayers, and visitors	• The ability to discharge to the network, reasonable charges • Fair application of the rules • Appropriate inclusion in decision making. Safe and well maintained assets that do not unduly affect their daily activities • Dry homes during flood events and ability to gain insurance cover for when they do get wet
Internal Customers	Asset Management / Operations Staff	• Good quality data to allow accurate long term planning. • Well organised and understood contracts and maintenance programmes to work to
	Water Supply, Wastewater and Roading Teams	• Minimise environmental effects. Cooperation in managing areas of overlap. Coordinate construction programmes
	Planners	• Good quality data to allow accurate long term planning
	Elected Representatives, Councillors and Community Boards	• Cost effective and well managed range of assets • Good communications to keep them informed of key items • Open and helpful staff that provide sound, well-reasoned and timely advice • Functioning network and infrequent flood events. Network is 'safe', especially stop banks / flood defences
Key external stakeholder groups	Canterbury Regional Council (ECan)	• Good quality data to allow adherence to statutory requirements • Open and helpful staff that provide sound, well-reasoned and timely advice • Compliance with plans and regulations • Engagement at bounds of roles and responsibilities
	Central Government, Office of the Auditor General, Ministry for the Environment, Department of Conservation, NIWA	• Good quality data to allow adherence to statutory requirements • Open and helpful staff that provide sound, well-reasoned and timely advice

Category	Customer groups	Needs and expectations
	Iwi	• Recognition of special status. • Consultation on issues with cultural aspects or environmental impacts • Open and helpful staff who provide sound, well-reasoned, culturally sensitive and timely advice • Work in accordance with the Iwi Management Plan[8]
	Special Interest Groups & Community Groups	• Open and helpful staff that provide sound, well-reasoned and timely advice • Engagement to inform decision-making • Inclusion in decision making – the need to be heard
Affected Parties	Contractors	• Well planned and scoped works programmes to bid for • Fair and open competition for their services • Clarity around standards of workmanship
	Customers with specific interactions – adjacent residents, land developers, river users	• Safe and well maintained assets that do not unduly affect their daily activities • Capacity for new development. Fair and reasonable charges • Early warning of changes to needs and system

Customer expectations are established through the development of the LTP and then communicated as a set of customer levels of service that relate directly to the level of funding provided.

Customer research is a feedback loop into this process to inform the iterative development of future LTPs. Direct communication between Council and stakeholders regarding Land Drainage has included:

- Direct contact with the public
- Community Board meetings
- Complaints/phone calls to the Council Call Centre
- Information provided and feedback from the Council website
- Formal consultation as part of the LTP and annual plan processes and on a project basis
- Delegations to Council meetings
- Submissions and petitions
- Pre-development meetings with developers

In addition to the direct communication with stakeholders, Council employs market research firms to perform unbiased, independent research on the performance of water supply activities.

Council engages with the community through the annual "General Service Satisfaction Survey" which includes questions relating to the condition of waterways, condition and appearance of the waterway margins, and the management systems to ensure the risk of flooding is minimised.

It should be noted that as the climate changes, it will become more expensive and challenging to maintain LOS regarding flooding in some areas. There may be a need to explore with the community different funding mechanisms (or changes of LOS) in those areas that are particularly prone to flooding. It is anticipated that this will be part of the process that will be undertaken during the community engagement of the Coastal Hazards Adaptation Project (CHAP) in the Planning and Strategic Transport section. Given the expected length of time that consultation will take with the CHAP programme, it is hoped that there will be sufficient feedback to inform the LOS for the next LTP, but this is not guaranteed. This may then delay Councils ability to respond to climate change in a way that manages the community expectations.

Table 3-2 includes a summary of all historic Land Drainage survey questions showing which year(s) they were included in the survey, whether they were related to condition, appearance or performance of the assets.

Since 2010, there has been consistent inclusion of the same questions relating to the condition of waterway channels and margins, and the appearance of waterway margins. A question relating to the appearance of waterways channels was only included in 2012 before being removed. Where it is proposed to retain or re-introduce any questions, a brief

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

interpretation of the purpose of the question is provided, which should be used as a guide when ensuring the question is understood by the resident. There are no results for 2011 as no survey was undertaken due to the earthquakes.

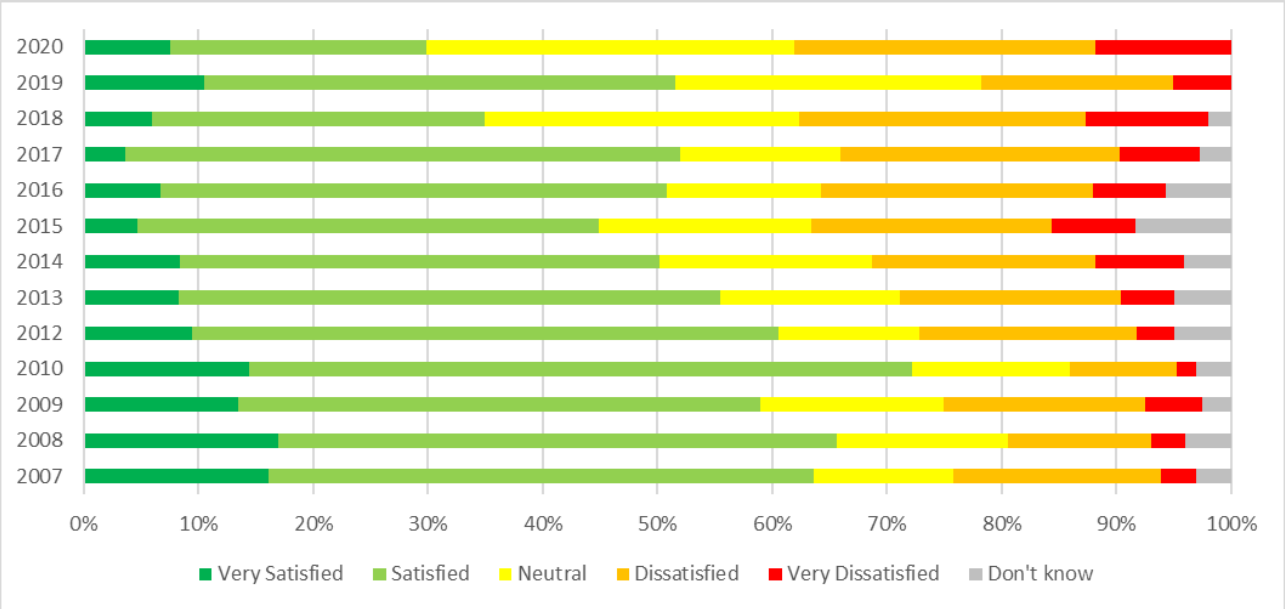
Table 3-2 - Customer Satisfaction Survey Results

Asset Type	Factor	Question Wording	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	Interpretation of meaning where question is to be included in future surveys
Waterways & wetlands	Condition & appearance	"Christchurch has a number of waterways and wetland. Overall, how well do you think these waterways and wetlands are looked after?"	✓	✓					No Survey Conducted										
Waterways		"Now thinking about rivers, streams and waterways in Christchurch City, overall, how satisfied or dissatisfied are you with how well Council maintains the rivers, streams and waterways and their banks?			✓	✓	✓												
Waterway channel	Condition	"Overall how satisfied or dissatisfied are you with the condition of waterways, which includes things such as maintenance and upkeep?"						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	Maintenance and upkeep of waterway channels (including rivers, streams and drains) and in-channel structures. This includes provision of planned or unplanned maintenance activities such as removal of rubbish, aquatic weed harvesting and control, removal of bank vegetation and sweeping of inverts. Also includes repair and replacement of engineered assets (such as lining and structures) and plants located within the channel.
Waterway margins	Condition	"Overall how satisfied or dissatisfied are you with the condition of waterway margins?"						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	Maintenance and upkeep of waterway margins (including those of rivers, streams and drains) by the Council. This includes provision of planned or unplanned maintenance activities such tree cutting, grass cutting, and removal of rubbish. Also includes repair and replacement of engineered assets and plants located within the margin.
Waterway margins	Appearance	"Overall how satisfied or dissatisfied are you with the appearance of Christchurch's waterway margins, which includes things such as the layout and type of plantings, (or shrubs, grasses and reeds)?"						✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	Layout and features including types of planting and proximity and type of development allowed
Waterway channel	Appearance	"Overall how satisfied or dissatisfied are you with the appearance of waterways?"								✓									Aesthetics of the water within the channel including whether it looks and smells clean and free from pollution.
Whole network	Performance	"Thinking about the collection of stormwater, which is the run off resulting from rain, how satisfied or dissatisfied are you with the removal of stormwater in Christchurch?"			✓	✓	✓												
Whole network	Performance	"Christchurch's stormwater management involves managing stormwater through things such as rivers, waterways, timbered drains and stormwater pipes. Overall how satisfied or dissatisfied are you that the city's stormwater management systems operate effectively to ensure that the risk of flooding is minimised?"												✓	✓	✓	✓	✓	How the Council manages the stormwater network to minimise flood risk

KEY	
Question recommended to be included in future surveys	✓

Tables 3-3 and 3-4 show the overall residents' satisfaction results with waterway condition and overall stormwater management from 2007 to 2020. For the latest Resident Satisfaction Survey Report, please refer to the following web page: https://ccc.govt.nz/the-council/how-the-council-works/reporting-and-monitoring/residents-survey.

Table 3-3: Degree of satisfaction with the condition with Council waterways[9]



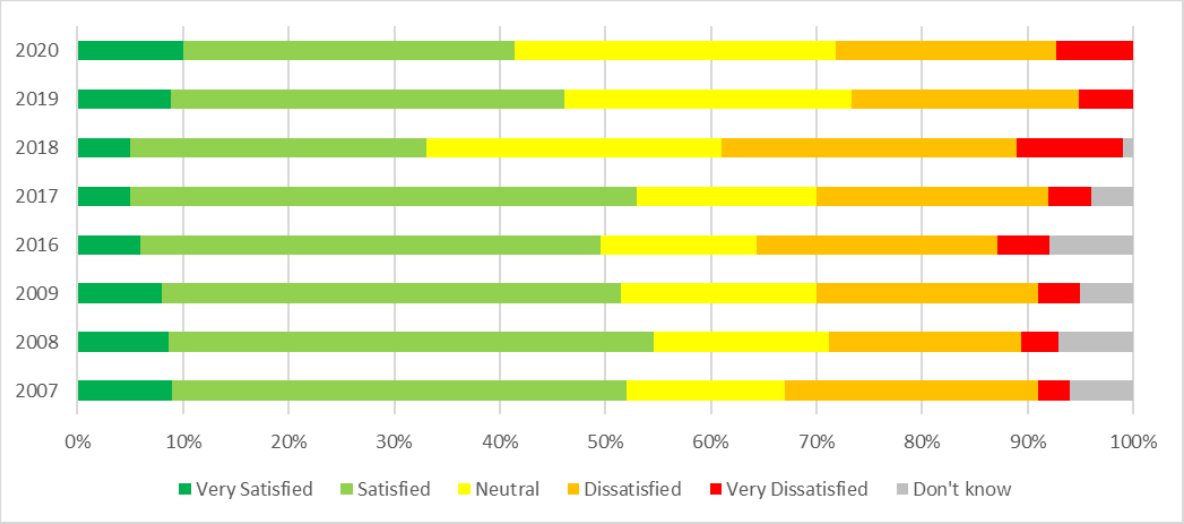
The performance measure target for overall resident satisfaction was ≥66% up to and including 2015, reduced to ≥65% for 2016 and increased to ≥70% and ≥75% for 2017 & 2018 respectively. With the exception of 2010 (72%), this target has not been met in recent years and the 2018 result (35%) is the worst since this survey was first conducted in 2005. The results have improved in the 2019 survey, bringing it back to the 2017 level. The performance measure target was set pre-earthquake and until all earthquake recovery works and central city developments are complete, is unlikely to be achievable again.

The targets for the level of service 14.0.3 – *"Council manages the stormwater network in a responsible and sustainable manner - Resident satisfaction with Council's management of the stormwater network"* has been set at a decreasing level of performance for the 10-year period of the Infrastructure Strategy. This is based on the reduced CAPEX available under the constrained spending option. As discussed in Section 8.1.2, there is uncertainty in the data held on the condition of waterway linings. Anecdotally, the condition of the waterway linings is in worse condition than that recorded, based on feedback from the Stormwater and Waterways Operations Area Supervisors. Therefore, if there is an issue with more assets failing, this will have a negative effect, likely reflective in the scoring of resident satisfaction.

In 2007 to 2009 residents were asked to rate their satisfaction with the physical removal of stormwater. In 2016 to 2019 residents were asked to rate their satisfaction with how the city's stormwater management systems operate to ensure that the risk of flooding is minimised. These survey results are both considered to measure the performance of the stormwater network and Table 3-4 shows the overall satisfaction results.

Table 3-4: Degree of satisfaction with Stormwater Management Systems[5]

[9] 2021 Land Drainage Amp – Residents satisfaction survey summary - *TRIM://21/18533*



It is unclear why no network performance related question was included between 2009 and 2015 (inclusive), however the historic and recent satisfaction results have remained consistent.

3.1.2 Legislation/Regulation

Alongside customer expectations, we consider legislation, regulation and standards that impose level of service standards for Land Drainage. These are summarised in Table 3.5 below.

Table 3-5: Legislative and Regulatory Level of Service Drivers

Legislation / Regulation	Impacts on Levels of Service
Building Act 2004	*Effects of flooding on residential floor levels*
Land and Water Regional Plan, 2017	*Compliance with discharge to land or water of stormwater*
CRC190445 Consent to Discharge Stormwater from within Christchurch City onto or into Land, into Water and into Coastal Environments	*Compliance with discharge to land or water of stormwater*
Department of Internal Affairs – Stormwater non-financial performance measures	All aspects of response to flooding from the public, effects on flooding events on the public, enforcement and prosecution for non-compliance
NZ Dam Safety Guidelines (NZSOLD)	Ensuring any SW facility identified as a dam is appropriately managed as per current guidelines.

3.1.3 Strategic Framework

Levels of service areas for Land Drainage identified through analysis of the strategic framework include:

- Resilient Communities
  - Safe and healthy communities - through flood protection, waterway enhancement and water quality enhancement
- Healthy Environment
  - Healthy water bodies – though waterway enhancement and water quality improvement, minimising the loss of waterways through piping.
  - Unique landscapes and indigenous biodiversity are valued and stewardship exercised – through increased waterway enhancement and investment in green infrastructure

- Sustainable use of resources and minimising waste – through managing our assets proactively and responding to customers quickly

- Prosperous Economy
  - Modern and robust city infrastructure and community facilities - through ensuring our infrastructure is resilient and prepared for the impacts and recovery from natural hazards
  - Great place for people, business and investment – through ensuring infrastructure is renewed at the right time, is fit for purpose and capacity constraints don't limit business opportunities.

Measures to monitor progress towards those priorities are included in the following section.

3.2 Defining and Measuring Levels of Service

3.2.1 Measuring our Levels of Service

Based on the activity objectives defined in Section 2, there are different Levels of Service as defined through the Activity Management Plan process. There are two types of performance measures that are used to report to the relevant stakeholders as per table 3-6 below.

Table 3-6: LTP vs Non-LTP Measures

Public and reported (LTP level) performance measures	Internal (non-LTP level) performance measures
• 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 in Annual Report	• Management oriented • Typically aimed at effectiveness, efficiency, compliance with legislation, completion of (key) processes • Become staff performance development plan accountabilities

The two types of performance measures are specifically related to the LoS items as indicated in tables 3-4 and 3-5 in the column titled "Type of Measure" where Governance relates to the "Public and Reported (LTP level) Performance Measures" list, and Management relates to "Internal (non-LTP level) Performance Measures".

3.2.2 Performance Framework 2021 – 2031

Please refer to Stormwater Drainage Activity Plan and Flood Protection & Control Works Activity Plan, Section 5 Specify Levels of Service.

3.3 Level of Service Projects and Programmes

Table 3-7 - Levels of Service major initiatives

Major Initiatives to address level of service gaps	Strategic and Level of Service Drivers	Indicative $	Year (if in existing budget)	Comments
Community Engagement	To define any changes required to the existing LoS for the next AMP	$80,000 (See Table 10.2 Task ID LD02)	Not in budget	An improvement item
SW Reticulation and Waterway Lining Renewals	Reduce the amount of grade 4 & 5 infrastructure for robust city	See Sections 8.1.1 & 8.1.5	2022-2052	On-going programme of works
Floodplain Management Projects	To address flooding risk across the city	See Section 8.3	2022-2052	On-going programme of works
Various SMP Projects	To improve water quality outcomes	See Section 8.2	2022-2052	On-going programme of works

4 Demand for our Services

This section provides details of growth and demand forecasts that affect the management, provision and utilisation of services and assets. New works will be based on the information outlined in this section.

4.1 Demand Drivers

For Christchurch to maintain its reputation as 'The Garden City' with an expectation around the visibility and appearance of the City's waterways, there must be continual improvement in the existing infrastructure, including waterbody health, and investment in new green infrastructure to meet growth and changes in public understandings, and adaptation to the changing climate we live in.

It is expected that future demand will shift from provision of infrastructure to address population shifts, loss of capacity and increased flood risk to include the following:

- Policy/Regulation influencing how stormwater is managed to remove contaminants and increase waterway health
- Population growth
- Central City infill development
- Climate Change related sea level rise reducing discharge capacity in coastal/tidally influenced catchments
- Climate Change leading to more intense storms and increased probability of the current network capacity being exceeded
- Cultural Values and mahinga kai restoration
- Otakaro-Avon corridor regeneration (formally referred to as "the Residential Red Zone")
- Difficulty controlling encroachment on waterways and floodplains through the District Plan
- Customer demand to improve the appearance of waterways
- Increased protection of indigenous instream fauna

4.1.1 Demographics

The SAMP forecasts population increase of 72,000 people in Christchurch over the next 30 years, giving a population of around 475,000 residents. It is expected that this population growth will have a direct effect to increase the demands on drainage whether by increased runoff generated by more impervious areas (housing) or more contaminates generated (more vehicles and impervious areas).

4.1.2 Customer Needs

There are expectations around the service provided, such as waterways being maintained to manage flood risk, to look attractive and to efficiently remove contaminants for improved water quality outcomes. Council, with the endorsement of the "Waterways and Wetlands Natural Asset Management Strategy 1999" instigated the use of a "6-values" approach to manage *"the natural and physical resources that make up Christchurch's system of waterways, wetlands and drainage.".* These values are considered with all land drainage works to improve, enhance and protect the cities natural water networks. There are increasing expectations from regulators and interest groups to improve the health of waterways.

Attitudes to flooding have not been formally surveyed, but there appears to be reasonable acceptance of the flood-related Levels of Service (LoS) that are applied to new housing and set by the Building Act; which is that over-floor flooding should not occur more frequently than approximately once in 50 years. However, recent Council decisions on floodplain management options along the Heathcote River in a 10-year event suggest that public tolerance for flooding lies between 10 and 50-year frequency. This may indicate that, in reality, the absence of objection to legislative policy settings may not equate to acceptance or that the general public understand that there is likely to be ongoing increases

to costs to meet the levels of service in areas that will become increasingly more flood prone.

Intensification of urban areas may lead to public requiring more areas of open green space to share. These areas would be an ideal opportunity to incorporate green infrastructure for the treatment/attenuation of run off from either existing development or from new impervious areas.

With water, and the restoring the Mauri of water, being of high cultural and spiritual significance to Maori, there must be the continued engagement with Iwi. This is to ensure appropriate stormwater management principles are being used, and future management plans and major projects are developed which align with related Maori values.

The Activity Management Plans provide the commitment of our levels of service to the community and a baseline for all customer expectations, however it would be helpful if specific expectations of the stormwater and land drainage network were better understood to allow Council services to respond to changing expectations.

4.1.3 Change in Land Use

Land Use changes will take place in new neighbourhoods provided for in the district plan. Growth areas are the South West Area, Belfast Area, Riccarton Area and central city. Infrastructure growth in the city centre and Riccarton will be due to infill housing and more intensive development generating additional stormwater.

South West Area Plan

The plan covers around 8,000Ha of land of which 2,000Ha is residential with a further 705Ha zoned for future residential, 1,045Ha is potential rural-residential and 1,200Ha is existing industrial. The remainder remains rural. The area will support greenfield growth with the potential for approximately 10,000 new households. Also included is the expansion and creation of business centres to meet demand and the redevelopment and expansion of the industrial sector.

Belfast Area Plan

The plan relates to an area of about 1,349Ha, of which 756Ha is currently zoned as rural, 284Ha zoned urban, 172 Ha zoned industrial and 103Ha have open space or conservation zonings. An additional 2,900 households are signalled to be provided in this area, 110Ha of additional industrial land is to be added and better servicing of 98Ha of existing inefficiently used industrial land is to be provided.

Central City Margin Rezoning

A report in 2009 considered stormwater network capacity in 51 central catchments, a total area of 1700 Ha zoned L2, L3, L4 and L5. This zoning is in some places more intensive than under the previous city plan. The new zoning is expected to lead to more intensive development than was anticipated during design of the stormwater infrastructure. The report concluded that the stormwater network in 17 catchments is likely to need capacity improvement to serve the fully developed catchment. The improvement cost was estimated to be $45 million. This cost was non-conservative, and is likely to under-predict the cost of intensification. Additional infrastructure costs are expected to arise from topographic changes following earthquake settlement and construction cost escalation when renewal or growth projects are prioritised in areas not currently considered as a “flood risk” such as the Flockton Basin, Cranford Basin or Dudley Creek catchments.

There are also unknown future growth demands associated with development of infrastructure in the Otakaro-Avon river corridor. A nominal sum has been allowed for within the LTP funding for preliminary works such as liaising and planning with internal and external stake holders to ensure works progress cohesively without requiring rework.

4.1.4 Environmental Changes

The climate, rainfall patterns, ground water levels and sea levels are changing and will increase the demand on stormwater and flood protection and control assets. Additionally, there is on-going sand accretion along the beach areas creating issue with outlet blockages, on-going maintenance cost, and future project costs.

The Council has incorporated the best available projections of heavy and extreme rainfall variation into its rainfall depth/frequency table (Waterways Wetlands and Drainage Guide Appendix 10: Christchurch Rainfall Intensities). The 2013 revision of Appendix 10 increased Christchurch (Design) Rainfall Intensities by 16%. This increase is intended to continue to make stormwater assets fit-for-purpose up to 2100.

The Ministry for the Environment projects that temperatures in Canterbury will rise by 0.9°C by 2040 and as much as 2.0°C by 2090. Increased water temperatures will lead to reduced oxygen levels in waterways and could lead to higher concentrations of other chemicals. This may impact on consent requirements for stormwater discharges and increased need for treatment facilities. The Council may act proactively to protect ecosystems from temperature changes, by modifying waterway margins (e.g. by planting trees to shade waterways).

Investigations are underway into the changes with sand migration, with several reports received by Council (Coastal sand budget for Southern Pegasus Bay - Stages A & B by Murray Hicks, NIWA) to better understand the effects of sand movement over time. This investigation was carried out for the Multi-hazard Study (earthquake, tsunami, flood management, sand budget) intended to provide Council with a framework to be able to provide options to take to the community as part of the Coastal Hazard Adaptation Planning consultation for the best management of land use versus hazards (current and future).

4.1.5 Channel and Floodplain Management

The ongoing process of gentrification affects waterways when development or property enhancements encroach into floodplains. Large lots that comfortably accommodated waterways in earlier times are subdivided, leading to houses in closer proximity to the waterways, filling of low-lying land near waterways to gain outdoor living space, construction of bridges or culverts, and construction of boundary fencing. These activities place more assets within the reach of flood water, restrict the capacity of floodways – the wide depressions surrounding waterways that convey rare large floods – and reduce the on-land storage area available to attenuate flood peaks.

At the same time there appear to be increasing expectations that houses should not be at appreciable risk from natural hazards. If the Council is unable to preserve drainage corridors through stricter application of the planning rules, then it is very likely that the equivalent capacity will need to be retrofitted in the future.

The potential cost could be estimated with the assistance of the City Wide Hydraulic Model, once it is completed. In the interim a ballpark estimate could lie in the range of $50 to $200 million. Further work would need to be carried out in the future to define works resulting from gentrification, however as this hasn't become a realised hazard affecting residents, there is no funding available within the LTP to commence investigation.

4.1.6 Technology

New knowledge and new technology are more evident in stormwater treatment systems than in other land drainage assets. The attenuation and treatment of runoff is accepted as a required cost of new development and is required over an increasing proportion of the city to control the discharge of urban contaminants. At the time of writing, Council is waiting for the final consent conditions to the new Comprehensive Stormwater Network Discharge Consent, which will guide the planning for either upgrading of existing or construction of new mitigation systems in both greenfield and brownfield areas. The cost of new assets will be high.

There is clear evidence that control of contaminants at source can reduce treatment costs. Sentiment is shifting from the view that the Council should provide a complete treatment service toward an expectation that individuals should mitigate their own effects where possible. The Council can reduce long term expenditure with education and regulation leading to cleaner stormwater entering the network. Some regulation would cover external factors (e.g. building materials or car parts) which contribute to waterway contamination which could only be practicably effected at government level.

Internationally, industry standards and practices for dealing with stormwater have been changing to incorporate more holistic outcomes. There is a transitional shift from the use of traditional engineering methods e.g. pipes and culverts) to the use of Water Sensitive Urban Design (WSUD) and green infrastructure to mimic natural habitat in the urban environment. This shift will provide technology that may provide benefits to water quality outcomes, biodiversity, carbon footprint reduction and even reduce urban heat island effects. On-going investigation and use of WSUD's and green infrastructure should be encouraged by both the Planning and Asset teams to role-model these solutions for both public works and private development.

4.2 Demand Forecasts

4.2.1 Historic Demand Changes

Historically, the Land Drainage activity was incorporated with the Parks and Transport Activities, and as such most of the funding was centred on the conveyance of run-off and flood mitigation works. With the advent of the 6-values approach, more funding has been used for water quality outcomes and amenity driven results.

Current demand for stormwater and land drainage assets is being driven by:

- Development driving the need for more detention facilities
- Consent requirements driving the need for more treatment facilities
- New assets in planning or flood mitigation works, redressing loss of capacity or household safety due to effects of the earthquake sequence

4.2.2 Forecast Future Demand

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 land use, and aging infrastructure. The other demand drivers are not quantified as part of this predicted growth analysis but have their likely impacts presented in "*Table 4-2 Demand Management Initiatives and Impacts*" in section 4.4 Demand Management Plan.

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

Table 4-1 - Changes in Demand Over Time

Demand Driver	Present Position	Projection	Impact on services
Customer Needs	Medium	High	Increase Demand
Changes in Land Use	Low	High	Increase Demand
Environmental Changes	Low	High	Increase Demand
Aging Infrastructure & Information Gaps	Medium	High	Increase Demand
Channel and Floodplain Management	Medium	High	Increase Demand
Technology	Low	Medium	

4.3 Impact of Changing Demand on Existing Assets

The impact of increased demand on assets is considered below.

4.3.1 Future Demand on Assets

Any change in demand could have an impact on the level of service and condition of each asset involved, potentially leading to differing maintenance requirements and/or the need for non-asset solutions. Impacst of demand on each asset group are considered below.

Reticulated Network

Demand will increase in proportion to normal changes within neighbourhoods including infill development, house extensions, more and larger impervious areas and individual property drainage improvements. Opportunities for green infrastructure must be utilised in growth and non-growth areas.

Utility Waterways (including waterway lining)

Demand is likely to increase in proportion to development. In this context "development" will usually refer to infill development. Utility waterways are likely to be naturalised and incorporated into storage/detention systems with increased capacity where they serve greenfield development.

Natural Waterways

Demand on this asset group will increase in proportion to new or infill development. Effects will be more likely in catchments with greenfield development. The Heathcote and Styx, and to a lesser extent the Halswell catchments have significant new residential and business areas. Comprehensive future planning for central city infill and strategic growth areas to the west will be required. Demand can be limited through stormwater detention facilities, which are now a requirement in developing areas. Parts of the Heathcote floodplain in particular are susceptible to increased flood risk if the effects of development are not fully mitigated.

Pumping Stations

Most pumping stations are situated in low lying, tidally influenced areas and will experience increased demand as sea level rises. Some new pumping stations have been installed by SCIRT and Council to protect areas that have experienced earthquake settlement. Due to changing climatic conditions, there will likely be a greater demand for pumping stations in catchments that discharge to coastal and tidal affected water courses and for the most critical stations to incorporate more duty assist or redundant water displacement assets.

Waterway Structures

Demand on this asset group is likely to increase as a result of climate change. More frequent rainfall events coupled with rising sea levels will place increased demand on flood gates and stop banks. Without intervention to keep up with climate change LoS not be met, resulting in frequent flooding. This will be addressed through renewal or upgrade of the assets to meet climate change demands, but as waterway structures tend to have a long asset life, renewal or significant upgrade may be required sooner than was expected when the structure was originally built.

Spatially variable LoS may need to be accepted by the community in the face of climate change.

Treatment and storage facilities

Detention and treatment facilities are generally built for a specific development density and land use type. In general, the design parameters are adequate but there is a risk that infill development, should it occur, will reduce facility performance.

4.3.2 Asset Utilisation

As described above the utilisation of all asset groups is likely to increase as a result of demand, leading to LoS issues and increased maintenance and renewal costs. Asset utilisation will need to be monitored more effectively so that trends, issues and solutions can be identified to respond to demand changes.

The potential for increased network fragility and reduced network resilience will need to be managed.

Reticulated Network

In many cases stormwater mains have been installed with conservative design standards, allowing surplus capacity for future development. In other cases, the levels of service will reduce as demand increases. The network will reach a point where it does not have enough capacity to manage demand, leading to occasional surcharging and increased incidence of surface flooding.

Increased occupation of network capacity with groundwater inflows will likely occur.

Utility Waterways (including waterway lining)

Demand increases on this asset group will lead to increased maintenance and renewals in order to maintain the level of service. Newly naturalised utility waterways will generally be more costly to maintain as mowing and vegetation maintenance costs are added. The condition of waterway lining in utility waterways could deteriorate at a greater rate

due to the demand placed on them, particularly if the waterway setback requirements are not enforced through the Resource Consent process.

Natural Waterways

From a 6-values perspective, natural waterways are fully utilised in providing environmental and aesthetic services. Most urban natural waterways are over-utilised in capacity terms (i.e. have less capacity than is desirable) and with foreseeable changes including increased imperviousness and climate change their utilisation will increase. This will lead to increased frequency of over-bank events and a perception that the LoS is not being met.

Pumping Stations

Pumping stations will experience longer run times as sea level rises. There is a likelihood of reduced levels of service as gravity outfalls, which are generally the primary outfall, become less effective and pumping stations, which generally have a lesser capacity and no redundancy, are required to operate for longer periods of time resulting in greater costs, increased wear and failures to meet LoS.

Treatment and storage facilities

Facilities built pre-2010 are more likely to have limited treatment efficiency due to the design standards of the time - a focus on sediment rather than metals removal – and some early (pre-2000) facilities are under-sized due to limited information about treatment performance. The current environment in which regulations are changing is likely to drive demand for improved performance, potentially through retrofitting.

There has been no testing of the current functionality of the facilities for either treatment provided or storage volumes. This reduces the ability to plan for maximising the existing facilities for additional demand.

4.3.3 Operational Costs

OPEX costs have been capped over recent years and not been adjusted for new assets coming on line. This includes all the stormwater detention facilities associated with new sub-divisions and items such as the cartridge filters associated with the Richardson Terrace Pumping Station. This has resulted in new assets not being maintained properly and often not to consented standards. Adjustment of annual OPEX budget is now urgently required to cover existing shortfalls, and an annualised increase for maintenance for new assets provided to meet the demands of maintenance of new assets to ensure they achieve their design life.

Treatment facilities are becoming more park-like with ever increasing amenity features such as plantings, walkways and in some cases car parks. The number of wetland type facilities is also increasing with the shift in demand from the “drier” south-west area of the city to the “wetter” northern area. These changes to maintenance are a departure from the “traditional” facility which may have only required weeding or mowing. These new and larger facilities will require additional staff within Council to manage the changing maintenance obligations of the treatment facilities to them from becoming run down, unsightly to the public and ineffective at providing treatment/attenuation as designed.

For the preparation of the capital works programmes for this LTP, there has been a focus on the inclusion of OPEX costs with new projects to ensure that the future funding for the new assets has been made clear as part of the whole of life costs. While the process is still being developed, it provides an improvement in the reporting of previous LTP’s.

4.4 Demand Management Plan

Demand for new services will be managed through a combination of managing existing assets, upgrading of assets and providing new assets to meet 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.

Non-asset solutions focus on providing the required service without the need for the organisation to own the assets and management actions including altering demand for the service, altering the level of service (allowing some assets to deteriorate beyond current service levels) or aligning customer's expectations to accept appropriate asset failures.

Management solutions that pertain directly to land drainage include complementary Policy and Planning initiatives such as minimum floor level requirements for new residential developments linked to the 200-year flood modelling results, and the Flood Intervention Policy which allows Council to purchase properties at risk of frequent flooding due to land settlement following the Canterbury Earthquake Sequence.

Opportunities identified to date for demand management are shown in Table 4.2 below. Further opportunities will be developed in future revisions of this asset management plan

Table 4-2 - Demand Management Initiatives and Impacts

Current initiatives			
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.**
City Wide Modelling	↔	The City Wide Model that is still currently in production, will allow prediction of the effects of backlog and growth areas on the current network to establish upgrade programmes. While this initiative doesn't "affect" demand, it will allow CCC to better manage the effects of growth and future demand management.	The model will allow for better planning for growth and renewal projects. There will be on-going CAPEX costs to maintain the model, and OPEX to run the model.
Stormwater Management Plans	↔	It is expected that the preparation of Stormwater Management Plans (SMP's) will provide a planned and co-ordinated means to meet demand before development occurs to inform how that demand is managed.	Greater demand on both CAPEX and OPEX costs. Whole of live costs must be provided to ensure suitable OPEX is provided as various devices come on-line.
Comprehensive Stormwater Network Discharge Consent	↔	The discharge consent outlines the responsibility and requirements on Council to meet its environmental responsibilities for stormwater discharge.	Greater demand on both CAPEX and OPEX costs. Additional staff resource is essential to manage the requirements of the consent.
Treatment and storage facilities	↓	Greater efficiencies can be achieved in larger facilities serving larger catchments. Source controls, particularly non-contaminating building materials and vehicle components.	Greater capital costs to establish larger facilities ahead of development. Greater operational and maintenance costs for the future.
Multi Hazard Strategy Project	↔	Strategic planning seeks to identify the effects of climate change on the city, particularly the coastal residents, to inform options council responds and adapts to.	The full impact is not yet known, but likely to incur increased capital and operational spend
Climate Change Adaptation Strategy	↓	Along with the multi hazard strategy project, a strategy will aim to provide policy that council can employ to allow the coastal residents to transition to safer areas without high economic loss	The full impact is not yet known, but likely to incur increased capital and operational spend

Future planned initiatives			
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.**
Designing green infrastructure in new development areas	↓	More Green Infrastructure and WSUD concepts to improve water quality and quantity provisions to cater for increased demand, and enhance wellness of communities with "park like" areas that are also SW facilities. Will also reduce the demand on capacity of the final discharge waterways, and contribute towards mitigation of greenhouse gases.	Increased capital costs to provide new assets or upgrade existing assets ahead of renewal life to cope with growth. Additional costs to e.g. naturalise the lined waterways for enhanced biodiversity. All new works will attract increased OPEX funding requirements
Education of riparian landowners to mitigate/reverse encroachment damage	↓	As in-fill housing continues, this places greater pressure on setback encroachment which makes access for maintenance more restrictive and places stress on waterway embankment stability, and biodiversity through less planting and natural setback area.	Through education, for both public and council staff, on the importance on setback requirements there may be a reduction in CAPEX and OPEX costs for renewals, and healthier waterways.
Policy for Rainwater tanks	↓	Growth places more demand on the piped networks requiring upgrades to mitigate flooding. On-site detention i.e. rainwater tanks and discharge to ground wherever possible can reduce the demand on existing assets or reduce the demand for new assets. Changes to climate will also intensify the demand and use of greywater and/or rainwater. Tanks can also contribute to managing demands on the water supply system-e.g. for watering gardens. Upgrade/renewal programmes to be developed to reflect the demands. Upgrade/renewal programmes to be developed to reflect the demands.	This will require policy and OPEX funding will be required to make changes to policies, provide public education and administer on-going inspection/enforcement.
Policy for controlling contaminant releasing materials e.g. building materials and brake pads	↓	Growth increases contamination that ends up in waterways, increasing the demand on existing facilities, or requiring additional facilities to be constructed and maintained. The initiative may require some input and leadership from central government e.g. to regulate	Increase in OPEX costs while policies and regulations are established, but potential savings in both CAPEX and OPEX if treatment devices can be reduced in size due to lower contamination levels, or an increase to an asset expected life span.

		brake pads that are acceptable for all NZ cars as well as CCC to make a concerted difference.	
Waterway Structures	↔	Infrastructure decommission required before end of design life due to rising sea levels, ground water and sand accretion. Some benefits in being able to create wetlands on land prone to flooding.	Loss of assets due to removal before full life span realised. Increased costs to replace the assets with more expensive options with greater capital and operational costs.
Partnering with ECan for water quality research	↔	Will allow for a better understanding of the polluting effects of development/demand on waterways to ascertain what treatment is then required to meet regulatory required water quality outcomes.	Increase in OPEX funding to work as a partnership. It is hoped that the outcomes may lead to better design decisions being able to be made and the potential for rationalisation of treatment facilities for reduced future Capex and OPEX funding.
Partnering with tangata whenua to improve mauri and mitigate mahinga kai loss	↔	Will allow for better understanding on measures to be employed for the improvement of waterway health to meet the needs of tangata whenua.	Increase in OPEX funding to work as a partnership. It is hoped that the outcomes may lead to better planning and capital works options which will ultimately lead to better outcomes for residents.

4.5 Growth Related Projects and Programmes

The following table summarises the major asset solutions planned to support demand growth.

Table 4-3 – Major planned asset solutions to support demand growth

Description of asset(s)	Year	Value
Piped Systems - Pipe Drains (New)	2024-2051	$20,834,871
South West SMP - Defined Projects - Waterways Detention and Treatment Facilities	2023-2051	$45,862,432
Open Water Systems - open drains reactive	2024-2051	$13,137,639
STYX SMP - Defined Projects - Waterway Detention and Treatment Facilities	2022-2051	$294,408,567
AVON SMP - Defined Projects - Waterways Detention and Treatment facilities	2022-2051	$160,905,695
Programme - Waterways & Wetlands Land Purchases	2025-2051	$56,000,000
Heathcote SMP	2023-2051	$153,563,996
SW Sutherlands Basin (Welsh) Stormwater Treatment	2022-2024	$19,916,459
SW Spreydon Lodge - Infrastructure Provision Agreement (IPA)	2022-2025	$6,976,442
SW Rossendale - Infrastructure Provision Agreement (IPA)	2022-2025	$5,250,699
SW Blakes Road Stormwater Facility (Works 1)	2022-2025	$9,146,240
SW Gardiners Stormwater Facility	2022-2023	$4,290,081
SW Greens Stormwater Facility	2022-2027	$13,790,331
SW Otukaikino Stormwater Facility	2022-2028	$17,814,448
SW Creamery Ponds	2028-2029	$1,253,359
Estuary and Coastal SMP	2024-2038	$30,593,503
Outer Christchurch Otukaikino SMP	2024-2040	$6,511,258
Banks Peninsula Settlements SMP	2024-2037	$13,861,816
SW Guthries Thompson Basins	2027-2028	$752,045
SW Kainga Basins	2023-2027	$10,010,640
SW Highsted Styx Mill Reserve Wetland	2022-2027	$12,008,642
SW Highsted Wetland, Highams Basin & Styx Stream	2022-2025	$13,891,987
SW Waikākāriki - Horseshoe Lake Stormwater Treatment Facility - Stage 1 (OARC)	2022-2027	$12,189,999
SW Waikākāriki - Horseshoe Lake Stormwater Treatment Facility - Stage 2 (OARC)	2023-2029	$12,080,808
SW Horners Kruses Land Purchase	2022-2026	$7,069,319

Acquiring these new assets will commit the Council to ongoing operations, maintenance and renewal costs for the period that the service provided from the assets is required. Unfortunately, the ongoing OPEX obligations for these facilities is not well understood and hasn't been allowed for in any Council data system. This is an Improvement Item that the Asset team would like to see carried out to improve our Asset Management Maturity. These future costs are identified and considered in developing forecasts of future operations, maintenance and renewal costs in Sections 8 and 9.

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

5.1.1.1 *Investing in Resilience*

The Resilience Greater Christchurch Plan (RGCP) provides a framework and multi-agency actions towards a more resilient 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.

5.1.1.2 *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

Section 4.3 of the SAMP detailed the 'shocks and stresses' (disruptors) that provide resilience challenges for Christchurch.

Table 5.1 summarises how each of these has the potential to negatively impact our assets and services:

Table 5-1: Potential Impacts of Resilience Disruptors

	Disruptors	Potential Impacts on our Assets and Services
Chronic Stressors	Climate Change	Sea level rise will expose infrastructure in low lying coastal communities, causing damage. The existing sea outfalls will be unable to discharge storm flows increasing the chances of flooding. This can result in water backing up a long way inland so that flooding may also affect communities that are further from the coast. Recent studies have identified that we can already expect higher storm tides than previously thought. Investment in larger capital works such as combined catchment pump stations maybe required, seawalls and stop banks constructed. Retreat from vulnerable areas may be required. Shallow, saline groundwater will rise closer to the surface in coastal areas, which will inhibit soakage to ground, leaving more runoff to be handled by the flood management assets. Shallow groundwater will also cause increased infiltration of the stormwater network, reducing its capacity. In some areas, groundwater will rise to the ground surface resulting in long-term standing water. This may be further exacerbated by ongoing subsidence identified along the Christchurch coast by an Otago University study. Rainfall and storm patterns involving intensity and frequency may require investment in pipe upgrades or duplication to mitigate flooding in communities. Periods of drought may also occur putting stress on the health of the waterways and ecology. A process of base flow supplementation from underground wells may be required to prevent the loss of habitat or aquatic/avian species. In coastal areas and lower reaches of rivers, stopbanks that are designed to be wet only during high rainfall events may be permanently wet due to rising sea level. This may accelerate deterioration of some assets. The increase in ground water levels, particularly saline water, may lower the expected life of pipework and structures meaning asset renewal rates are accelerated causing funding problems.
	Covid-19 and 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 has this meant for the Land Drainage activities in this LTP? • Initial focus on critical projects and completing committed projects • Considerable caps applied to the capital works budgets • Deferral of projects to fit within the funding envelope • Increased risk levels of asset deterioration • Increased risk of not meeting statutory and discharge consent obligations 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. If waterway health deteriorates further, NZ's reputation as being "Clean and Green" may be further compromised and affect tourism.
	Demographic Changes	As the population increases, greater stress is placed on existing underground infrastructure, requiring an upgrade programme as well as a replacement programme. There may also be pressure for housing developments to impinge on waterway setbacks affecting open waterway lining replacement and maintenance to maximise development potential. Population shift within the city may not align with planned areas of infrastructure expenditure requiring more network planning and funding shortfalls. Change in the public's perception and desire of public infrastructure from solely economic to environmentally lead is not being visualised by Council.
	Population Health	The role of open spaces and the connection with water (Mauri) on mental health and well-being is to be met by Councils planning and expenditure increases in the future. Greater investment may be required to maintain the flooding levels of service to ensure homes are not flooded causing physical and mental stress.
	Housing and Social Inequity	To offset potential intensified housing areas to service a community need, an increase in greenspaces could be provided with enhanced waterways as a public meeting point for families and communities. This would involve the daylighting of assets where possible, property purchase for increased waterway margins and enhancement requiring increases in operational funding.
Acute Shocks	Seismicity	Seismic events have the ability to disrupt underground services for long periods of time, create failure of waterway embankment linings and stop banks, cause alterations to raise/lower ground levels, fill assets with sediment and alter springs. All of these affects would increase the potential for flooding involving considerable investment to overcome. There will be a reduced level of service while the clean-up occurs.
	Tsunami	Tsunami events are likely to cause private and public damage, require major operational investment to clean up and affect the health and wellbeing of people due the risk of water borne diseases and the clean-up of flood damaged homes. There will be a reduced level of service until the clean-up has occurred. Gouging by water as the tsunami flows back out to the sea can result in significant change in drainage and serious damage to stopbanks. A great deal of debris is carried by tsunamis and this can also lead to filling of assets with sediment.
	Flooding	Flooding causes major operational investment to clean up, and may require capital investment to repair major infrastructure or provide new infrastructure to try and prevent a reoccurrence. There will be a reduced level of service until the clean-up has occurred. An adaptation policy is required for areas most at risk due to sea level rise. Funding would need to follow.

5.2.2 Resilient Projects or Activities in this Plan

The following projects and programmes to build the resilience of our assets are already underway and/or are included in this AMP programme. 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.

LDRP 97 Multi-Hazard Risk Analysis:

Project Description	Council is currently undertaking an assessment of future flooding risk along the lower rivers, the Ihutai Avon-Heathcote Estuary and Sumner. This considers a changing climate, chronic stressors (e.g. rising groundwater) and other natural hazard shocks (e.g. earthquakes and tsunami) and explores the significance of co-located, co-incidental and cascading hazards. The purpose is to identify potential floodplain management approaches within a multi-hazard context.
Scope and Expected Impact	This project will improve resilience through building a more complete understanding of natural hazards, risks and intervention options. The project will consider both engineering and non-engineering intervention options for floodplain management and is closely linked with the coastal hazard adaptation planning work that is currently underway. It will not consider options for mitigation of other hazards. The project is planned to be delivered in stages for individual catchments over the next 3 years and will be used to inform adaptation planning.
The Case for Change	This project will directly inform adaptation planning which will inform Council's long term approach to manage flood risk.
The Resilience Dividend	The resilience dividend is very high with this project as it strengthens community understanding of risks, is the next step in delivery of risk reduction measures and allows for better optimisation of our future network infrastructure. This project directly leads to building understanding of natural hazard risks and works towards safe waterways.
Further Opportunities	There is a logical extension to the project to consider other non-flood hazard interventions to further strengthen infrastructure and planning decisions e.g. planting of the hillside catchments for mitigating sediment mobilisation, policy changes to require source control on all properties.

Upper Heathcote Stormwater Basins Project:

Project Description	As a result of changes caused by the earthquakes, flood risk has increased along the Ōpāwaho -Heathcote River. The Council has investigated the benefits of increasing floodwater storage in the upper Heathcote catchment. The team looked at whether this would help reduce flooding of homes along the Ōpāwaho - Heathcote River. Additional storage in these areas will primarily reduce flood risk in the upper and mid-Heathcote. Due to the tidal influence in the lower reaches other floodplain management options will still be required to reduce flood risk in the lower Ōpāwaho - Heathcote.
Scope and Expected Impact	Construction of four more large storage basins, which when working together will hold back water during flood events and release it after the storm has passed. These storage areas are Wigram East Retention Basin, Cashmere-Worsley Valley, a wetland facility at Curletts Road and further storage in Eastman Wetlands on Sparks Road. Modelling results showed that additional storage areas in the upper catchment will reduce flood levels, reducing the number of floors levels at risk of above and below floor level flooding in both more frequent and more extreme events.
The Case for Change	The storage basins will reduce the impacts of flooding, allowing people to more easily live with the effects of flooding along the Heathcote River and improve community resilience.
The Resilience Dividend	This project reduces the risk of flooding along the Ōpāwaho - Heathcote River. As a result it increases the ability of Christchurch to be well prepared for natural hazards and can respond and recover quickly.
Further Opportunities	There is the opportunity to use this project to better inform Ōpāwaho -Heathcote River residents about the flood risk in their community and how to learn to live with flooding.

Monitoring of baseline indicators

Data collection and monitoring of background conditions.

> Ongoing monitoring of tide levels, river flows, rain gauges and shallow groundwater provides a baseline from which to recognise how the climate is changing and to identify triggers and thresholds that can be used to signal the need for a change in adaptive pathways at appropriate times. Data can also be used to calibrate flood models and provide projections for future conditions. In the short term, monitoring can provide an indication of antecedent conditions ahead of incoming storms, helping to inform where flooding may occur and giving time to make preparations for response.

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

Often, we will need to do further work to build a case for future investment in resilience e.g. information/data, policy directions, guidelines, modelling, etc. These opportunities are the basis for a potential investigatory programme of work to inform the 2024 and 2027 LTP's and are summarised in Table 5-2 below.

Table 5-2: Opportunities to Improve Resilience

Disruptor	Opportunities	Timeframe	Resources
Flooding/Climate Change	Provide additional budget to accelerate the City Wide modelling programme, an annual amount for the upkeep of the model and for running various scenarios on behalf of the business unit (funding amount for 10 year period shown, but continues annually from year 11 at approx. $224k/year)	Commencing 2022	CAPEX - $2.7M & OPEX-$900k
Climate Change	Carry out investigations to identify the assets at risk of sea level rise (as discussed in LGNZ document "Vulnerable: the Quantum of local Government Infrastructure Exposed to Sea Level Rise") to allow future strategic planning for asset renewals and/or new capital works, community consultation, and staged budget setting to match rate of sea level rise.	Not funded	$TBA**
Climate Change	To prepare for the effects of groundwater rise, investigate at risk assets and establish levels where levels of service will be compromised. Install level monitors and model levels across the city. Carry out optioneering to mitigate effects based on model, and budget for renewed/new capital works and community consultation.	Not funded	$TBA**
Climate Change	Carry out further investigation and optioneering to assist with Councils programme for operational Carbon neutrality by 2030 and Christchurch Carbon Neutrality by 2050. Investigate carbon pricing to enable cost-effective minimisation in embedded carbon in capital works, taking a whole-of-life approach to mitigation of greenhouse gases.	Not funded	$TBA**
Demographics	Fund further investigations and capital works upgrades to 16 identified flood management projects to address backlog required to manage increased run-off and intensification due to land use rezoning, and general intensification of the city.	Commence 2024	$77.8M
Earthquake	Carry out a review of 67km of existing CCTV footage of deferred SCIRT works, programme the re-inspection of critical assets deferred to allow comparisons, and programme the inspect assets only assessed by Pipe Damage Assessment Tool (PDAT) [10] methods. This can allow budgets to be prepared for the CCTV inspection works and urgent capital replacement works needed to prevent failures of the already compromised assets in the event of lesser seismic events.	Not funded	$150,000

[10] Pipe Damage Assessment Tool (PDAT) Design Guideline - TRIM://13/969151

* The budget for these works was previously applied for as part of the FY21 Annual Plan submission under the LDRP 97 – Multi Hazard Project, but were not approved. These investigation works are required to inform the adaption to Climate Change.

** There are no budget figures available as there has not been any firm guidance from Council on what needs to be done to meet the carbon neutrality goals. Guidance is pending the completion of the Climate Change Strategy.

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 4.3 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' that are rated as high or very high. The reporting within Promapp ensures that there is visibility of the risks Council is managing. The Council risk framework sets out the levels at which residual risks are escalated, reported and governed.

The strategic risks identified in Promapp in relation to this activity are:

Table 5-3: Strategic Risks for this Activity

Key	Description of Risk	Residual Risk Rating
R00199	Major Infrastructure Failure	Very High
R00518	Resources and Capability	High
R00011	Damage by Unauthorised/accidental Interference	High
R00574	OPEX/budget risk City Services	High
R00354	Staff Health and Wellbeing	High
R00420	Capital delivery	High
R00102	Environmental Damage	High
R00105	Chemical Leak within 3 Waters Operations	High
R00578	Wigram Basin dam failure	High
R00103	Health and Safety/Environment Damage	Medium
R00567	Compliance with approvals, licenses and consents	Medium
R00097	Failure of IT and business communications technology to transfer field data into asset systems.	Medium
R00117	Flooding of buildings	low
R00445	Hydraulic Modelling Strategy not followed	low

5.3.2 Activity Specific Risks

The Land Drainage unit has also identified a number of additional risks not recorded within Promapp but either currently affect the activity or are at risk of affecting the activity. These are at a more detailed level of discussion as shown in Table 5.4 on the following page.

Table 5-4 - Additional Departmental Risk Items

ID	Risk	Risk Description	Inherent rating	Treatments in place (today)	Residual rating	Proposed additional treatments	Funding Provided?
R00199/SW01	Major Infrastructure Failure	There is a risk that critical pipe failure may cause flooding preventing access through a lifeline route. This may result in inaccessibility of emergency services to reach injured/isolated people during seismic/tsunami/flood events.	Very High	AAIF schemas include critical lifeline routes to identified critical assets who's failure will effect accessibility during civil defence emergencies	Very High	Ensure CCTV records are completed for all high consequence of failure pipe pipelines (as identified by AAIF) and within identified lifeline routes. Ensure there is a fully funded proactive renewal strategy based on criticality.	No additional funding provided
R00199/SW02	Major Infrastructure Failure	Risk of major infrastructure failure interrupts the capital works programme because funds are required to be spent elsewhere. This will prevent assets being renewed in a timely manner and Council not meeting levels of service	High	Funding allowance in reactive budgets	High	Additional funding to replace critical assets as required	No additional funding provided
R00199/SW03	Major Infrastructure Failure	Earthquake damaged infrastructure not discovered by SCIRT investigations, or deferred by SCIRT fails causing flooding, property damage, impacting capital programme	Very High	The current OPEX funding required to support investment decisions i.e. to repair or replace is insufficient. Additional funding is required to meet required levels of service.	Very High	Carry out re-inspection of deferred works if CCTV exists, and complete inspections not carried out by SCIRT and assess for deterioration to offset risk of unknown or unquantified damage	No additional funding provided
R00199/SW04	Major Infrastructure Failure	Major failure requires a large operational spend to clean up damage to adjacent infrastructure, property impacting current budget resulting in shortfalls for programmed work	High	There is a nominal reactive funding within the Operation and Maintenance budgets to deal with clean-up operations following infrastructure failures.	Medium	Additional funding would be beneficial, but difficult to quantify given the unknown quantum of work following an undefined	Yes
SW01	Outdated or inadequate flood models	The risk exists that the Council does not have the capacity to accurately assess flood hazards for all aspects of stormwater management from zoning in the District plan to setting floor levels and building infrastructure including roading and other infrastructure as well as flood mitigation infrastructure and also the management of flooding events. Unnecessary under and over design will result which will have long term financial and physical risks	High	Many older and outdated models exist and these are being relied upon for assessing current and future needs. Newer models are in various stages of development but it is unclear when these will be available for priority issues such as defining flood hazard zones in the District Plan and all the regulatory compliance that flows from that	Medium	Identify budget to accelerate the City Wide modelling programme. Future budget to be provided annually (estimated at 3% of Capital Expenditure) to provide the upkeep of the model to ensure that it remains current and accurately reflects the stormwater network.	Yes
SW02	Basin Operational Criticality	There is a risk that CCC cannot demonstrate compliance with ECan consents caused by a lack of information on as-built operational parameters of the LD basins and wetlands. This may result in Councils inability to demonstrate compliance and prosecution by ECan, not meeting agreed environmental outcomes,	High	It can be inferred that if the facility is constructed as designed, and the design is carried out to appropriate and current design standards, then the required quality and quantity outcomes should be realised. The O&M manuals will confirm the	High	Carry out water level/flow level monitoring to better understand the operation and performance parameters of the existing devices as compared to the design. City wide programme will be required to monitor devices	No additional funding provided

		negatively impacting CCC's reputation, insufficient budgeting for Operation and Maintenance and Capital works.		operating levels to confirm the compliance of construction as compared to design.		to check against design, and where not compliant either amend features of the device or accept new regime if doesn't cause a non-conformance	
SW03	Poor performance of treatment devices	There is a risk that CCC cannot demonstrate compliance with Ecan consents due to poor performance of treatment devices, lack of baseline and monitoring records and poor capital renewal works planning and decision making. This may result in facility performance visibly impaired, testing shows non-compliance, and prosecution by ECan, not meeting environmental outcomes, and insufficient budget when devices fail prematurely.	Very High	Current capital works project to investigate 5 partially non-performing basins for operational parameters to compare to required performance standards. Remedial works to be carried out if funds allow. Additionally there is a water quality monitoring programme testing contaminant removal from 4-5 existing catchments.	Very High	Further investigation on a greater number of basins is required to better establish baseline information to better inform operation and maintenance tasks and capital renewals. Prepare a dynamic contaminant load model that provides loadings on a storm basis (with inputs from the City Wide Model) rather than an annual yield to better understand predicted contaminants at the point of discharge as compared to sampled data. This would provide greater confidence for consent compliance. A more extensive water quality monitoring programme will be required. Once data is available from an investigation on treatment device operation and replacement regime and costs, carry out investigation to compare this to field data to actualise report findings.	No additional funding provided
SW04	Poor performance of treatment devices - Operational Funding	The CCC cannot comply with consent conditions for basin and facility operations due to insufficient operational funding. This may result in failings such as excessive vegetation growth causing short-circuiting of flows and insufficient water quality treatment. Inspection, maintenance and renewal conditions are breached.	Very High	Currently Operations and Maintenance has a minor budget for maintenance of facilities, however this only covered mowing, and the level of funding provided in successive years has not been increased in proportion with the increased number of facilities adopted.	Very High	Further investigation into the cost to maintain the current and future number of devices to match international best practice to allow Council to meet its agreed levels of service.	No additional funding provided
SW05	Changes in technology - Operation and Maintenance	With the changes in technology in water quality treatment, there is a risk that the operational team are not suitably trained/upskilled in the management of the new technologies, that the	High	Currently Operations and Maintenance has budgeted for maintenance, however it is unclear if these amounts are sufficient.	High	Council ensures all Operation and Maintenance staff are suitably trained, and upskilled to understand new technologies.	No additional funding provided

		maintenance provider will not be able to fully meet the required maintenance of the technology, and that there will be insufficient budget provided to meet the costs of maintaining the technology. This may result in the technology not being sufficiently maintained, the waiving of warrantees from the supplier/manufacturer, poor water quality outcomes, and potential action from ECan.		The maintenance of some new technology will be undertaken as part of an agreement with the supplier.		Ensure that all technologies proposed by design staff (internal and external) are discussed with the Operation and Maintenance staff. Council to ensure that sufficient budget is provided to maintain the new technologies before they are bought on line.	
SW06	Funding for Climate Change Investigations	If there is insufficient OPEX investment for the continued investigation and research into the effects of climate change on its asset base, then Council will not be adequately informed leading to poor decision making, serious maladaptation and indicating that intervention using capital works is Councils position for adaptation. Poorly based decision making means that it will cost more to maintain Councils Levels of Service (higher stop banks, bigger pumps, more groundwater pumping), and if/when that the system fails, there will be a greater loss in terms of damage to public and private property, community values, and negative effects to Councils reputation and possible litigation. Funding for the LDRP97 Multi-Hazard Study Project was applied for within the 2020 Annual Plan submission for funding for the FY21-23 period. Despite Councils commitment for "Meeting the challenge of climate change through every means available", this funding was not approved.	Very High	Funding has again been requested through this LTP process.	Very High	Apart from applying for funding within the LTP process, there may be possibilities for cost sharing with other departments i.e. Strategy and Transformation. However, this is assuming that these other departments are sufficiently funded. Council is working with external stakeholders as part of "information sharing". Without funding Council could continue to increase its knowledge, but will be more reliant on others for information provision.	No additional funding provided
SW07	Sand Accretion	There is an existing risk that the predicted accretion rates will further reduce the effectiveness of the current sea outfalls to the point where they will no long be operable, increasing the risk of flooding from more frequent nuisance to floor inundation events. If Council doesn't act in time it will expose CCC to costs for more frequent maintenance to opening the outfalls, potential liability for private property damage if outfalls are not cleared in time.	Very High	Maintenance provider contracted to open outfalls prior to wet weather events. Investigation being carried out by TSD for long term plan.	Very High	Long term focus on renewal/extension of sea outfalls, future planning to rationalise catchment discharge points with possible pump stations. Greater investment in monitoring and research maybe required, including a network investigation. Investigate the long term erosion risk along the wider coastline, and the effects of deposition in the estuary mouth and up into	No additional funding provided

						the rivers. Council to be proactive and set suitable future budgets to pay for the effects of sand accretion before it worsens	
SW08	Climate Change - Sea Level Rise	There is an existing risk that with sea level rise existing Council infrastructure will be exposed to damage, existing gravity outfalls will no longer work as designed, pipelines will become inundated reducing capacity and causing premature aging/wear of pipe materials, riverbank destabilisation and erosion with change in vegetative cover, saline intrusion will occur further inland etc. To avoid multiple failures, Council needs to address this issue with a large investment to identify at risk infrastructure and upgrade infrastructure with decisions to be made if the most at risk areas are to be serviced, being able to set floor levels, or even whether these areas should potentially retreat and be abandoned. Additionally, there may become a decrease in the level of flooding that is considered acceptable if the number of frequent/nuisance flooding events that occur. This may lead to increased pressure on Council to accelerate funding of future works to protect properties or otherwise respond to community disagreement.	Very High	LDRP 97 Multi-Hazard Risk Analysis project looking at defining risks for Council to address both engineered and non-engineered interventions with the at risk communities.	Very High	A multi-approach investigation to be undertaken to identify the at risk services and to decide on the best means to continue to provide service if a non-engineered solution is not selected. The investigation needs to consider catchment rationalisation. Council to be proactive and set suitable future budgets to pay for the effects of sea-level rise before it worsens.	No additional funding provided for this activity. Funding is provided for other CCC units for Coastal Hazard Adaptation Planning
SW09	Climate Change - GW rise	There is an existing risk that groundwater rise will cause inundation of subsoil drains and field tile systems resulting, reduced capacity in the piped network, permanent standing water and associated damage due to soft ground in public and private land. There may also be an increased risk of inflow containing bedding sediments washing through pipe joints or breaks which could lead to voids/road collapse. This may result in Council needing to renew field tile pipework with poor access or compensate landowners for damage, increased maintenance costs or costly renewals in the event of road collapse. Additionally, in the coastal areas, the elevated groundwater will become more saline which will accelerate pipe degradation, necessitating more frequent renewals.	Very High	Council's Operation and Maintenance Team is responding to customer service requests for any on-site issues. Council is installing ground water monitoring devices in parts of the city to monitor changes over time.	Very High	Identify all field drains in the city that maybe affected by ground water rise and ascertain any gaps in as-built data. Include these at-risk areas in a model which is verified by groundwater level monitoring to provide early warning of potential issues. Follow up design to identify any new piped network requirements. Council to be proactive and set suitable future budgets to pay for the effects of groundwater level rise before it occurs.	No additional funding provided for this activity. Funding is provided for other CCC units for Coastal Hazard Adaptation Planning

SW10	Climate Change - Changing Rainfall Patterns	There is a risk that rain events will become heavier over time, and will be greater than values used in design guidelines. This may result in existing pipework becoming overwhelm due to insufficient capacity resulting in flooding, or new infrastructure not being designed with sufficient redundancy.	Very High	The existing CCC design documents require an allowance for climate change which should provide some redundancy.	Very High	Council is moving to a 3rd party provider (NIWA) to provide design rainfall information. This will ensure that the rainfall data is current with climate predictions and prevents design standards recoded in documents from becoming outdated.	No additional funding provided
SW11	Climate Change - Increased Dry Periods	There is a risk that there will be longer antecedent periods of dry weather between rain events that may cause higher concentrations of contaminants in the first-flush of run-off entering the treatment devices/waterways. This will result in the existing treatment facilities operating at a lower treatment standard, possibly causing a non-compliance with consent conditions and prosecution from ECan and affecting Councils reputation.	Very High	Devices are designed to current standards only, which does not consider dry weather patterns	Very High	Carry out a high level investigation to ascertain the risk, identify at risk devices and ascertain if remedial works can be carried out.	No additional funding provided
SW12	Climate Change - Water temperatures	There is a risk that as temperatures increase, there will be a corresponding increase in water temperature which will have an adverse effect on the amount of DO and other chemicals in waterways, and potentially cause a change in invasive/pest species. This may result in CCC not meeting consent compliance requirements resulting in prosecution.	Very High	Council is collecting a suite of data from water quality monitoring to meet Regional Council Consenting requirements.	Very High	Council continues to collect regular water quality samples and invertebrate observations of waterways at strategic locations to monitor for any water quality or biodiversity deterioration. Amending levels of service to reduce the amount of mowing at stream banks (may result in negative public perception) and Good Practice education with Council Maintenance provider with bank treatments and waterway care e.g. not leaving cut grass in waterways. Council to provide budget for optioneering and provision of measures to mitigate the effects of warming e.g. more plantings and shadings as part of water way enhancement where possible.	No additional funding provided
SW13	Residential Development - Infill and Backlog	There is the on-going risk that the infrastructure in the central catchments is under capacity due to intensification without corresponding upgrades. This has resulted in increased demand on the pipework and an overdue investment on infrastructure upgrades. With a future scenario of increased density in the central city to assist	Very High	none	Medium	The City Wide Model has been used to indicate areas of the city predicted to flood due to insufficient capacity/backlog. Budget for infrastructure upgrades, outside of the	Funding has been provided with the 30 year LTP period, although no projects are

		with demographic shifts, this risk may lead to further under capacity issues, flooding, much higher renewal costs due to constrained corridors for pipework and negative reputation.				renewals required to replace aged and failing assets. A programme of Capital Works has been proposed for approval in this LTP	scheduled in the 3 year period, most commencing within the 10 year or later period of the LTP
SW14	Residential Development - Waterway Encroachment	There is the on-going risk that Council will find it more difficult to maintain its open waterway and piped network due to Council allowing encroachment of the waterway set back rules. This may become exasperated with infill housing if not appropriately regulated. This results in renewal costs in excess of the asset valuation rates resulting in budget shortfalls.	Very High	Variable application of District Plan Rules.	Very High	Ensure the setback criteria are not breached. Carry out GIS based assessment on assets affected by encroachment where the value of renewal is higher and allow for this in the overall asset valuation. Carry out enforcement to remove illegally installed structures where practical	No additional funding provided
SW15	Residential Development - Greenfield	There is a risk that Council has not invested enough in the proposed development area, that the management plans are not correct, Private Plan Changes are approved by Council or that development may occur out of sequence. This may result in Council required to carry out upgrades ahead of budget, or to deny development. This may result in budget changes required, or shortfalls, and loss of reputation if development is denied.	Low	Council has invested time and money in the development of SW Management Plans in the proposed development areas of the city. Budgets are available for the required infrastructure provided by Council	Low	None	Yes
SW16	Residential Development - Unexpected Areas	There is a risk that Council may not have invested in infrastructure in areas of the city that need to be habitable for a large population shift following a major emergency e.g. tsunami or earthquake.	High	Councils Strategy and Transformation team plan for population movements.	High	Councils Strategic Team to investigate/confirm where possible population migration within the city may occur to allow high level infrastructure checks to be carried out.	No additional funding provided
SW17	Dam classified retention basins	There is a risk that Council has facilities that are classified as dams under the Building Act 2004 and MBIE's Dam Safety guidelines, without the corresponding classification, inspections and safety plans being prepared and acted upon. This may result in Council being at considerable risk in the event of a failure of one of the basins resulting in public and private damage or loss of life.	Very High	Some facilities have been reviewed against the correct guidelines where they have been constructed or amended as part of an LDRP project.	Very High	Council to fund the initial assessment required to define the number of facilities that need to be classified as dams. Once identified, all dams need to be classified, and depending on the classification, further inspections, assessments and safety management plans are to be prepared by a suitably experienced person.	No additional funding provided

						All dams need to undergo regular inspections and updates of the safety plans	
SW18	Insufficient Expenditure for Asset Renewals	There is a risk that the annual budgets are insufficient to meet the levels of replacement to meet the infrastructure costs of replacing all pipework at or beyond its RUL. This risk maybe exasperated by valuation not allowing for all unexpected costs for construction or investigation and design works being carried out by external parties. The risk of not renewing assets at an appropriate time will mean that there is an increase in OPEX expenditure required, a higher chance of network failure leading to a high clean-up cost due to public and/or private infrastructure damage and an eventual higher renewal cost.	Very High	Council carried out regular valuations of assets. Council has HDM panel to provide pool of suitable contractors and consultants for "better" delivery of services and construction works.	Very High	Carry out a study comparing the current valuation data to market rates for design, procurement and construction activities. Carry out a GIS based exercise where the valuation of an asset type has suitable multipliers applied to cater for variables that may not be considered at the time of valuation e.g. not just pipe size but increases for material, location, depth, GW level, road hierarchy etc.	Budgets have been restricted over the 30 year LTP period to manage the financial constraints
SW19	Insufficient Expenditure for Operation and Maintenance	There is a risk that the annual budget for Operation and Maintenance costs is not kept up to date to account for new and future planned infrastructure. This may cause a lower level of service due to insufficient funding, resulting in a loss of reputation to Council and an increase in public complaints.	High	Council is working through the process for hand-over of new assets from private developments and Council projects to ensure the operational and maintenance costs are captured and planned for.	High	All capital works projects to have an OPEX cost forecast at the time the project brief/CPMS data is entered, and this amount is to be added to the Operations budget in a timely manner to ensure maintenance items are added to be the Maintenance Contract as the items come on line. Review of budgets to be based on actual and forecast future costs to meet Councils agreed level of service and to ensure compliance with consented water quality outcomes.	No additional funding provided
SW20	Insufficient Investment in Technology - green infrastructure	There is a risk that Council does not invest in green technologies to assist with meeting many of its strategic directives. This may result in current capital works projects are being progressed without considerations for the future. This may cause Council to not meet its strategic directions, to be "left behind" in improvements affecting its position as the "Garden City", and miss opportunities to incorporate green infrastructure in its development plans.	Medium	Council currently requires drainage designs to consider the 6 Values Approach (Ecology, Landscape, Recreation, Culture, Heritage and Drainage). Where achievable swales are utilised for conveyance and enhancement of waterways is favoured over piping or relining where practicable and funding allows.	Medium	In line with its Strategic Directions, Council should investigate what green infrastructure could work in the city, and how it could be incorporated into its open spaces and streetscapes for the future. This would pick up the direction that Auckland Council is focusing on with its healthy and connected waterways philosophy.	No additional funding provided
SW21	Insufficient Investment in	There is a risk that Council is not carrying out sufficient monitoring to manage flood events or calibrate and verify flood models and undertake	High	Model calibration and validation is based on limited measured data plus visual assessment of flood extents.	High	Council to fund additional level sensors in key areas of the network - including groundwater,	No additional funding provided

	Technology - monitoring	active flood management resulting in preventable flood damage. Alternatively not having sufficient information to able to defend against claims of incompetent management or to identify and track longer term trends as a result of urban development, climate change or any other causes e.g. weed growth or sediment deposition resulting in underperformance of infrastructure and ineffective use of budget.				soil moisture, ground surface levels (GPS & Lidar) and tide levels - to provide for better calibration and validation of flood models, event management, strategic management and the prediction and tracking long term climate change effects.	
SW22	Insufficient Investment in Cultural/Toanga	There is a risk that Council undervalues the cultural and spiritual significance to Maori of restoring the Mauri of water, resulting in an erosion of relationships, potential legal action and negative impact on Councils reputation.	High	Council operates with the 6 Values Approach for Stormwater Management (Ecology, Landscape, Recreation, Culture, Heritage and Drainage). Currently consulting with Iwi on capital works projects.	Low	Council could engage with local Iwi to discuss the benefits of integration of measures such as green infrastructure and water quality enhancement to meet common guidelines for designing stormwater infrastructure for the future. Again this would line up with the work that Auckland Council is progressing. 3-Waters Head of Department has approved an increase in staffing within the Planning Team to facilitate the works	Yes
SW23	Insufficient Investment in Community Engagement	There is a risk that the Council will not provide sufficient and compelling information to ensure that the decisions taken on future strategies are based on good scientific and technical evidence which has been well communicated to affected communities and the greater Christchurch population. This will result in angst if Council pursues retreat options to be pursued without the community being actively engaged resulting in considerable damage to Councils reputation.	High	Community board engagement in capital works projects.	High	Council commences discussions internally about how to ensure that the scientific and technical information is clearly understood by the majority of the population in the affected areas and in the wider Christchurch Population.	No additional funding provided
SW24	Insufficient Investment in Continual Asset Assessment	There is a risk that Council does not regularly reinspect assets for condition assessment (e.g. the open waterway condition assessments carried out by the LDRP team in 2015/2016) and update the existing grading's to reflect maintenance and capital replacement works. This will result in a lower level of confidence in the grading ratings, making it more difficult to select renewal candidates, and incorrect information for BAU works.	Very High	None, there is a 3 year backlog to catch up on	Very High	Council to fund a process for updating the existing asset data to reflect all repair works carried out since the waterway inspections. The reinspection of the assets (pipes, waterways, headwalls, grills etc.) to be included in the new Operations Contract at a frequency to ensure all assets are reviewed over an e.g. 10 year cycle	No additional funding provided
SW25	Silo Working Departments	There is a risk that different departments in Council carry out works with possible synergies	Medium	While this an on-going issue between Council departments, the silos are	Medium	Council to fund a project (GIS based) where all future projects	Funding not required

		in isolation from each other, or with a timing that affects other renewals. This may result in unnecessary rework, damage to new assets, and damage to Councils reputation.		slowly becoming reduced due to inter-departmental update meetings occurring i.e. 2 monthly catch up meetings between Waterways and Parks		with approximate years of design and construction are presented on a platform so all staff can align projects, discuss options for inter-department projects for enhanced outcomes etc.	
SW26	Insufficient Investment in Stormwater Education and Awareness particularly for industrial and commercial site operators that handle, store or transfer materials that are hazardous to the aquatic environment	Spills and deliberate discharge of hazardous materials, chemicals or fuels into waterways is an ongoing risk which is not easily mitigated by "end of pipe" treatment systems. A programme of industrial site audits, education and awareness is required to inform site operators of the risks and their obligations.	High	Industrial site audits (15 per year minimum) are undertaken by 3WW Technical Services Team.	Medium	A fully funded education and awareness programme to be funded as part of the CSNDC requirements. This programme could be coordinated with Environment Canterbury for a more cohesive message and better coverage.	Yes
SW27	Surface Water Quality and Habitat decline	There is a risk that in areas where there is no or limited treatment we will continue to see a decline in surface water quality and ecological habitat. There could be some lag between facilities built recently and goals/objectives to improve water quality.	Very High	Council has invested time and money in the development of SW Management Plans and SW treatment facilities. Limited budget is available for habitat improvement provided by Council Monitoring	Very High	More treatment facilities within urbanised areas/more investment in waterway enhancement/protection projects. Education for residents adjacent to waterways on ways they can help protect and enhance waterway health.	Additional funding is provided, however, much of it is deferred to late in the 10-year programme or later. Risk exists for some time.
SW28	Unresolved issues from Amalgamation with BPDC	As part of the amalgamation between Christchurch City Council and Banks Peninsula District Council there were several issues that were not fully resolved or detail in any reference document. These issues relate to: 1. The division of operational and renewal expenditure between Christchurch City Council and Environment Canterbury. 2. Unrealised works within some of the communities for works that were covered by historic rating districts, but no works were delivered. This has led to confusion over which authority carries out works in the Peninsula, with Christchurch City Council taking the funding lead.	Very High	Issue 1 Council carried out preliminary discussions with ECan to establish role/responsibilities for both authorities at the end of 2018. The discussion were not completed, and further work would be warranted. Issue 2 The Land Drainage team has sought legal advice over the responsibility of the historical works that were previously rated by Banks Peninsula District Council. There is still some disagreement between staff, further discussions will be required.	Very High	The previous discussions with ECan need to be recommenced to ensure that adequate funding for future years for the communities on the Peninsula is provided for. The legal opinion provided should be discussed amongst the business and then taken to management for a final decision. Again, this may require funding to be provided for future works depending on the outcome.	No additional funding provided

		The undelivered works on the Peninsula may expose Council to costs that have not been budgeted for and negative reputational issues.					
SW29	Carbon Neutrality Goals	There is a risk that Councils goals for achieving operation carbon neutrality by 2030 and achieving Christchurch wide carbon neutrality by 2050 won't be realised.	Very High	Currently Council is preparing a new Climate Change Strategy document which will provide high level direction for informing how Council will progress to meet is mandated carbon targets. It is likely that the new directions will add more detail to the targets set in 2019 and the previous Climate Change Strategy.	Very High	Following the acceptance of the new Climate Change Strategy, Council proposes: 1. Develop two detailed action plans to: (a) reduce greenhouse gas emissions and (b) prepare for the impacts and opportunities presented by climate change. 2. Develop an inclusive and enabling management structure that will develop these documents and drive the implementation of actions. 3. Measure and report the greenhouse gas emissions arising from the Council's own operations and the Christchurch District. 4. Support the established internal resource efficiency and greenhouse emissions reduction programme of Council. Source: http://intranet.ccc.govt.nz/Projects/ClimateChange/SitePages/Home.aspx#	No additional funding provided

5.3.3 Risk Mitigation Strategies

Risk management is inherent in all of Council's asset management processes. Significant risk management strategies for this activity include:

5.3.3.1 *Asset Design*

Council requires all new assets to be designed to accord with the following standards:

- Waterways, Wetlands and Drainage Guide
- Infrastructure Design Standards
- CCC Construction Standard Specification
- Building Code
- City Water & Waste Specification for Control Equipment (Pump stations)
- Sewage Pumping Station Design Standard (until a Stormwater Pumping Station specification is prepared)
- General Electrical and Automation Specification
- Manufacturer's specifications and maintenance manuals (Mechanical & Electrical equipment)
- Operation and Maintenance Manuals

It is anticipated that if all Land Drainage assets are designed, constructed and maintained to accord with the above list, then they will include suitable resilience and redundancy to meet Councils Levels of Service and mitigate risk. The difficulty will be when these design standards are applied to older assets, built before these standards were adopted, but are still expected to conform to the same risk profile.

5.3.3.2 *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."

5.3.3.3 *Business Continuity and Emergency Response Planning*

There is a comprehensive Business Continuity Plan (BCP) that covers the roles, responsibilities and procedures to allow Council to recover its essential services following a natural disaster. A number of individual Continuity Procedures have been assigned to Land Drainage in the 3 Waters and Waste BCP, and they are:

1. CWW-SWLD-001: Land Slips and Storm Water Pipe Blockage
2. CWW-SWLD-002: Major Flooding Event
3. CWW-SWLD-003: Pollution of Waterways and Stormwater Network
4. CWW-SWLD-004: SCADA and/or Telemetry Failure (3 Waters)
5. CWW-SWLD-005: Major Power Failure (3 Waters and >4 hours
6. CWW-SWLD-006: Loss of Manpower (3 Waters Pandemic, Lack of Market Resource etc.)
7. CWW-SWLD-007: Failure of Stop Bank - Waimakariri, Avon, Styx, Heathcote Rivers

There are some other Continuity Procedures that are also relevant to land drainage such as:

1. CWW-WS-027: Tsunami (3 Waters)
2. CWW-WS-028: Earthquake (3 Waters)
3. CWW-WW-059: Other natural event incidents excluding earthquake and tsunami (3 waters)

5.3.3.4 *Other specific initiatives:*

To manage risks related to future demand the Land Drainage Planning team carries out the preparation of Stormwater Management Plans which are referenced in the District Plan. These plans outline required stormwater devices and possible treatment methods to meet Council water quality and quantity control for the planned urban growth.

5.4 Summary of Risk and Resilience Projects

The following risk and resilience improvement projects or activities are included in the AMP programme and budgets.

Table 5-5 - Risk and Resilience improvement Projects.

Risk Category	Improvement or Mitigation	2022-2024 LTP Cost Period	2025-2051 LTP Cost Period	Cost beyond 2054 LTP Period
Flooding/Climate Change	Provide additional budget to accelerate the City Wide modelling programme, including the refinement to the Avon River model and the creation of the Styx catchment model, and an annual amount for the upkeep of the model.	CAPEX - $3.4M & OPEX-$900k	CAPEX - $6.5M & OPEX -$6.3M	Min 3% of CAPEX spend
Climate Change	Investigate the effects of predicted Sea Level Rise and sand accretion on vulnerable assets, and develop high level future scenarios for catchment management and resilience. Develop mitigation measures and budget figures for renewed/new capital works options. The cost figures are currently forecast in the budgets from the 3 Coastal Hazard Adaptation Programmes proposed for funding in this LTP.	Nothing funded in this period by the Land Drainage activity (estimated as OPEX - $2.12k)	CAPEX $0.5M (estimated as OPEX - $559.8M)	CAPEX & OPEX - On-going
Climate Change	Carry out investigations to identify the assets at risk of sea level rise (as discussed in LGNZ document "Vulnerable: the Quantum of local Government Infrastructure Exposed to Sea Level Rise") to allow future strategic planning for asset renewals and/or new capital works, community consultation, and staged budget setting to match rate of sea level rise.	Not Funded (proposed to use existing FY22 funding that was cut)	Not Funded (estimated as OPEX - $2.12M)	Not Funded (estimate was to be calculated)
Climate Change	Investigate the effects of predicted Groundwater Rise on assets and establish levels where levels of service will be compromised, to include level monitors and modelling. Develop mitigation measures and budget figures for renewed/new capital works.	No Funding Required	Not Funded (estimated as CAPEX & OPEX - $355M)	Not Funded (estimated as CAPEX & OPEX – on-going)
Climate Change	Carry out further investigation and optioneering to assist with Councils programme for operational Carbon neutrality by 2030 and Christchurch Carbon Neutrality by 2050. Further guidance is required from Council on the methods to meet targets and/or provide funding for further investigation works.	Not Funded (estimate was to be calculated)	Not Funded (estimate was to be calculated)	Not Funded (estimate was to be calculated)
Seismic Activity	Review existing CCTV footage of deferred SCIRT works, respect for deterioration, and programme the inspect assets only assessed by PDA methods.	Not Funded (estimated as OPEX - $150k)	No Funding Required	No Funding Required
Basin Operational Performance	Investigate the operational parameters of treatment/storage facilities to better understand if the facilities are operating as per design, and if not propose remedial works to be carried out. Additionally, collect performance data from facilities to better inform maintenance and renewal lifecycle estimates.	Not Funded (estimated as OPEX - $500k)	Not Funded (estimate to be calculated)	Not Funded (estimate was to be calculated)

Basin Operational Performance	Construct and operate a dynamic contaminate load model to compare predicted basin performance against samples collected at the discharge points.	CAPEX - $274k & OPEX - $285k	CAPEX - $2.54M & OPEX - $2.5M	Min 3% of CAPEX spend
Basin Operational Performance - Operations	Investigate the discrepancy between the current budgets provided for maintaining stormwater facilities as compared to estimates based on local expected maintenance regimes and rationalise Operational budgets (part of the proposed works in Item LD-03 of Table 10.2).	Not Funded (estimated as OPEX - $50k)	Not Funded (no estimate provided)	Not Funded (no estimate provided)
Dam Breach	Ensure that all stormwater retention devices that can hold a volume greater than 20,000m^3 of water shall have a NZSOLD Consequence Assessment carried out, and if deemed appropriate a Potential Impact assessment with relevant assessment and safety reports completed with inspections and reviews being undertaken. This task acknowledge Councils responsibility to ensure public wellbeing in the event that there is a fault with a major stormwater facility causing a failure similar to that of a dam breach.	Not Funded (estimated as OPEX - $650k)	Not Funded (estimated as $230k annually)	Not Funded (estimated as OPEX - $230-250k annually)

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

The earliest evidence of stormwater drainage is a brick stormwater sewer along Tuam Street east from the Town Belt constructed by the Provincial Government and City Council. The sewer discharged into the Estuary via an outfall at Linwood Avenue. The main outfall built between 1871 and 1874 has served the City ever since.

The Christchurch Drainage Board, formed between 1875 and 1876, decided early on to keep the stormwater drainage system separate from the sewage system. Continuing the work of the City Council the Board "created a complex system of drains, both open and piped, to carry stormwater from the city to the main stormwater outfall down Linwood Avenue. Natural streams and creeks were utilised. Many became boarded drains or were piped." The Contextual Historical Overview for Christchurch City by John Wilson notes the peculiar drainage problems of Christchurch which resulted in "the worst rates of water-borne diseases in the country and then the country's first comprehensive, effective drainage system."

In 1868 Christchurch experienced flooding from the Waimakariri River which prompted the construction of flood protection works from the 19th century well into the second half of the 20th century. Whilst these works are outside of the City's boundaries, they provide a historic record of the development of the site of the City and its modifications.

The management of stormwater continued to be a problem for the Drainage Board well into the 20th century with flooding in St Albans, Waltham and Barrington. Stormwater relief projects included the building of the Dudley Creek Diversion in 1979, ending flooding in St Albans and the construction of the Woolston Cut in 1986, reducing stormwater issues along the Lower Heathcote River. Shortly after these projects the Board was disbanded and the City Council took on the role as Drainage Authority in 1989.

The major earthquakes of September 2010 and February 2011 as part of the Canterbury Earthquake Sequence caused substantial changes to both raise and lower ground levels around the city. Areas such as Mairehau, Richmond and St Albans have experienced flooding on a regular basis since the earthquakes. In 2012 the Land Drainage Recovery Programme (LDRP) was established to better understand the effects of the earthquakes on the land drainage network, and prepare a programme of works to restore the network to reflect the pre-quake flooding risk.

Following a series of flood events in early 2014, a Mayoral Taskforce was set up to understand the risks and the areas of the city where the residents were most vulnerable to flooding. The Taskforce focussed on short-term solutions to flooding, and gave more focus to the projects and funding requirements for the LDRP works. The LDRP programme was absorbed back into "business as usual" works at the end of 2019.

There is no concise history of stormwater and land drainage on the Banks Peninsula. The stormwater brick barrels in Lyttelton were constructed in the late 19th and early 20th centuries to enclose hillside streams for safety and land stability reasons. Work to prevent flooding was carried out by aiding the drainage to sea of Lake Forsyth and Lake Ellesmere. Lake Forsyth was opened regularly in the 1830's but by the mid-century is was closed off by a shingle barrier, leading to increased flood waters flooding local roads and farmland. In the 1870's a permanent culvert was installed, only to be washed out to sea. Since then the lake has been opened regularly, on average 1-2 times a year and more frequently in the last couple of years.

6.2 Internal Business Structure

The land drainage activities are primarily the responsibility of the Three Waters and Waste Unit and is supported by the Asset Management Unit as shown in the organisational structure below.

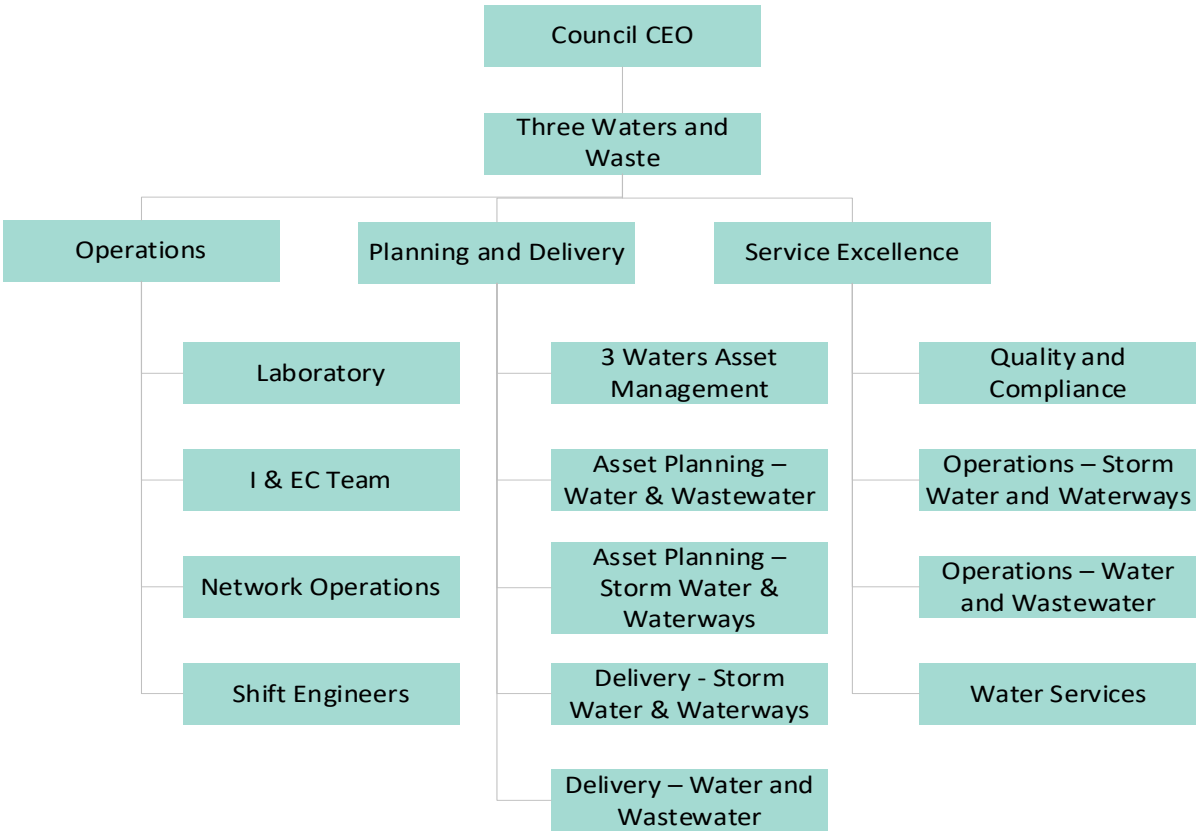


Figure 6-1: Organisational Structure

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 team.

The roles of the main service delivery teams within Council are shown below.

Table 6-1: Council teams involved in the Land Drainage Activity

Team	Role
3 Waters and Waste Asset Management	Responsible within Council as the "asset owners" and provide decision making throughout the asset lifecycle. Manage the renewals budgets and programming for the existing land drainage assets.
CSWW Delivery and Planning	Carries out planning for growth and development of new land drainage assets, including managing the timing of asset provision to meet growth requirements, manage the requirements of the Comprehensive Stormwater Discharge Consent and advises various Council departments of any land drainage information such as development compliance with legislation and flood levels etc.
CSWW Land Drainage Team - Operations	Manages the operations and maintenance contract with Council's service providers. Liaise with the public with any customer service requests. Provides details to assist with renewals programme setting.
CSWW Land Drainage Capital Delivery Team	Formed to carry out option studies, plan and deliver projects to resolve flooding issues related to the Canterbury Earthquake Sequence. This team also

	provides a project management team for the delivery of renewal and growth projects.
Asset Management Unit	A team with a cross functional responsibility to deliver a sustainable and appropriate Advanced Asset Management service.

The Land Drainage team also interfaces with departments across Council which support the asset management and service delivery functions.

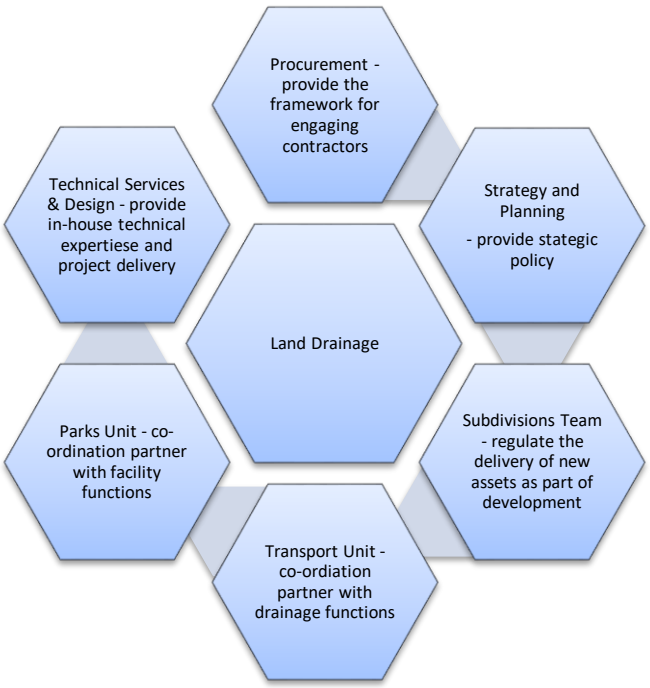


Figure 6-1 Other Council Departments Land Drainage Activity Interfaces With

6.3 External Contracts and Partners

Council engages a number of internal and external service providers to deliver the Land Drainage services.

Contracts for the various service providers will be procured according to the Council's Procurement Policy[11]. This policy outlines the principles Council will follow in order to provide clear direction to management and staff dealing with procurement. It includes guidance on transparency and accountability; value for money; effective market competition; and emergency procurement.

The main contracts are summarised in Table 6-2.

Table 6-2: Major Contracts for Service Delivery

[11] https://www.ccc.govt.nz/the-council/plans-strategies-policies-and-bylaws/policies/council-organisational-policies/procurement-policy/

Types of Service	Contractor	Scope	Term
Annual maintenance contract	City Care Ltd	Planned and reactive maintenance of the rivers, tributaries, utility waterways and the stormwater reticulation network	Currently extended until March 2022
Annual maintenance contract	National Institute of Water and Atmospheric Research Limited (NIWA)	Contract for the maintenance of hydrometric equipment needed for flow monitoring of waterways and rain gauges.	Ongoing
Capital Works (Professional Services)	• CCC Technical Services & Design • External consultants	Creation and renewal of assets as per the capital programme Condition assessment, one off design projects and any other professional service require	Ongoing
Major Capital Works (Renewals & New Infrastructure)	• CCC Technical Services & Design • External consultants • Winning contractor	Competitive tender contracts for large scale renewal works	Ongoing
Plans and Asset Data	CCC Corporate Data Team	Plans/maps and asset management information systems.	Ongoing
Sampling	CCC Laboratory Team	Collection and analysis of river water samples for compliance with resource consents.	Ongoing
Christchurch River Environment Assessment System (CREAS)	EOS Ecology	Collection and analysis of various waterway data to assess the human impacts on rivers and streams	Ongoing
Hybrid Delivery Model (HDM) Panel	Varies	Assessment, design, construction etc.	3+1+1

6.4 Co-ordination with other Authorities

The operation of the assets described in this AMP require co-ordination with other key authorities as listed below:

- Council – liaison and co-ordination required with other internal sections where their work impacts on Land Drainage assets and vice-versa
- Canterbury Regional Council (ECan) – Regional Authority
- Mahaanui Kurataiao Limited
- Ōtākaro Limited

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.

The management of land drainage assets involves coordination with ECan, in particular through the Resource Consenting process but also through working towards the goals and targets as set in various strategies and plans, including the Surface Water Strategy, Canterbury Water Management Strategy, Floodplain Management Strategies and the Land & Water Regional Plan. The Council's land drainage assets need to give effect to regional policy statements, which can indirectly lead to a requirement for investment.

6.5 Business Reviews Undertaken

Section 17A of the Local Government Act 2002 outlines Council's requirement to undertake regular reviews to ensure funding, governance and service delivery of all services, including for the three waters are set up in the best way to deliver good service and value for money to all citizens in the future. A review is expected at least every six years and within two years of major contracts expiring.

A Section 17A review for the delivery of 3-Waters Services 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 3-waters 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 land drainage 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

Given these short timeframes proposed for the water reforms to become enacted, it is anticipated that there will be changes to the structure of the land drainage assets within this LTP period but at the time of writing, it has not yet been determined what they will be.

6.6 Significant changes planned for the activity

Excluding the business changes discussed above, there are no significant changes planned to the services provided or the way in which the activity is to be managed in the future. 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.

There will be minor changes in the activity to do with data collection and storage which is hoped will provide a better understanding of the condition of some assets, and the better inform future AMP's and LTP's.

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.

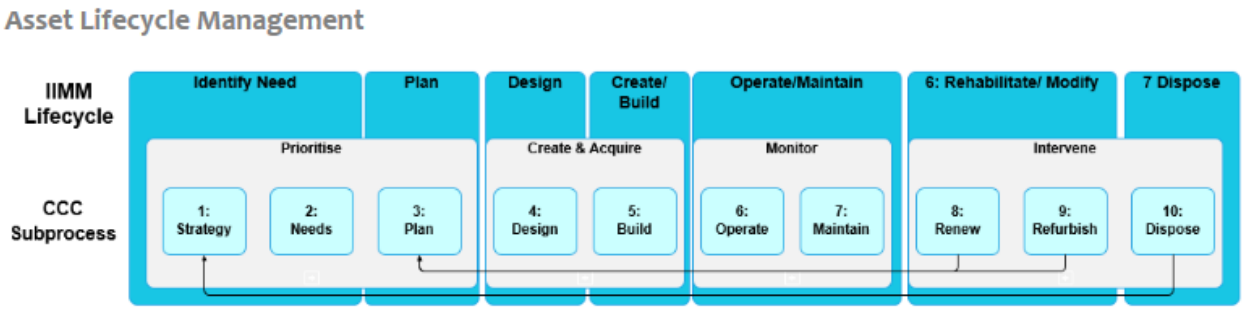


Figure 7-1: Asset Lifecycle Categories

7.2 Our Asset Portfolio

7.2.1 Location and Value

In June 2020, 3-water assets under direct Council Control carried a book value of $10.1 billion dollars. A detailed summary of the assets covered by this AMP is included in Table 7-2 and for the purposes of this AMP, the assets are considered to fall in to 8 groups as follows;

1. Reticulation
2. Waterway lining
3. Open waterways
4. Open waterway structures
5. Hydrometrics
6. Pump stations
7. Flood protection structures
8. Treatment and storage facilities

The 2020 Valuation[12] found the total value (optimised replacement cost) of the assets covered by this AMP to be **$2.12 Billion.** Over 90% of this value is associated with the 935km of pipes and 25,662 nodes (inlets, outlets, manholes etc.) that make up the reticulation network.

[12] CCC Three Waters Final Valuation Report June 2020 - TRIM://20/897727

The asset base also includes 50 pump stations, 669 treatment facilities, 20,8054m^2 of waterway lining and 12.1km of stop banks.

7.2.2 Asset Data Confidence

Table 7-1 below summarises the Land Drainage asset information both in terms of completeness (% of assets for which that data type is stored) and reliability (using the A-E grading below). Asset data is held in SAP and GIS. The description of the confidence grade is below.

Table 7-1 Confidence Rating Definitions

Confidence Rating		Description
h	Highly Reliable	Data based on sound records, procedures, investigations and analyses, well documented and recognised as best practice.
r	Reliable	Data based on sound records, procedures, investigations and analyses, well documented but has minor shortcomings.
u	Uncertain	Data based on sound records, procedures, investigations and analyses, but not well documented, incomplete, unsupported, interpreted from limited sample of good data.
v	Very Uncertain	Data based on unconfirmed verbal reports, weak inspection and analysis processes with the majority of data interpreted or extrapolated.

Note: Grading and Description are based on Table 3.5.3 of the "International Infrastructure Management Manual – 2011"

Table 7-2: Asset Summary table based on 2020 stormwater valuation data

Asset type & valuation data								*Data confidence and completeness From 2020 valuation*			
Activity	Asset Group	Asset Types	Quantity	ORC ($)	ODRC ($)	AD ($)	Proportion of total Asset Value	Quantity	Size	Age	Condition / Performance
Stormwater Drainage	**Reticulation**	Pipe	39,643No. / 935 km	$1,823,055,515	$1,228,485,946	$16,421,588	86.0%	h	h	h	r
		Pipe Protection	2,700 No. / 83.4 km	$3,655,597	$2,650,131	$36,523	0.2%	h	u	h	u
		Access	14,201 No.	$60,038,293	$41,616,273	$547,783	2.8%	h	h	h	u
		Inlet *(excl soakpits)*	2,890 No.	$5,623,460	$4,012,589	$60,073	0.3%	h	h	h	u
		Outlet *(excl valves & soakpits)*	509 No.	$1,134,472	$760,853	$25,458	0.1%	r	h	h	u
		Junction	4,616 No.	$3,518,716	$2,131,891	$43,984	0.2%	h	h	h	u
		Restriction *(weir)*	36 No.	$125,078	$112,065	$1,137	0.0%	h	u	h	u
		Pipe restraint *(thrust block)*	13 No.	$13,611	$11,687	$170	0.1%	u	u	u	u
		Flow Control	470 No.	$2,883,144	$2,267,837	$29,041	0.0%	h	h	h	u
		Headwall	1519 No.	$5,863,234	$4,393,459	$53,399	0.3%	r	u	h	u
		Grill	333 No.	$1,297,435	$677,621	$25,138	0.1%	r	r	h	u
		Structure	1075 No.	$6,903,095	$5,394,557	$71,109	0.3%	h	u	h	u
	Lined/Unlined Drains	Bank lining	208,054 m2	$97,064,522.62	$43,657,795.45	$1,889,348.67	4.6%	r	u	u	h
		Bed lining	89,362 m2	$18,631,389.00	$9,150,166.47	$229,277.84	0.9%	r	u	u	h
		Earthworks	124,876 m	$6,898,290.64	$6,898,290.64	$0.00	0.3%	r	u	u	h
		Earth channels	187,291 m	$6,966,020.00	$6,966,020.00	$0.00	0.3%	r	u	u	h
	Open Waterway Structures (excl lining)	Weirs	247 No.	$1,403,037.95	$ 764,393	$18,707.17	0.1%	r	v	u	u
		Debris Poles	10 No.	$43,332.00	$21,666.00	$866.64	0.0%	r	u	v	u
		Debris Racks	42 No.	$152,434.80	$76,217.40	$3,048.70	0.0%	r	u	v	u
		Flumes	13 No.	$16,430.25	$8,215.12	$657.21	0.0%	r	u	v	u
		Fords	3 No.	$58,070.40	$29,035.20	$725.88	0.0%	r	u	v	u
		Valves *(instream valves such as penstocks etc.)*	28 No.	$218,073.35	$109,036.68	$2,180.73	0.0%	r	u	v	u
		Energy Dissipation	76 No.	$439,477.07	$ 268,683	$5,065.95	0.0%	r	u	u	u
	Monitoring & Hydrometric Equipment	Instruments	209 No.	$329,072.40	$20,946.67	$10,033.71	0.0%	r	r	u	u
		Structures	45 No.	$56,672.47	$22,853.09	$1,051.86	0.0%	r	r	u	u
		Piezometers	789 No.	$579,465.93	$289,732.47	$11,589.30	0.0%	h	h	v	u
		Other equipment	102 No.	$118,356.37	$37,317.46	$2,539.12	0.0%	r	r	u	u
Flood Protection & Control Works		Pump	125 No.	$ 1,911,266.77	$ 416,683.75	$59,128.60	0.1%	h	u	r	u
		Building	14 No.	$7,262,531.30	$3,520,857.02	$90,781.64	0.3%	h	r	r	u
		Well	16 No.	$617,274.00	$306,225.77	$ 7,715.93	0.0%	r	v	u	u

	Pump stations	Electrical	121 No.	$1,464,283.24	$633,727.62	$36,041.05	0.1%	u h r u
		Pipework	90 No.	$1,157,388.75	$624,622.50	$16,534.13	0.1%	u u r u
		Tank	11 No.	$664,341.14	$379,925.72	$9,011.56	0.0%	r u r u
		Instrument & control	100 No.	$593,369.23	$245,638.77	$36,402.99	0.0%	r u u u
		Fittings	17 No.	$131,170.73	$ 97,992.25	$1,639.63	0.0%	u u r u
		Standby plant	10 No.	$215,531.51	$32,092.39	$4,585.47	0.0%	r u r u
		Other	55 No.	$151,297.04	$102,299.27	$4,845.63	0.0%	u u r u
	Flood protection structures	Stop banks	228,438 m2	$9,087,881.81	$9,087,881.81	$0.00	0.4%	r v u u
		Valves - Flow Control	470 No.	$2,883,144	$2,267,837	$29,041	0.0%	r u v u
	Treatment & Storage Facilities*	Earthworks	1,366,008 m2	$40,467,068.48	$40,467,068.48	$0.00	1.9%	u u r u
		Lining	683,004 m2	$10,576,620.17	$7,073,783.87	$348,075.42	0.5%	r r r u
				$2,124,269,463.99	**$1,433,258,421.64**	**$20,134,299.32**		

*Note - The 2020 valuation included all water quality/storage facilities (wetlands, dry basins, rain gardens, silt tanks, swales, soak pits etc.) under the two line items without acknowledging that the different treatment facilities are constructed differently at different costs. The valuation is based on a m2 of the device with a standard depth and a grass lining. Therefore, the values should be treated with caution, as well as they are likely very conservative.

7.2.3 Critical Assets

Critical assets are those whose failure would likely result in a significant disruption in service resulting in financial, environmental and/or social cost, and therefore warrant a higher level of asset management.

As shown in Table 7.2, there are a number of asset groups encompassed by the Land Drainage Activity. For piped reticulation critical assets are identified under the consequences of failure schema of the AAIF project. The details of the pipeline consequence of failure assessment methodology is covered in the "Lifecycle Management Manual"[13] currently being compiled. The main principles are briefly discussed in Section 8.1.1 – "*Reticulation*" below.

The waterway networks i.e. waterways that are still open or piped along the waterway alignment, have also been prescribed a "criticality" score which was determined by a panel of operations staff (CCC and City Care Limited). This gave the "criticality" grade of the drainage network based on *"the potential outcome should any section of that reach be blocked completely in a single location"*[14] This "criticality" grading has not been included in any AAIF assessment. There will be synergy in doing this in the future to improve the renewals programme, and is included as improvement Item LD-04 in Table 10-2 Asset Management Improvement Table in Section 10.

The remaining asset groups are also not covered by the AAIF project. There was an assessment carried out in 2017 by Intergroup "Christchurch City Council Stormwater Asset Criticality Model V1" which attempts to provide a "criticality" 1-5 grading to all asset types. There are a number of attributes that attract weightings depending if the asset is involved/crosses that attribute e.g. if asset crosses a road, rail, community facility or contaminated land GIS parcels it attracts a "critical" weighting. While it is expected that the "consequences of failure" data as applied to the pipe assets could be manipulated and used for all other assets, this has not occurred yet. Again, this needs additional work to be done to make the data more useable.

Using the above framework, the criticality and consequences of failure of the assets for each activity area are shown on Figures 7-1, 7.2 and 7-3 below.

[13] "Lifecycle Management Manual" TRIM://16/212372

[14] "Land Drainage Network Criticality Assessment Methodology" TRIM://19/870491

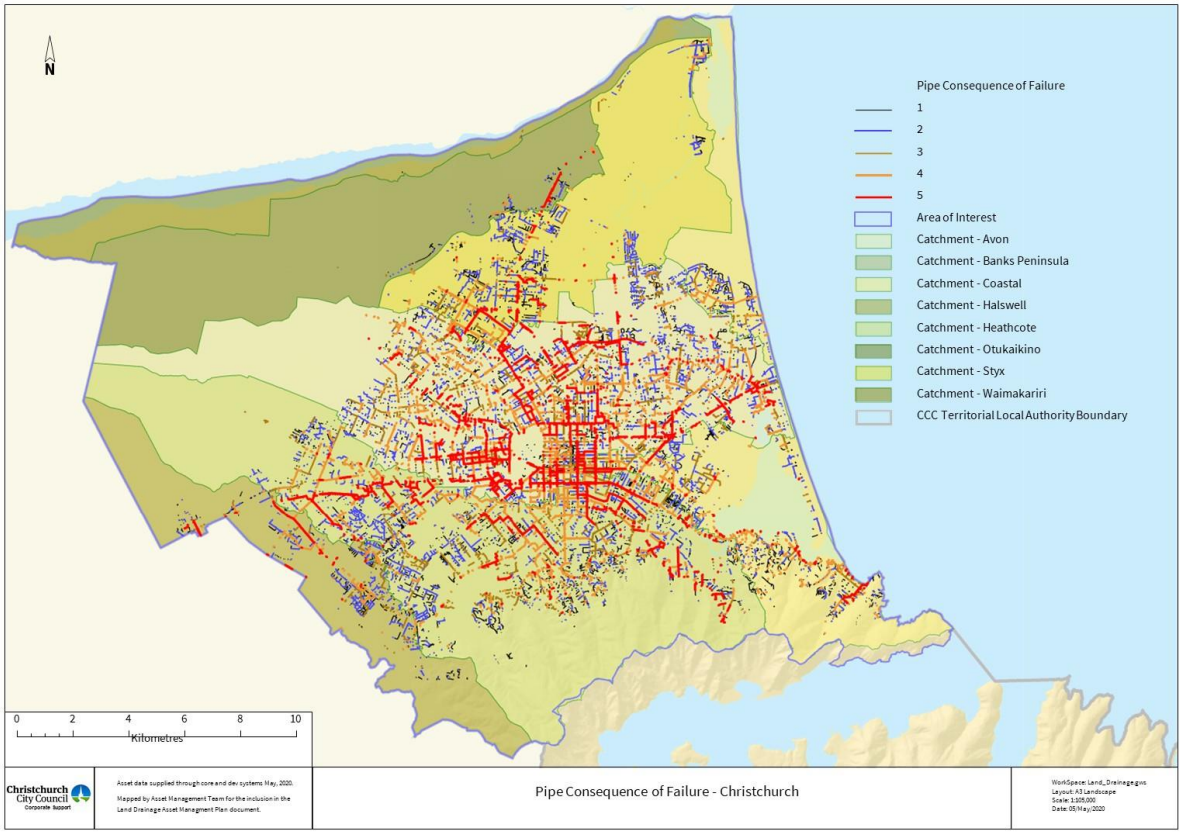


Figure 7-1: Pipe Consequences of Failure – Christchurch City

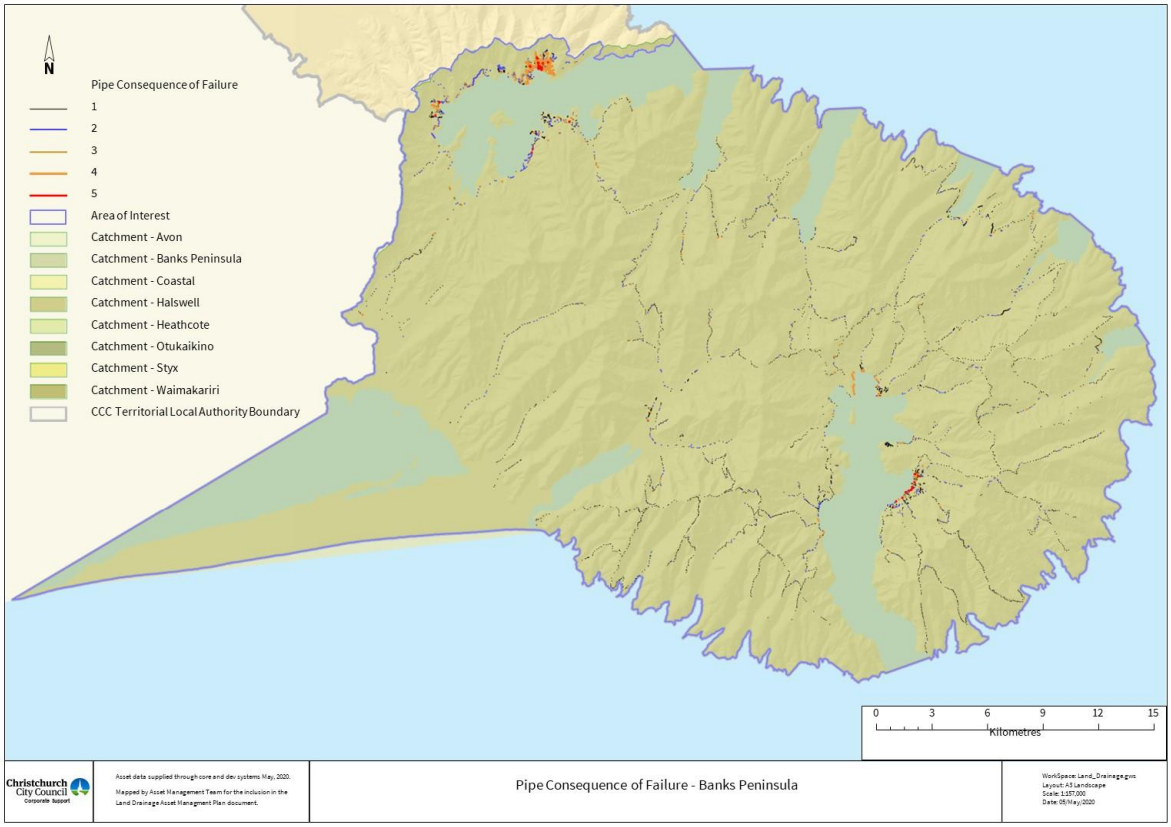


Figure 7-2: Pipe Consequences of Failure – Banks Peninsula

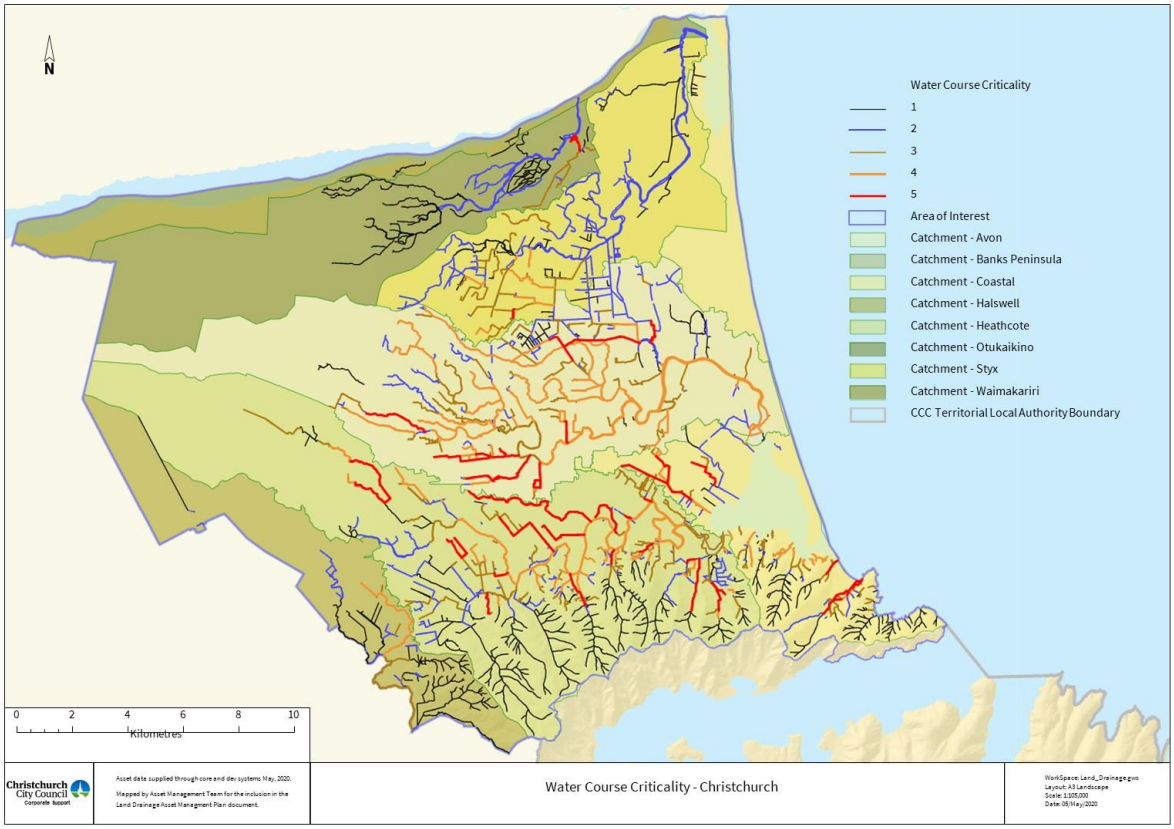


Figure 7-3: Watercourse Criticality – Christchurch City

7.2.4 Network Aged and Lifecycle Stage

The lifecycle stage of the assets is a useful indicator of whether the portfolio is healthy and balanced. Unfortunately given the data uncertainty of some of the asset classes, the completion of all data into one data set is not appropriate. Therefore, the age of each asset class is discussed in more detail within the specific sub-sections in Section 8.

7.2.5 Asset Data Improvements

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

- Clarify asset ownership for pipelines between roading, parks and land drainage portfolio's.
- Update monitoring & hydrometric asset data to incorporate all existing assets and required attribute data
- Obtain data from NIWA via Water Outlook if the assets are owned by them.
- Add accurate data for existing stop banks to asset systems.
- Develop a method for updating condition data of waterway linings following repair/renewal works.
- Develop and implement pumping station renewal programme/prioritisation methodology using a risk-based approach.
- Implement regular and planned inspection and condition assessment programme for stop banks and report this to support the relevant performance measure.
- Implement treatment and storage facility condition/performance monitoring programme.

7.3 Asset and Network Planning

7.3.1 Asset planning strategies

In late 2019 the Te Wai Ora o Tane - Integrated Water Strategy[15] document was approved by Council. This strategy document provides Councils 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.

The Christchurch Drainage Board developed catchment plans to assess and manage surface run-off from individual catchments. Due to the historically lower areas of impervious areas per lot and conservative run-off rates, the constructed infrastructure had inherent redundancy meaning on-going network planning was not considered. However, due to recent and more intensive development, this redundancy has become eroded without future planning considerations.

The "modern" methods for network planning involve a catchment capacity model of the drainage network. A capacity model that covers interactions between multiple catchments and the main water bodies has not been undertaken until recently due to the unavailability of suitable technology. The City Wide Model (CWM) is currently being developed, due for completion in 2021. This tool will allow for the identification of the network capacity deficiencies to inform future upgrades, rather than programming works reactively as is currently done. Some planning works have been set in this LTP using the partially completed models.

Water quality planning, in the form of Stormwater Management Plans, has occurred to meet the requirements of the Resource Management Act, Local Government Act, and Regional Council plans such as the Land & Water Regional Plan. Council developed the Surface Water Strategy which defined water quality goals and how to meet them through the implantation of Integrated Catchment Management Plans – or Stormwater Management Plans (SMP). There are 7 management plans, which are required under the Comprehensive Stormwater Network Discharge Consent (CSNDC) issued by ECan which authorises the discharge of stormwater onto or into the land or surface water, and the acceptable contaminate limits. Network planning would also benefit by the construction of a contaminant load modelling tool that would better assess the treatment potential of our devices, and predict the water quality outcomes.

The SMP's are the planning tool that details what infrastructure is required to meet the water quality treatment for a specific catchment in order to meet the demands of growth. Projects to create new assets are prioritised according to the programmes delivering Area Plans, the Urban Development Strategy and the Land Use Recovery Programme. It is these plans, programmes and strategies which drive the development of the asset creation plan.

New assets fall under the following categories; New Services, Improved Level of Service, Growth based Projects and Backlog projects and can be either council funded (funded and constructed by CCC) or developer funded (funded by developers as part of subdivisions or developer contributions).

Due to a historical lack of planning tools (i.e. capacity model) Capital works for growth have been prioritised on a reactive basis rather than a structured plan, and they are often driven by private development, making annual year spends difficult to predict.

Table 7-1 – Asset Planning Strategies

Plan, Strategy, Model	Content	Next review
Te Wai Ora o Tane - Integrated Water Strategy (2019)	Provides the framework for the future management of water resources, services and associated infrastructure.	First review in FY 2023/24, then on a 6-yearly cycle
Stormwater Management Plans	Details the infrastructure required in each catchment to meet the consented water quality and quantity outcomes.	Many are still in development – approx. delivery or review dates: Opawaho/Heathcote River Area – June 2021

[15] "Te Wai Ora o Tane - Integrated Water Strategy Adopted by Council 26 September 2019" trim://19/1465878

		Huritini/Halswell River Area (Review) – June 2021 Estuary and Coastal Area – December 2021 Otukaikino/Outer Area– June 2022 Otakaro/Avon River Areas– December 2022 Te Pataka o Rakaihautu/Banks Peninsula Settlements – December 2022 Puharakekenui/Styx River Area (Review) – June 2023
City Wide Capacity Model	Capacity network model for the city divided into the major catchments as defined by the main rivers. Will be used to allow robust network planning decisions to be made.	Still in development – comprises 5 catchment models, with the Huritini/Halswell and Puharakekenui/Styx currently incomplete but scheduled for completion before 2026
Waterways, Wetlands and Drainage Guidelines	Design stands specific to Land Drainage that encompasses Councils 6-values approach to managing stormwater run-off.	On an "as is required" basis as determined by industry changes
Infrastructure Design Standard	Design standards for all Council assets	On an "as is required" basis as determined by industry changes
CSS	Construction standards for all Council assets	Generally updated annually depending on the number of submissions made to the CSS committee

(Note - the above table only includes CCC documents, not Central Government or Regional Council strategy policies or documents.)

7.3.2 Asset Planning Improvements

The following improvements to asset planning processes are included in Table 10-2: Asset Management Improvement Tasks in Section 10.

- Place more emphasis on the use of Low Impact Urban Design & Development (LIUDD) in the planning process. Empower Council Planners to become responsible and accountable for promoting the use of LIUDD.
- Complete and ensure sufficient annual funding is provided to maintain the City Wide Capacity Model.
- Invest in a City Wide Load Contaminant model.
- 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).

Asset creation is also based on a need or gap where levels of service will be unable to meet future demand, or as identified by a risk assessment. Areas identified by CCC as requiring capital works to solve a problem undergo different processes depending on the significance of the problem. Projects are selected from a range of options with the intention of optimising the four community well-beings; social, economic, environmental and cultural.

Until 2013, the largest proportion of expenditure was for new Waterways & Wetland Protection and since 2013 this has been renamed Stormwater Drainage. The intention of W&W Protection was to purchase (protect) land for stormwater mitigation projects. Thus the projects in both profit centres included development of stormwater detention and treatment facilities and land purchases. The Utilities profit centre includes the construction of new utility infrastructure such as culverts, sumps and pipes.

The Asset Creation and Improvement Plan is further discussed in Section 8.2 – "*Management Plan – Asset Creation and Improvement Planning"* including future costing scenario predictions.

7.4.2 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.

Council has a robust set of design and construction documents that are required to be used for all new assets. New developments will be bound by council consents to ensure compliance with any SMP and regional council consenting requirements.

7.4.3 Management of Vested Assets

Property vesting is handled through Councils internal property consultancy team, but infrastructure assets must be approved as compliant to Council requirements by the business unit which is accepting them for operational purposes. Vesting agreements should 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 the quality of construction is demonstrated through the provision of the required quality assurance records and compliance with Contract and/or Consent documents the hand over will be accepted.

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.

7.4.4 Asset Creation and Upgrade Improvements

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

- 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

Operation and maintenance costs associated with stormwater and waterway assets are considered to be associated with waterways, utilities or flood protection and are not further split between the asset groups. Therefore, operations and maintenance must be discussed as a whole for the asset portfolio.

There are three contracts for the maintenance and operation of the assets:

Table 7-2 – Maintenance and Operational Contracts

Contract Number and Title	Provider	Brief Details
CN4600000778 - Maintenance of City Water & Water Network	City Care Limited	City Care Water manages, operates and maintains stormwater pumping stations and mechanical and electrical assets including the Woolston Barrage. The Land Drainage Operations team funds this component of the contract but are not involved in its management.
CN4600001152 - Service Agreement for maintenance of hydrometric equipment	National Institute of Water and Atmospheric Research Limited (NIWA)	Contract with NIWA for the maintenance of hydrometric equipment needed for flow monitoring of waterways and rain gauges.
CN4600001064 – Land Drainage Maintenance Contract	City Care Limited	City Care Water maintains the stormwater and land drainage assets. This contract is managed by the Land Drainage Operations team. The contract is split into two parts; programmed maintenance and scheduled work, and reactive and unscheduled work.

The current annual maintenance programme is a streamlined version of what has occurred historically. The programme has been rationalised to be needs-based rather than routine based, while still providing for the required levels of service but with a more cost effective approach. The programme is flexible enough to allow for changes in the frequency of maintenance tasks, for example additional weed harvesting following a rapid growth season. Additional tasks are then accounted for through the reactive maintenance budget.

Refer to Table 7-3 for an overview of programmed maintenance tasks.

Table 7-3 - Programmed Maintenance Tasks

Maintenance Type	Description	Frequency
Waterway	Bank vegetation cuts	2-4 per year
	Rubbish clearance – banks, channel, structures	1-2 per week to 'as required' (depending on location)
	Aquatic weed harvesting	2 or 3 per year
	Root cutting	as required
Tributary & Utility Waterways	Riparian vegetation & rubbish control	2-3 per year
	Aquatic weed control	2-3 per year
	Lined invert sweeping	2-3 per year
	Root cutting	as required
Detention & Treatment Facilities	Weed & plant removal	Work here varies on location and availability of public access. Some of this work is carried out by Parks – under their maintenance contract
	Rubbish/debris/silt clearance of grates, inlet/outlet points	
	Basin grass cutting	
	Inspection of ponds & margins	
	Aquatic vegetation removal	
Grills, Grates & Energy Dissipaters	Rubbish/debris removal and/or control	Varies according to location & critically. Can be as much as twice weekly to four times a year. In addition to this there critical grates which are inspected during every significant rain event
	Silt removal	
	inspection	
Reticulation	Primary pipe inspection & cleaning	1 per year
	Sump to waterway connection inspection & cleaning	1 per year

Maintenance Type	Description	Frequency
	Sea outfall inspection & clearance	2 per year
	Sumps, soak pits, soakage chambers cleaning	Depends on location, 1 per week or 1 per year
	Manhole inspections & clearance	34 specific sites, 2 per year
	Backflow control valves & gates inspection & clearance	Depending on location either 1 per week, or 4 per year

Maintenance of publicly accessible/amenity stormwater detention and treatment facilities is carried out under the Parks Maintenance Contract. The maintenance involves tending to the plantings and mowing the turf which forms a park asset. The Parks contract is best placed to continue with this maintenance and no changes are proposed for the delivery of this activity.

In addition to the programmed maintenance items, approximately $2.2 million is spent on reactive maintenance. This work is carried out either following an inspection by operational staff or the contractor, or following a complaint. The decision to carry out reactive maintenance is made by operational staff, using their knowledge and experience of the asset. This level of reactive maintenance is necessary to respond to storm events as these require cleaning of the network prior to and following an event and may also lead to a requirement for repair works.

Reactive maintenance includes all of the tasks listed in Table 7-3 above with the addition of;

- Bank repairs and stabilisation
- Tree pruning and felling
- Dredging and invert regrading
- Any other work as instructed by the Operations team
- Investigations including CCTV inspections
- Clearance of blockages
- Repairs and replacements
- Response to flooding events

Repair work has an additional budget of around $2.5m and is prioritised taking in to consideration the condition and criticality of the asset. Currently there is a backlog of timber lined drain repairs.

The maintenance contract and programme has been developed in order for Council and its contractors to meet the agreed Levels of Service as set in the Service Plans (previously called Activity Management Plans). Currently, all levels of service related to maintenance activities are being met.

In order to keep the condition data for assets up to date, it is planned to include a visual inspection of all assets as part of the maintenance contract so that each asset class will be assessed as part of a rolling programme over e.g. 5-10 years. Due to some existing deficiencies, an Improvement Item is required to ensure that the collected data is able to be input into Councils data systems, this is included within Table 10-2 in Section 10.4.

The operations team decide what can and can't be undertaken in order to work within the budget allocated, whether the works are programmed or reactive. It is included in the Improvement Plan for this AMP that maintenance strategies should be developed so that longer term impacts can be identified and better understood and so that mitigation measures can be put in place. The success of any maintenance strategy relies on ensuring that sufficient funding is provided to maintain the assets at a level that prevents increased degradation and early renewal. Any reduction in the OPEX funding requested in this document will likely result in under performance of the asset systems.

7.5.2 Operations and Maintenance Improvements

The following improvements to operations and maintenance processes are included in the AM Improvement Plan in Section 10.4.

- Record maintenance requirements against each asset in SAP
- Develop maintenance strategies so that longer term impacts can be identified and mitigation measures put in place

- Develop and implement a system for ensuring that the future OPEX costs associated with new and upgraded assets are identified at the design stage and that this information is used to inform future OPEX budget
- Ensure all key data from existing and future O&M manuals is integrated in to the asset systems/contracts and is easily accessible

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 land drainage pipes to date include:

    - Condition
    - Deterioration
    - Consequences of failure

    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

3. Risk – the risk of failure of the asset and the associated financial, environmental and social impact justifies action.

4. 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.

5. Political and Community Feedback – Any feedback received from political or community sources that influence or change decision making.

7.6.2 Renewal Process Improvements

The following improvements to asset renewal processes are included in the AM Improvement Plan in Section 10.4.

- Continue to improve upon the renewal assessment tools for the prioritisation of renewal candidates.
- Expand the AAIF project to include waterway and waterway lining assessments for the prioritisation of renewal candidates.

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.

In the event that the requirement for an asset disposal is required e.g. existing asset conflicts with new assets proposed as part of a subdivision, a catchment check will be carried out to ensure that there are no negative effects associated with the proposed disposal. If this check confirms that the asset can be disposed of, then this is to be carried out as per the Disposal Policy[16].

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

8 Lifecycle Management Plans

8.1 Asset Renewal Planning - Lifecycle Management Plan

8.1.1 Reticulation

Storm water reticulation consists of mains, accesses, inlets, outputs, headwalls, valves and fittings. Due to the specific health and safety requirements grills are excluded and managed separately. Asset management effort typically focusses on the mains as they form the greatest proportion of reticulation network value. Renewal of auxiliary assets such as valves, manholes, pipe protection, etc. takes place as part of a main renewal. Manholes and inlets (sumps) are a slight exception where reactive renewal occurs where required as well as normal renewal as part of a mains renewal. Reactive renewal is required where assets fail, typically due to external damage.

The Asset Assessment Intervention Framework (AAIF) mentioned in Section 7.6.1 is underway to improve 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.

8.1.1.1 *Reticulation Age and Condition*

Storm water reticulation condition grades use the 1 to 5 scale as described in Section 7.6.1. CCTV inspection results are the primary source of storm water reticulation condition data with valid and complete inspections providing a measured condition grade for 60.2% of mains. The remaining 39.8% of mains have an estimated condition grade based on the installation year and a theoretical useful life. Where a large amount of data exists for a particular pipe material a statistical analysis provides an evidence based theoretical useful life for that pipe material. Pipe materials lacking this data use a theoretical useful live based on international documentation and staff knowledge of how pipes in the Council networks are actually deteriorating. Review of the theoretical useful lives and modification to reflect recent trends in failures occurs as part of each LTP. The overall condition profile of the Council storm water reticulation network is shown in Figure 8-1 below. We note that Figure 8-1 indicates a significantly improved condition profile over the network compared to previous AMPs, this is a result of the new condition grading process developed as part of the AAIF project.

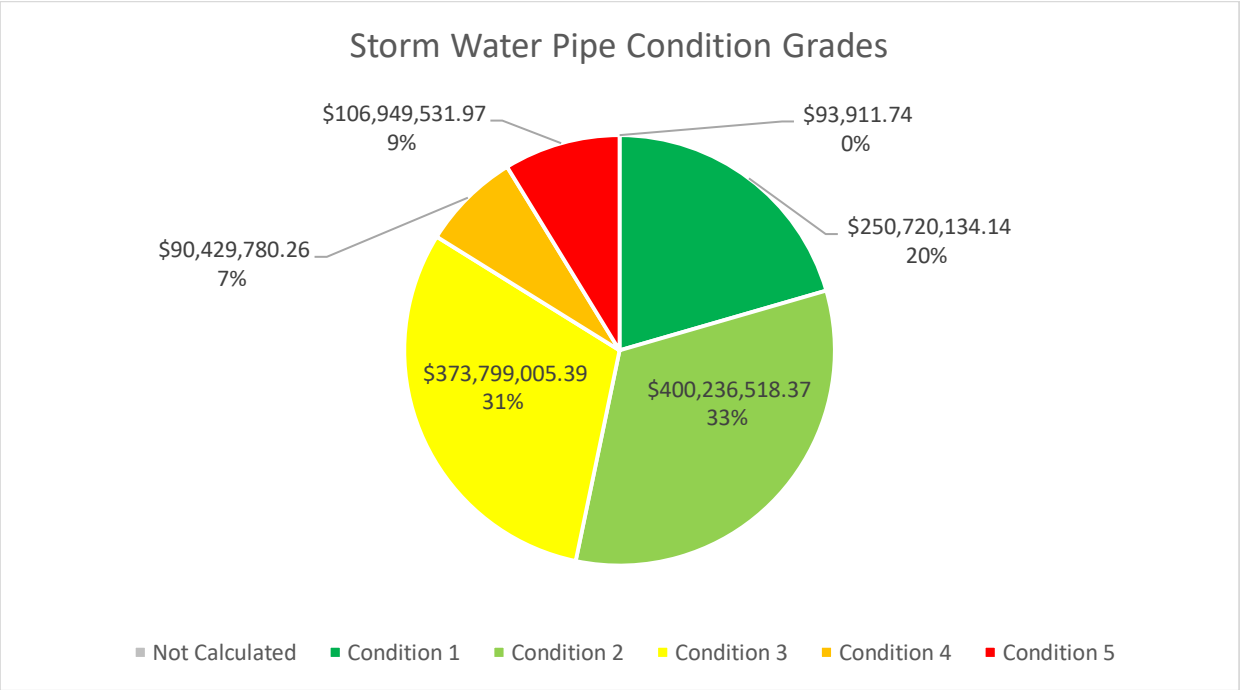


Figure 8-1 – Pipe Condition Based on Value

CCTV inspections currently target expensive pipes. Based on the proportion of length only 36.9% of the length of the storm water network has been inspected; however, when assessing by value the proportion increases to 60.2% indicating that inspections have been targeted at the large, deep or otherwise expensive pipes. Breaking down the proportion of network inspected by condition grades, measured condition 5 pipes are only 41.4% by value while it increases to 70.0%, 75.9%, 37.9% and 77.1% for condition grades 4, 3, 2 and 1 respectively. This indicates CCTV inspections are not providing evidence based data for renewal requirements.

Figure 8-2 shows the development of the Council storm water reticulation network. Pipes installed prior to 1950 are concrete, earthenware or constructed pipes using bricks or rock. The majority of pipes installed since 1950 are reinforced concrete with rubber ring joints (RCRR). Based on the age profile pipes approaching end of life are the brick and rock culverts and earthenware pipes, confirmed in the breakdown of condition grade 5 pipes shown in Figure 8-3. Earthenware, concrete, RCRR and constructed pipes are all susceptible to brittle failure, especially if exposed to ground movement, therefore remaining earthquake damage is also apparent in this figure by the proportion of RCRR pipes.

The proportion of brick and rock barrel pipes approaching end of life is a concern. These pipes are typically larger diameter and higher criticality but also more difficult to repair than newer pipes; therefore, the need to renew prior to failure is higher.

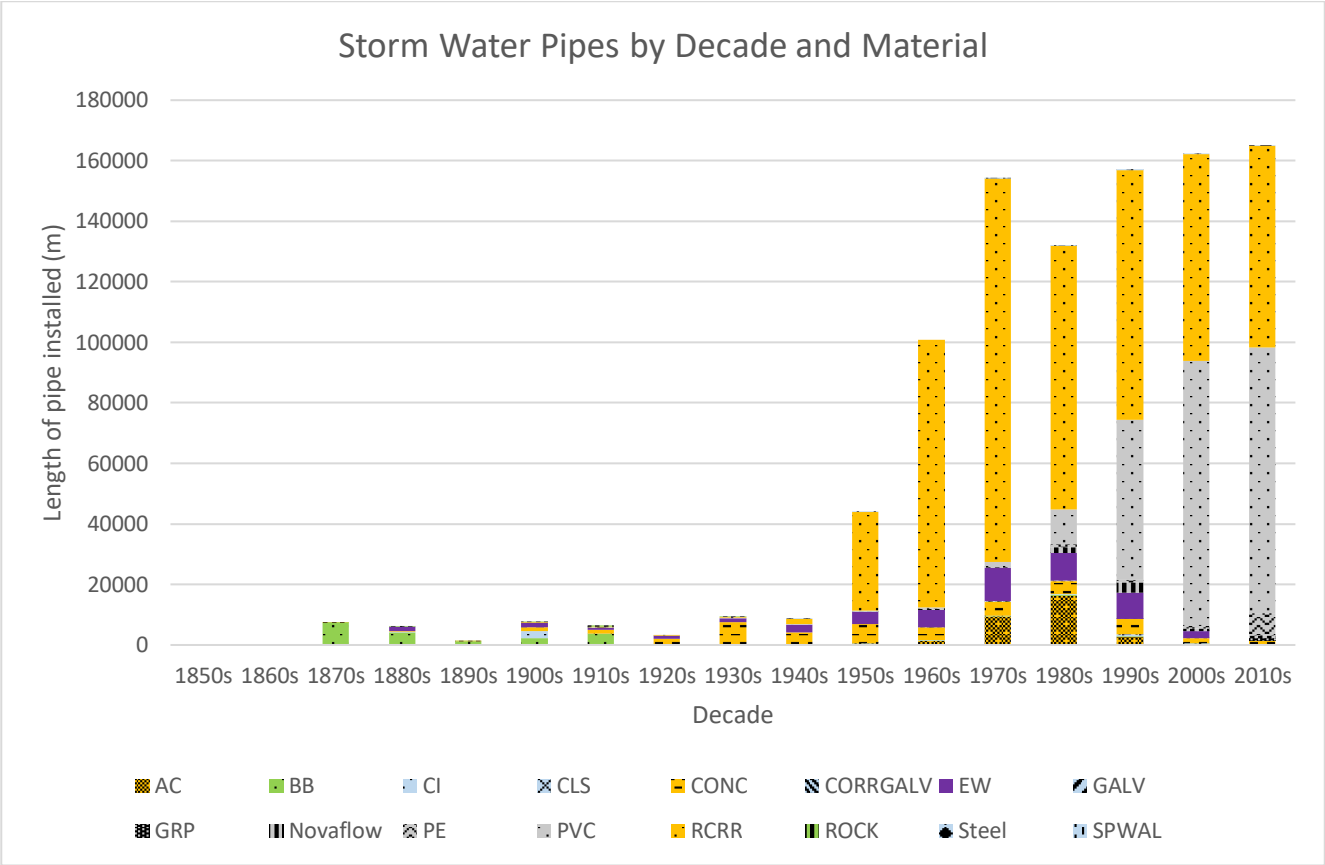


Figure 8-2 – Reticulation Development (including materials used)

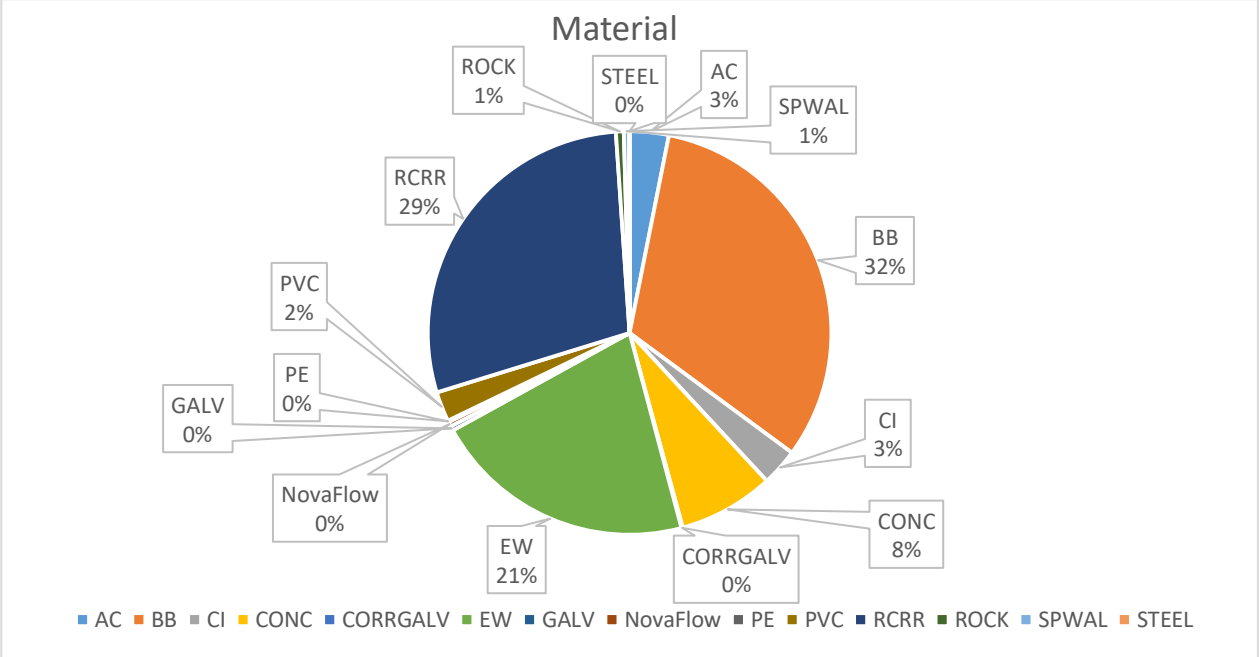


Figure 8-3 – Grade 5 Pipelines by Pipe Material

The distribution of the different condition grades is shown in figures 8-4 and 8-5 below.

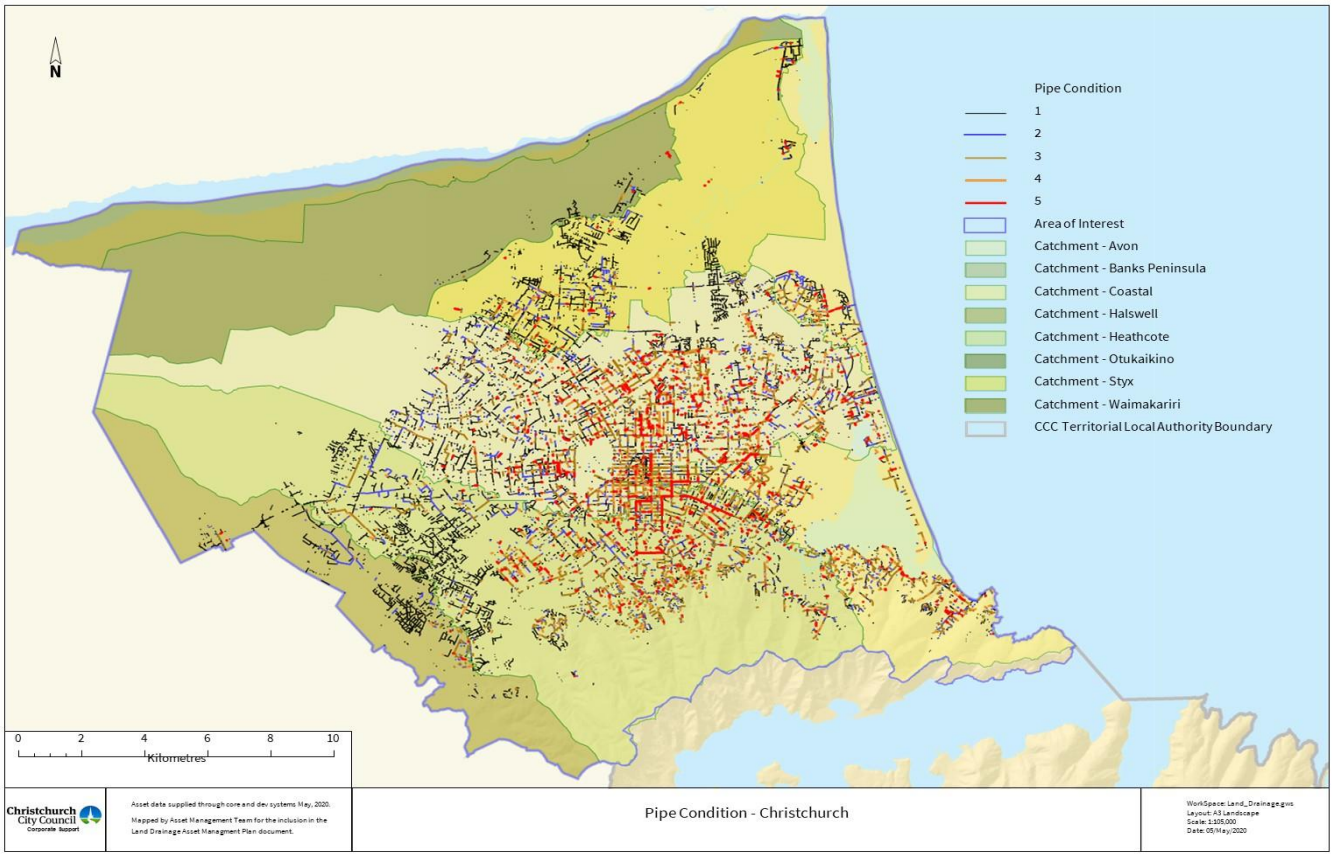


Figure 8-4 – Condition of Pipelines by Grade – Christchurch City

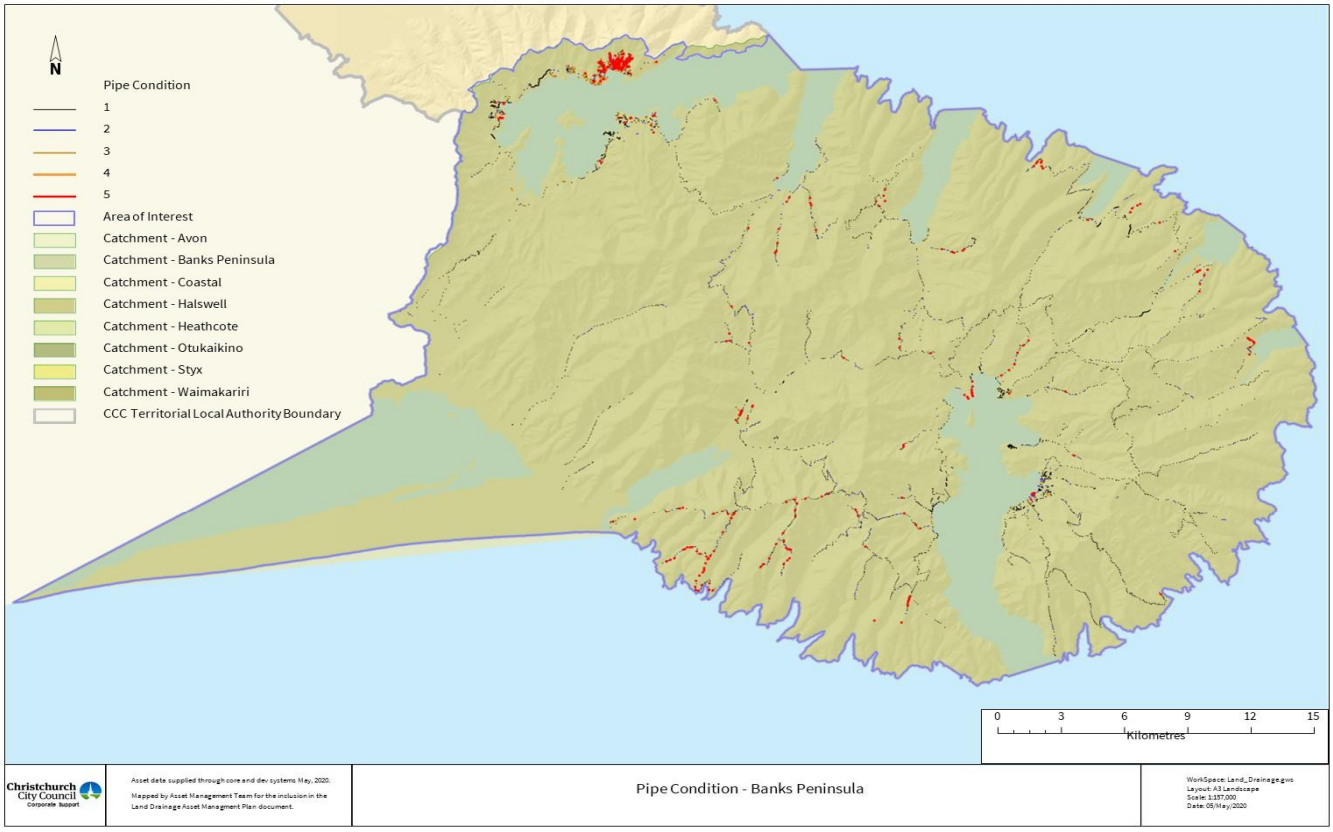


Figure 8-5 – Condition of Pipelines by Grade – Banks Peninsula

8.1.1.2 *Reticulation Repairs, Maintenance and Operation*

Where the condition grade is an assessment of the structural strength of a pipe, the repairs, maintenance and operation (RMO) grade gives an assessment of the ability of a pipe to provide the service of collecting storm water. In other words, the storm water reticulation RMO grade would be a measure of the level of maintenance intervention required to keep a pipe operating. However, the current maintenance contract does not provide for allocating maintenance actions to specific pipes and making the RMO grade impossible to calculate.

The new three waters maintenance contract will remediate this omission by requiring the maintenance reporting as currently required under the water supply and wastewater maintenance contract.

8.1.1.3 *Reticulation Degradation Rate*

The degradation parameter is a 1-3 score for identifying pipes likely to deteriorate faster or slower than average. Although in the water supply and wastewater networks degradation is a 1-5 score, lack of data and inapplicability of parameters limits the storm water degradation score to 1-3.

Exposure to trees and tree roots and the susceptibility of the pipe material to tree root damage determines the degradation score. Other networks apply pressure spikes, hydrogen sulphide exposure and groundwater exposure; however, pressure spikes and hydrogen sulphide do not occur in the storm water network and lack of invert data prevents assessment of groundwater exposure. Planned import of SCIRT import data will allow degradation assessment by two parameters expanding the score range.

Figure 8-5 shows the breakdown of degradation grades in the storm water reticulation network by value.

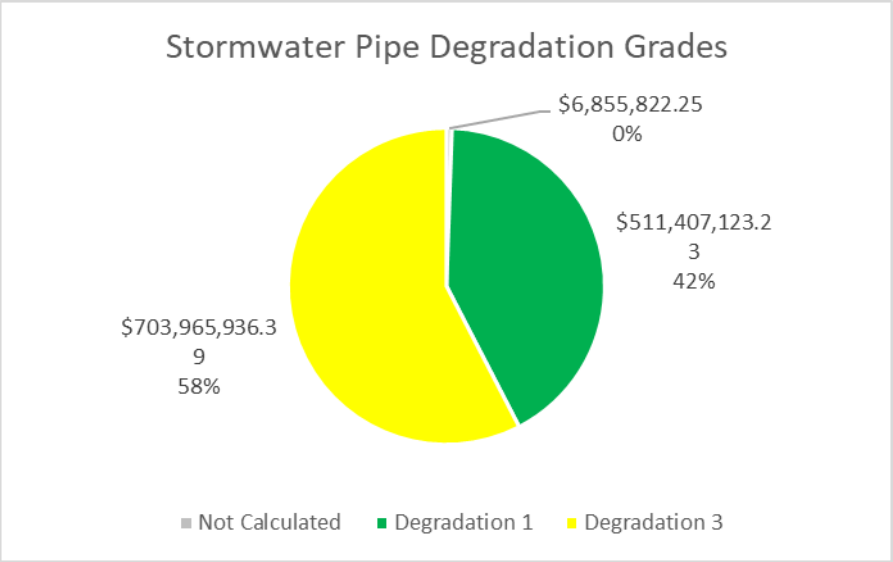


Figure 8-6 – Degradation of Pipelines by Value

Degradation grades adjust theoretical useful lives therefore also adjusting the estimated condition and prioritising renewal of different pipes with a condition grade.

8.1.1.4 *Reticulation Consequences of Failure*

Consequence of failure (CoF) grades for storm water reticulation depend on scores in each of eight parameters:

1. Criticality CoF – The number of people and importance of individual facilities that would lose service following a failure.
2. Infrastructure CoF – The likelihood a failure will result in damage to other infrastructure and importance or criticality of the other infrastructure damaged.
3. Legislative CoF – The likelihood a failure will result in Council failing to meet our legal requirements including resource consent conditions.

4. Financial CoF – Anticipated direct costs of repairing a failure.
5. Reputational CoF – The likelihood a failure will result in significant negative publicity to Council.
6. Environmental CoF – The likelihood a failure will result in damage to sites of natural, cultural or heritage environment.
7. Health & Safety CoF – The likelihood a failure will create public hazards.
8. Service Delivery CoF – A measure of the number of repeat failures affecting the same group of people should this pipe fail.

In assessing these parameters loss of service means that stormwater would flood on the property, or stormwater would pond on roads preventing access to the property.

A specific and unforeseen consequence of failure in the storm water network comes about from pipe ages. Some pipes are now so old that they are historic places of archaeological significance. This has a legislative and heritage environment with permission required from the Historic Places Trust before any work on the pipes is possible. Pipes falling into this category are typically the larger brick and rock constructed pipes. Many of these pipes are also under buildings on private property increasing the financial and health and safety consequences of failure.

A weighting is applied to each of the eight parameters based on Council strategic priorities. The overall CoF grade is the maximum of the weighted average and the score of any individual parameter given a 100% weighting.

Figure 8-7 and Figures 8-8 & 8-9 show the consequence of failure profile by length for storm water reticulation and maps showing consequence of failure across the network.

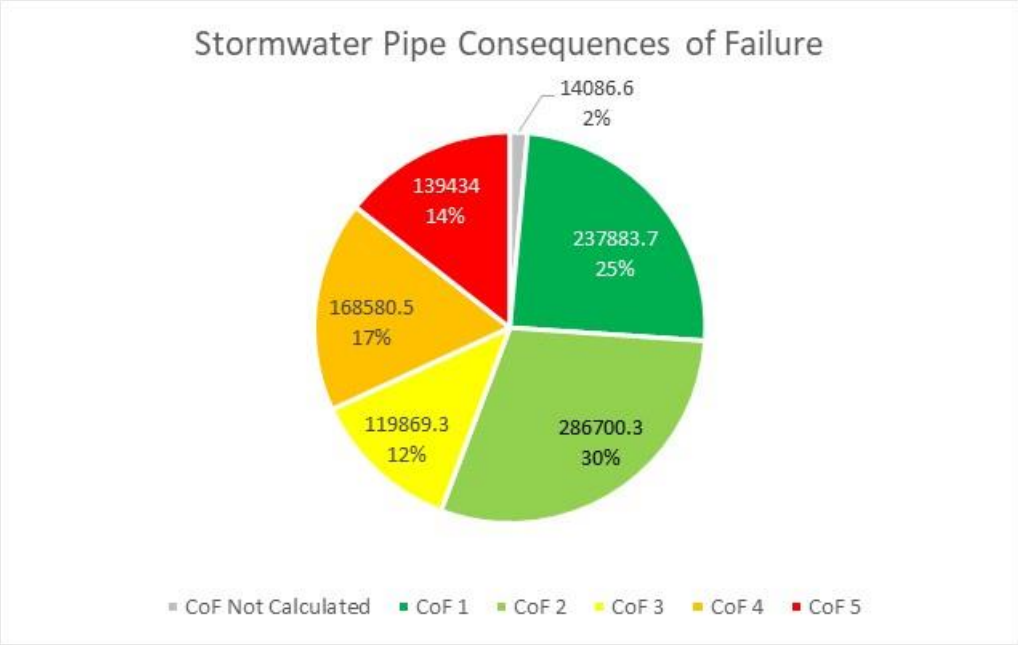


Figure 8-7 – Consequence of Failure Grades by Length

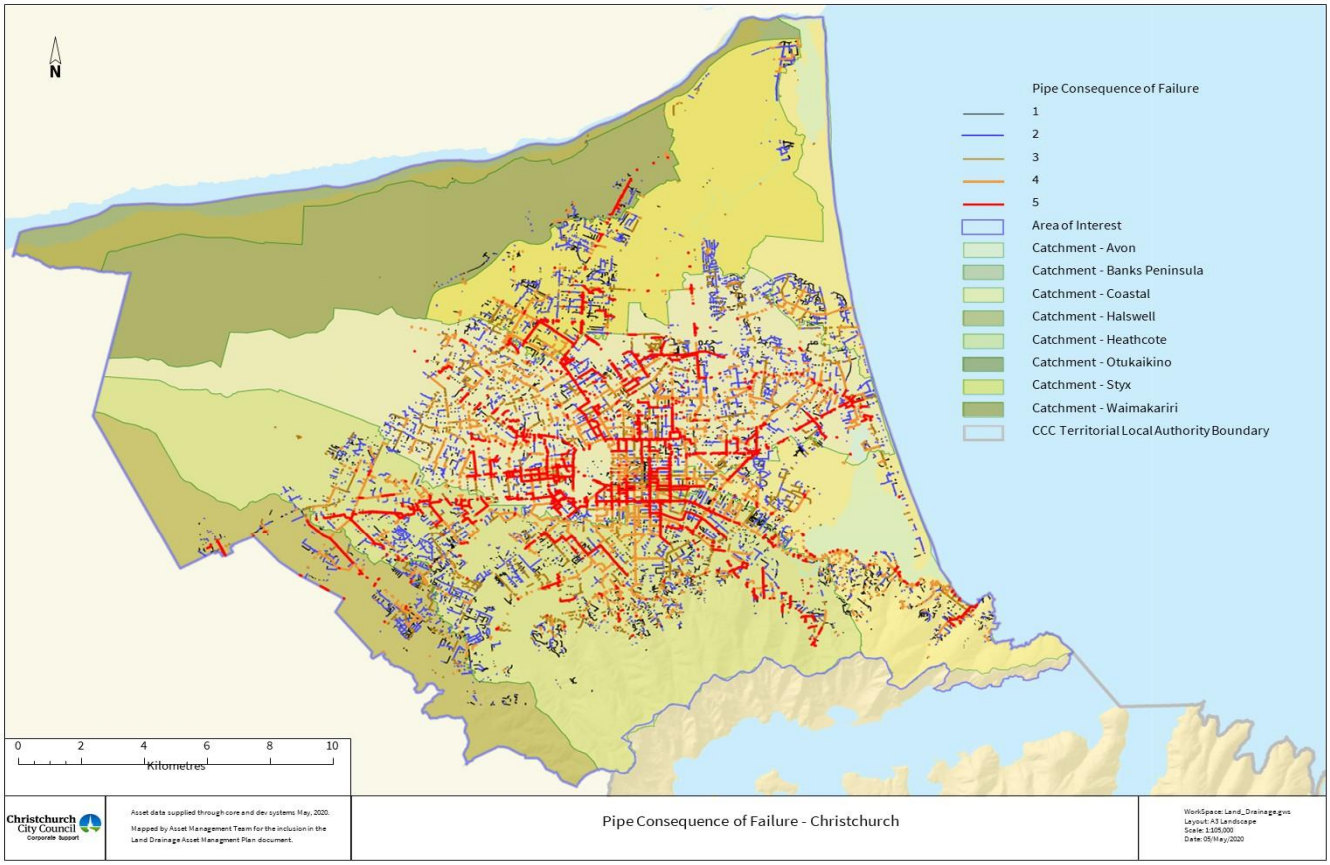


Figure 8-8 – Consequence of Failure Map for Christchurch City

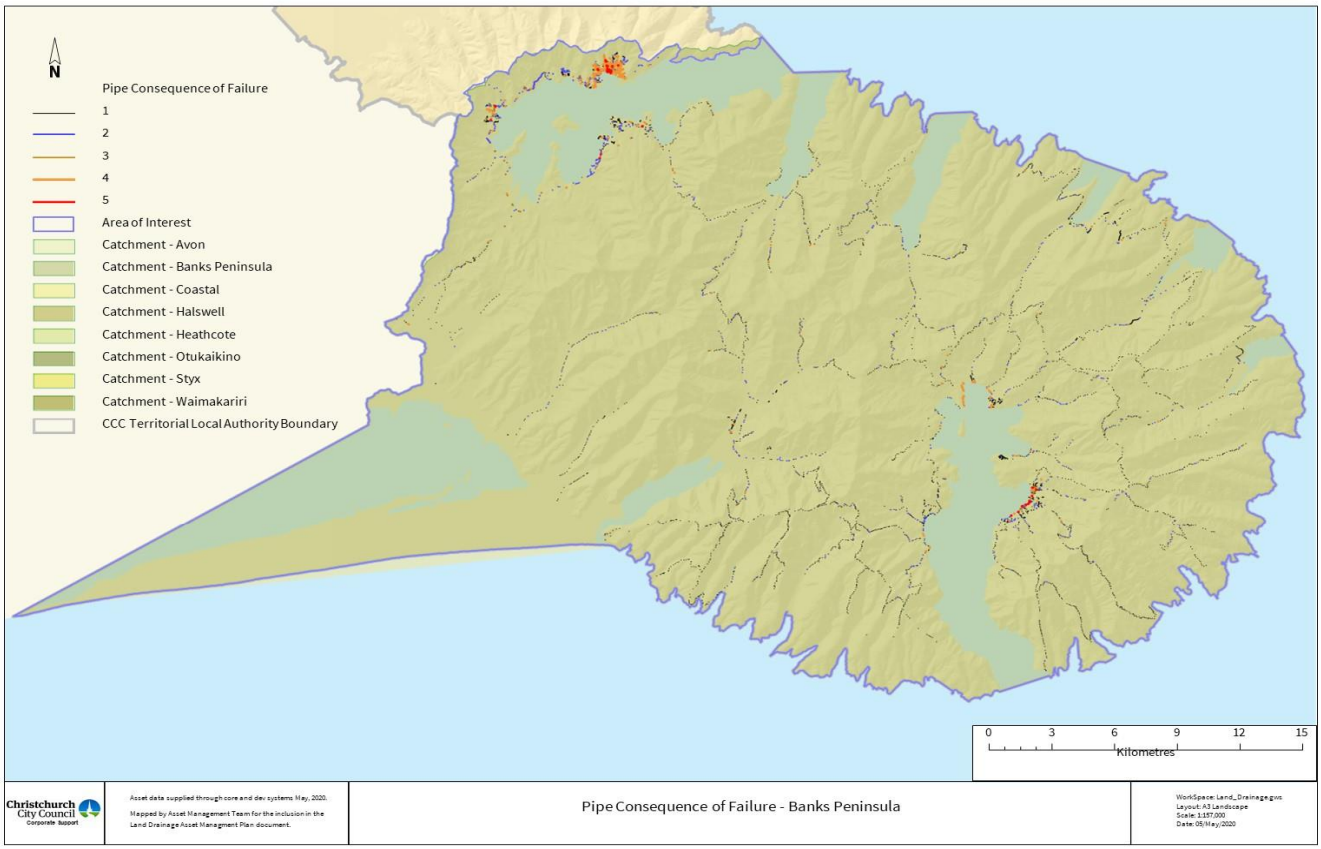


Figure 8-9 – Consequence of Failure Map for Banks Peninsula

8.1.1.5 *Grills*

There are an estimated 333 debris and security grills and of these approximately 100 were visually inspected through the LDRP 98 project and assigned a 1 to 5 condition grade in accordance with the Open Channels Condition Assessment Specification[17] and these are shown in Figure 8-10. Although these condition assessments have been carried out there is no stand-alone renewal plan for grills and the need for grill renewal is assessed at time of pipe renewal or carried out reactively.

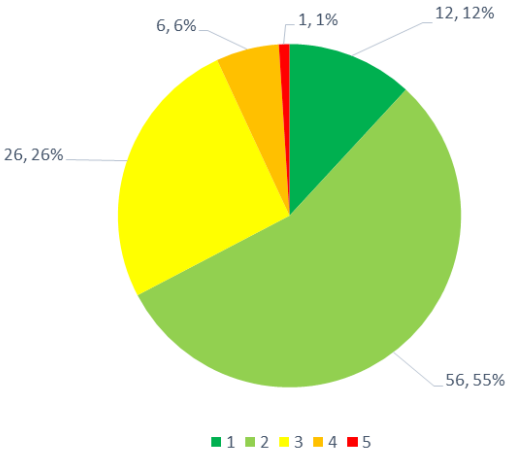


Figure 8-10: Debris & security grill condition grades (refer to TRIM://18/661552 'Pivot for AMP' tab for source data)

8.1.1.6 *Required Renewals*

Applying the AAIF process to the storm water mains results in the renewals profile in Figure 8-11. This figure shows the renewals that are required to maintain the current network condition and retain the current level of service, especially in relation to blockage rates and response times. This profile shows a backlog of overdue renewals where $68.8 million or 45% are CoF 5.

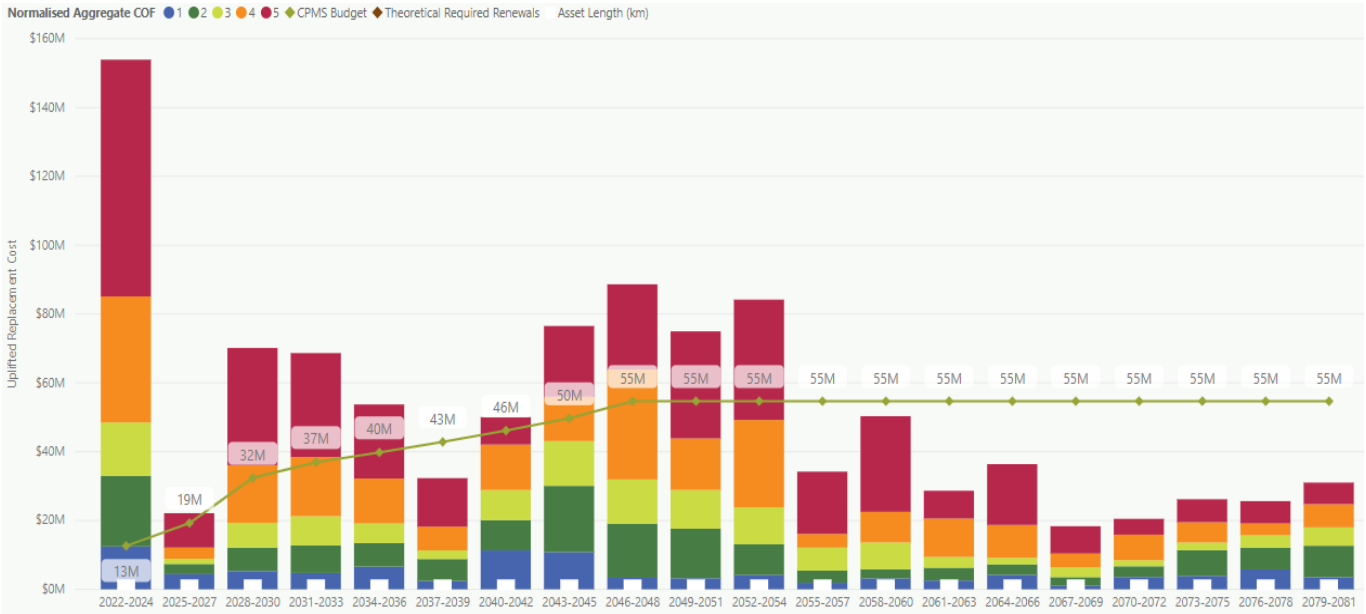


Figure 8-11 – Renewals Forecast for Pipeline Renewals – Including Backlog

[17] Open Channels Condition Assessment Specification Rev 8 TRIM://15/724077

Renewals profiles such as that shown in Figure 8-11 and later in this section show the sum total required capital expenditure in each three year LTP period as a single column. The colours of each individual column show a breakdown of the CoF scores of individual pipes. The green line shows current budgets from the 2018 LTP.

Renewal year calculations in Figure 8-11 use the condition and degradation scores. Estimated condition scores based on age and theoretical asset life are an average and some pipes will fail early while others will survive longer than predicted. The AAIF process allows for these differences from an average using the RMO scores; however, as storm water lacks data to calculate RMO scores a more accurate renewals profile cannot be calculated.

8.1.1.7 *Funding Profile Plan*

Required renewals shown in Figure 8-11 assumes a run-to-failure approach. Under the run-to-failure approach, all pipes will suffer breaks and cause service disruptions, exposing Council to an unacceptable level of risk. The original "Recommended Option" used to set the LTP budgets was based on an option that balanced an acceptable level of risk with deliverability (See Figure 8-12 below).

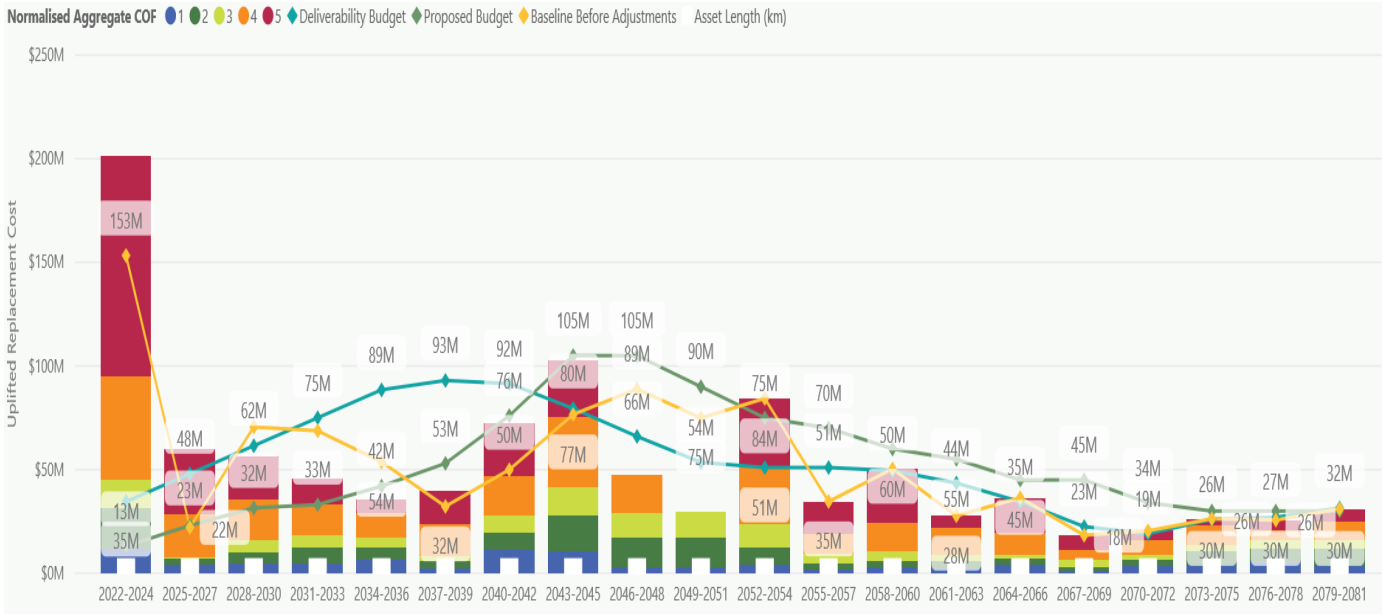


Figure 8-12: Storm Water Main Renewals – Original Recommended Option

As discussed in previous sections, the available funding has been limited due to the acute and on-going effects of Covid-19 and to limit rates increases. Although the main constraints were applied to the years 1-10 of the LTP, further caps were also applied to years 11-30. The final proposed budget profile is shown below in Figure 8-13.

With a reduction in CAPEX investment comes a predicted increase in OPEX expenditure and maintenance to keep the asset base operating as some pipes exceed their useful life and suffer more frequent repair. This additional OPEX cost as compared to the current cost to operate the assets is shown Figure 8-14 below.

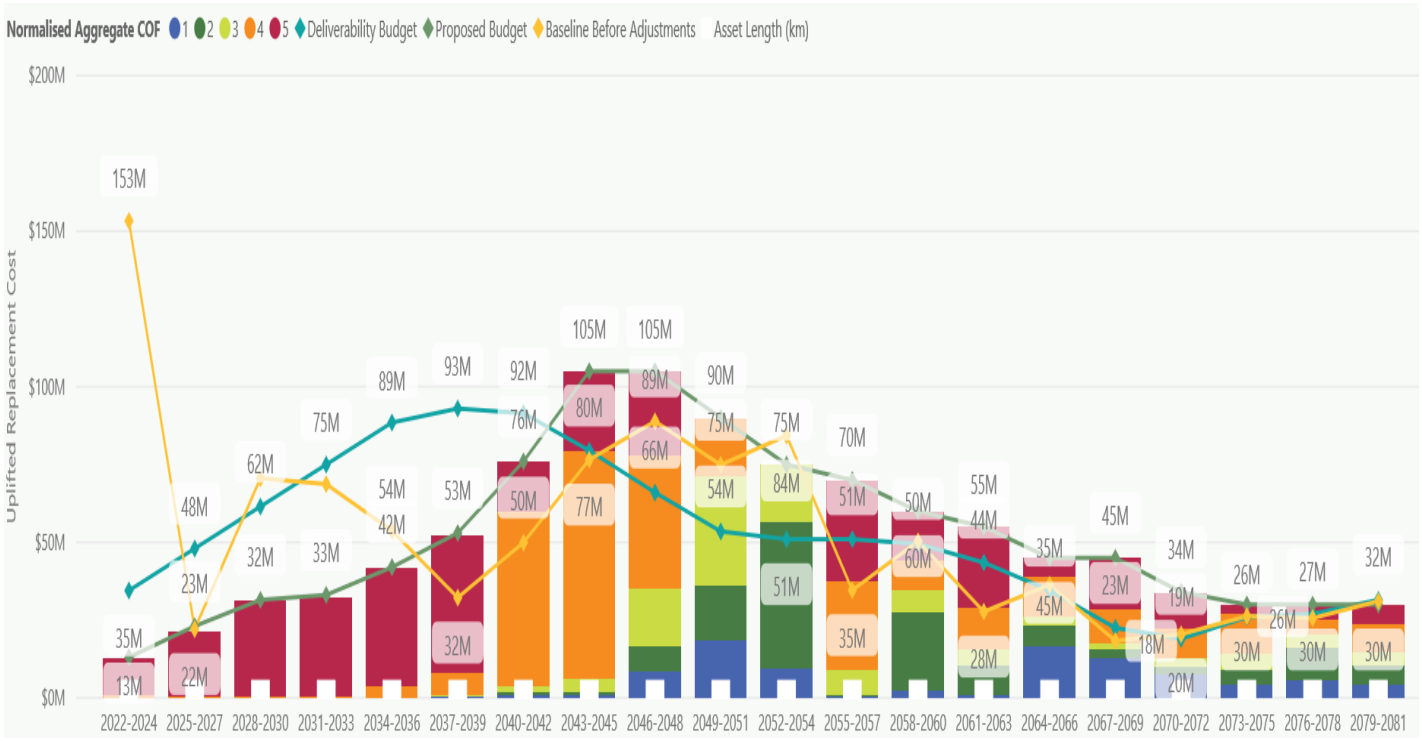


Figure 8-13: Storm Water Main Renewals – Recommended Option with Funding Available

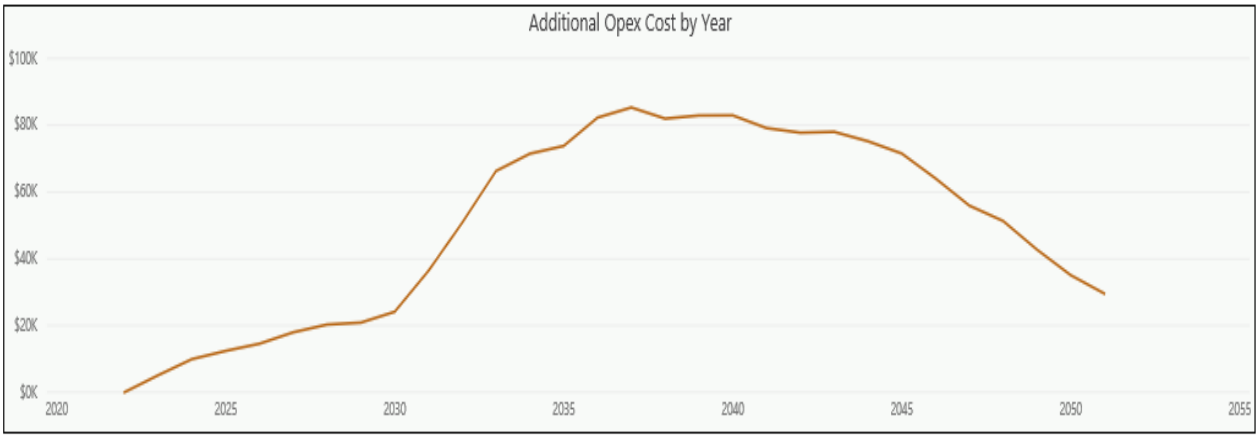


Figure 8-14: Additional Annual OPEX Cost Projection

8.1.1.8 *Renewal scheduling by year for first three years*

Renewal scheduling by year continuously maintains a three-year rolling renewal programme. The scheduling takes the budgets set within the LTP and annual plans and distributes funding to individual projects.

Renewals scheduling is a manual desktop exercise that includes:

- 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 storm water followed lastly by road reconstruction or resealing.
- Further prioritisation of renewals allowing for pipes where failure numbers have increased.

This is a manual and time-consuming process, which depends on budgets other Council units receive; therefore, scheduling is performed after LTP finalisation.

Table 8-1 - Summary of waterway lining renewal programme and major projects and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
324	SW Reticulation Renewals PRG	4.05	68.55	562.14
	Committed Projects			
37305	SW Lyttelton Brick Barrels Renewals Work Package	3.80	3.80	3.80
48551	SW Manchester St Drain DN750BB Renewal - Purchas St to Bealey Ave	0.00	0.55	0.55
49093	Corsair Bay SW pipeline renewal from Park Terrace inlet to coastal outfall	1.72	1.72	1.72
55065	SW Jacksons Creek Brick Barrel Renewal Brougham/Barrie Street - SwPipe ID 17624	1.34	1.34	1.34
55073	SW Tennyson Street Brick Barrel Renewal	0.07	0.07	0.07
56034	SW 4 Spencerville Road - Pipeline Realignment and general repairs	0.48	0.48	0.48
60183	SW Hempleman Drive Asset Improvements, Akaroa	0.96	1.06	1.06
60209	SW Stevensons Steep Network Renewals, Lyttelton	0.69	1.43	1.43

8.1.2 Waterway Lining Assets

Waterway lining is generally installed to stabilise banks and prevent erosion/scour. The asset types included in this group are covered by the Stormwater Drainage Activity and include the following;

- Bank & bed lining (timber, concrete, rock etc.)
- Retaining Walls (special lining type – see proposed definition below)
- Bank Stabilisation

There is limited asset data available for retaining walls and bank stabilisation as specific assets, but it is proposed that these assets be considered as types of lining. To differentiate retaining walls from non-structural lining, any effects of using the definition “retaining wall” must be considered along with any additional inspection or maintenance requirements. To improve the business over this LTP period, the definition of the retaining linings shall be resolved, allowing greater visibility over the asset base, and an improved valuation.

The data set held in CCC’s corporate information is compiled from data collected under the LDRP Open Waterway Condition Assessment project (LDRP98) and historic CCC information. Unfortunately, this data cannot be used directly for this AMP due to the following:

1. No differentiation in the data set between public or private linings, where private linings are generally for aesthetic purposes and not waterway protection.
2. No updates to lining type, installation or condition for any capital or operational repairs since the LDRP98 data was collected.
3. There is no difference in valuation or useful life between waterway linings or retaining walls.
4. Anecdotal discrepancies between the assessed condition grading collected and the condition advise from CCC Operations staff.

The basic waterway lining model used for the 2018 AMP has been reused for this AMP (minor updates exclude capital works where committed and update remaining age data) as it is the most appropriate tool currently available that applies

a multi-criteria assessment for renewal modelling. The only deficiency is that the model excludes any sub-reach data if the bank linings aren't the same on both banks. This is to attempt to exclude any private linings, however there are many locations where council has historically lined only one side of a water course. The data related to the ownership of the lining must be resolved to better forecast lining renewals in future AMP's.

There are several projects that the AMU team is currently working on to improve the quality of waterway lining data. This includes:

1. Assessing lining ownership (public or private) initially as a desk-top exercise followed by site inspections as required.
2. Carry out a coarse check on the condition grading comparing the collected data to the Operations Staff knowledge, which may prompt further condition assessments.
3. Create a process to capture new and repaired lining information to update the data set to keep the condition ratings current.
4. Assessing alternative methods for carrying out assessments and collecting site data such as drone or "go-pro" camera footage.

Projects 1-3 are currently funded from the 3-waters Asset Management Team OPEX budget, however the funding for project number 4, along with other projects required to address deficiencies with managing corporate data, is not guaranteed, with the Improvement Item OPEX funding requested (see Section 10 for further detail) not being approved. These projects are required to better inform future AMP's, and it is anticipated that projects 1-3 will do this.

Figure 8-16 shows the total length of each lining type; the most common lining type is timber with top struts (approximately 38km).

Figure 8-17 shows the length of each lining type installed in each decade and shows that concrete was predominantly used from the 1930's to 1960's, timber was predominantly in the 1970's and 1980's and since around 1990, there has been a move towards using more rock along with continued use of timber and concrete.

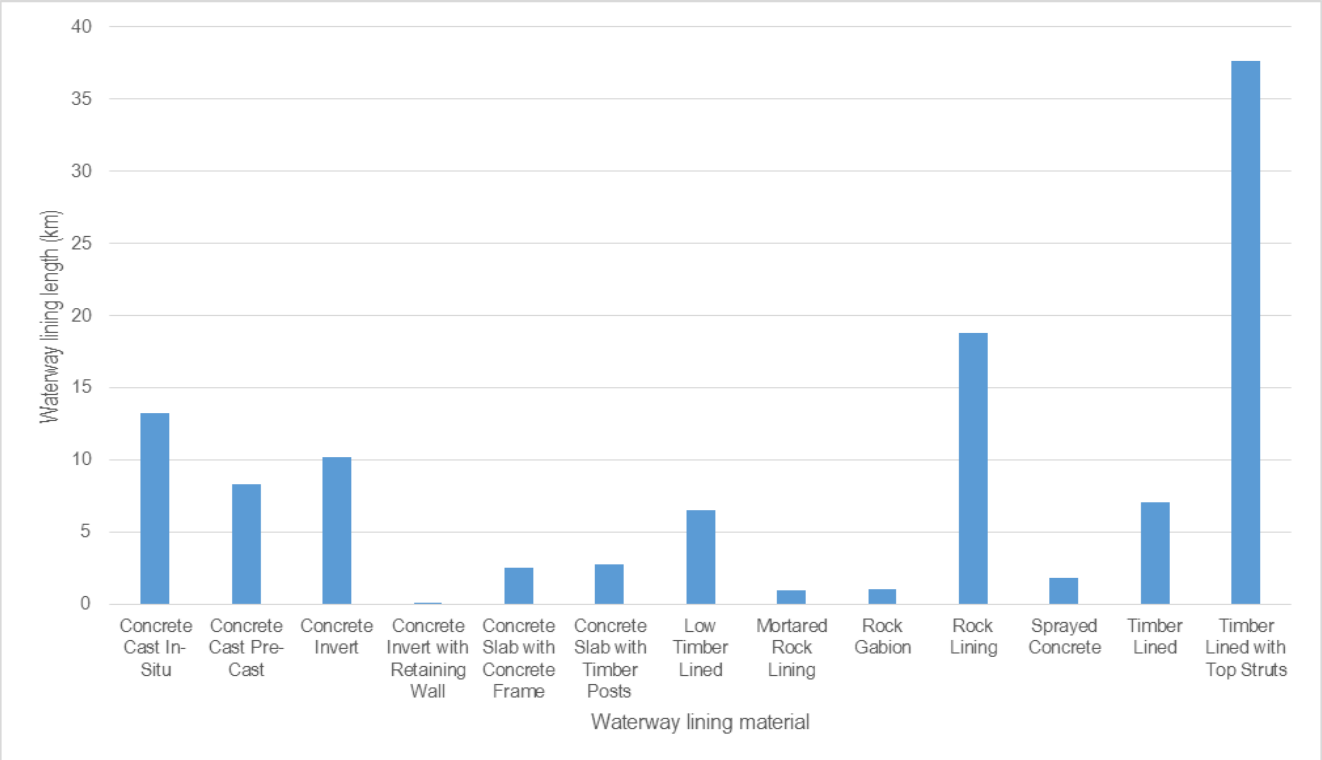


Figure 8-16: Waterway lining length by material/type (refer to TRIM://17/186435 'Type by length' tab for source data)

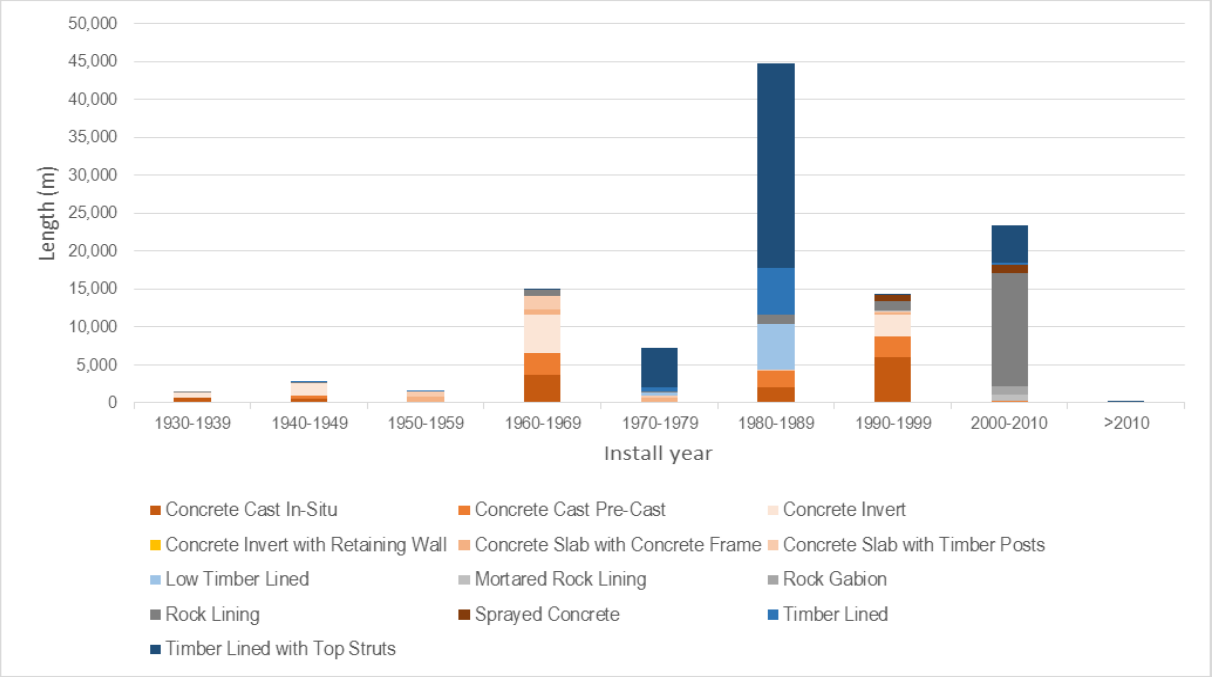


Figure 8-17: Length of lined waterway by type and install year (refer to TRIM://17/186435 'LengthByInstallYr (2)' tab for source data)

Figure 8.18 shows the estimated remaining useful life of waterway lining from the renewal model, which indicates a significant peak in lining reaching the end of its useful life in the next 6 to 10 years and again in 16 to 20 years. This is due to the large amount of timber lining installed by the Drainage Board lining gangs in the 1970's and 1980's coming to the end of its 40-year life. This will result in the requirement for significantly increased investment in waterway lining renewal or naturalisation over the next 20 years.

The useful lives were derived using deterioration curves for the different lining materials and the install dates as well as physical inspection. Where physical inspection has not been undertaken, it was necessary to estimate the remaining useful life based on lining install dates, and where the install dates where not known the estimate was based on the average known install date for that lining type.

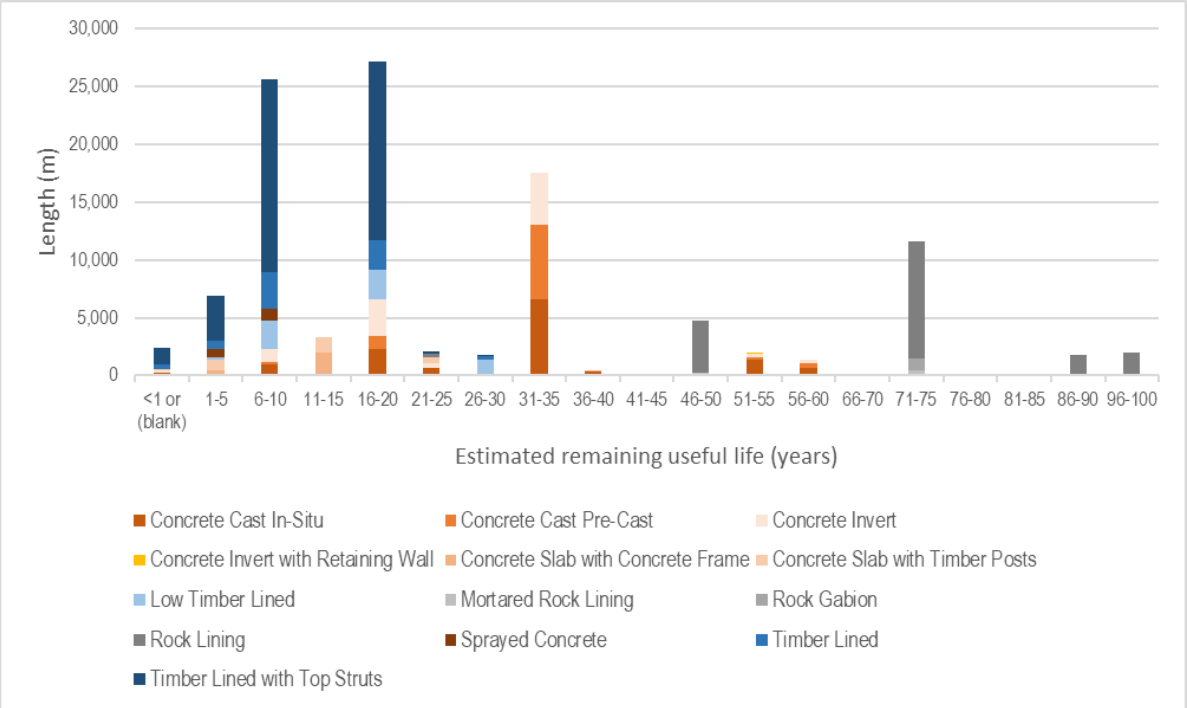


Figure 8.18: Waterway Linings Remaining Useful Age Profile

Figure 8.19(A) shows the condition grading of the waterway linings that has been assigned through physical inspection vs theoretical modelling; approximately 90% (100km) of the lining that is known to exist was physically inspected through LDRP98, which means the overall condition of the network should be well understood.

The average drainage condition of all waterway lining is included in Figure 8-19 (B), which shows that 10% of the network (approximately 11.5km) is condition grade 4 or 5 and of this 8.7km (76%) has been physically assessed.

The condition grade by lining type is shown in Figure 8-20. This shows that the most common lining type of timber lining with tops struts has the largest length of condition grade 4 and 5 assets (6.5km). The standard deterioration curve for timber lining indicates that when it reaches condition grade 4 it has an estimated remaining useful life of 2 years.

It should be noted that since the condition survey was undertaken which informs the data in figures 8-19 & 8-20, the identified condition grade 5 linings have been repaired. However as discussed above, the records have not been updated to provide an updated condition grading. Additionally, it is presumed that with the useful life of drain linings being approx. 40 year and the survey being done 5-6 years ago, a number of the assets have likely deteriorated enough that the previous percentage of grade 4 & 5 assets are still applicable. The noted improvement items will vastly help with the renewal profile for the next LTP.

The condition grade is shown geographically on the maps in Figures 8-21 & 8-22.

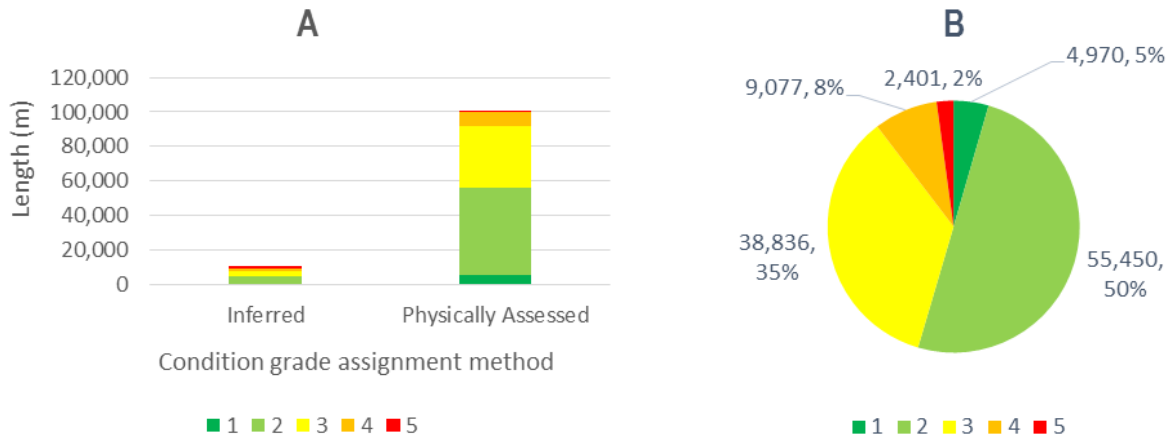


Figure 8-19: Waterway lining (A) physically assessed and inferred average condition grades and (B) overall average condition grade (source TRIM://17/186435*)*

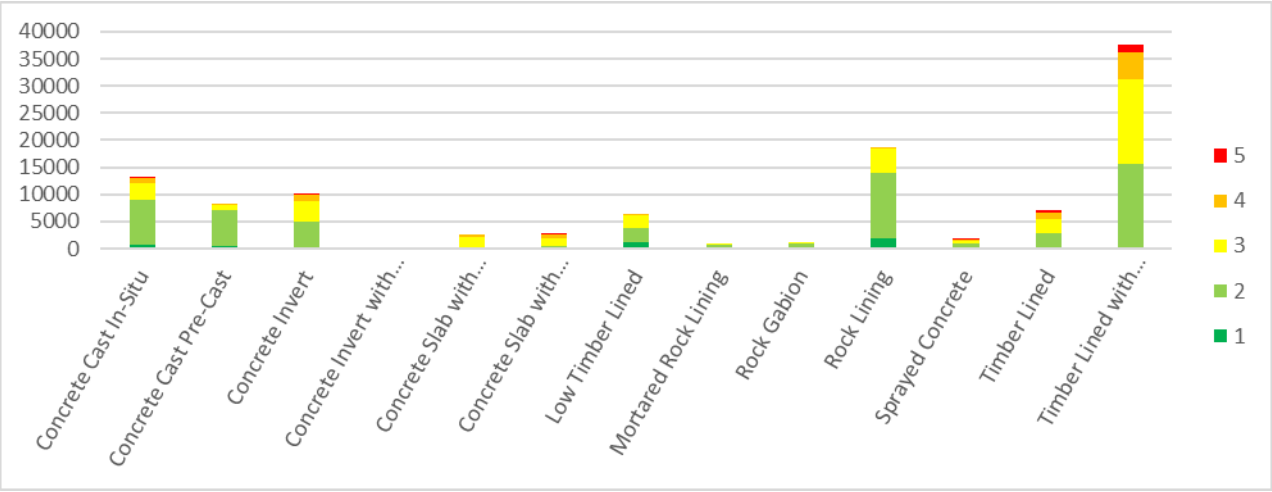


Figure 8-20: Lined drain average condition grade by lining type (source TRIM://17/186435*)*

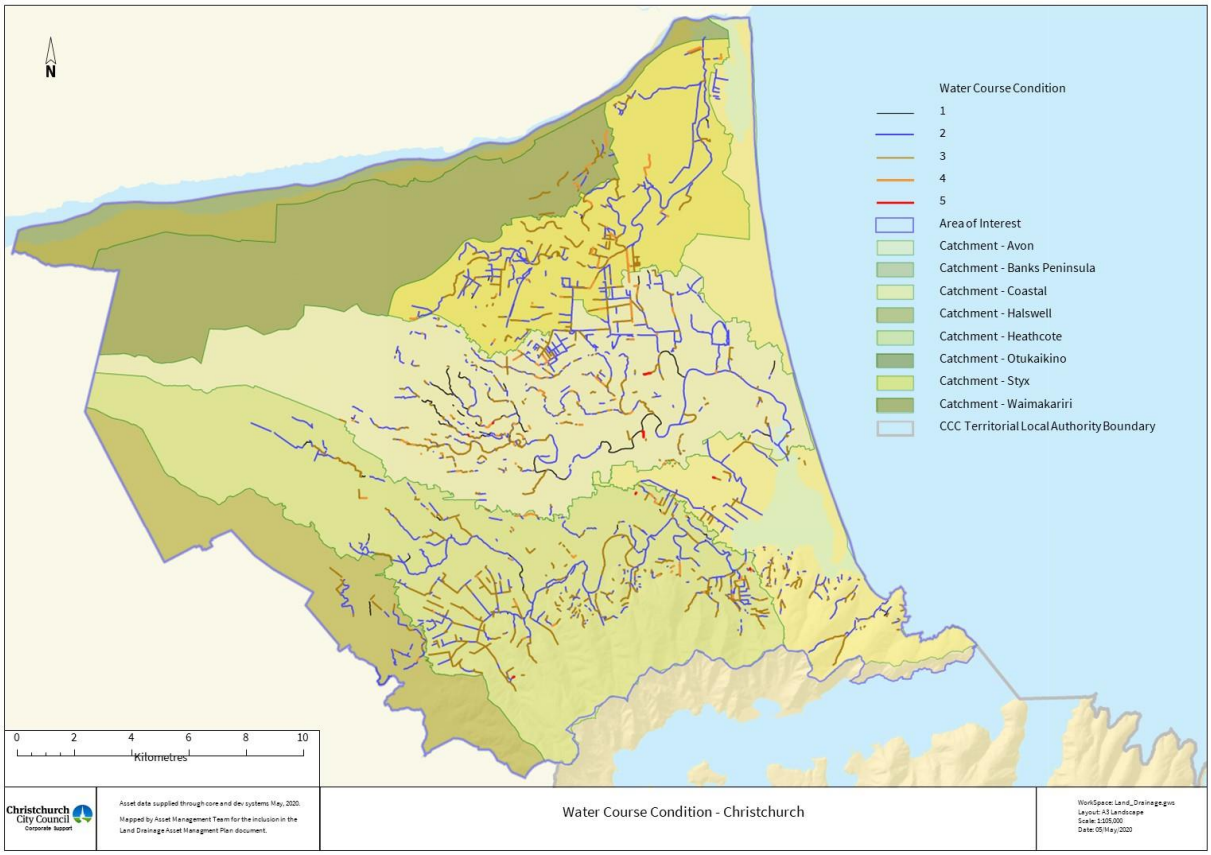


Figure 8-21: Watercourse Condition Grading – Christchurch City

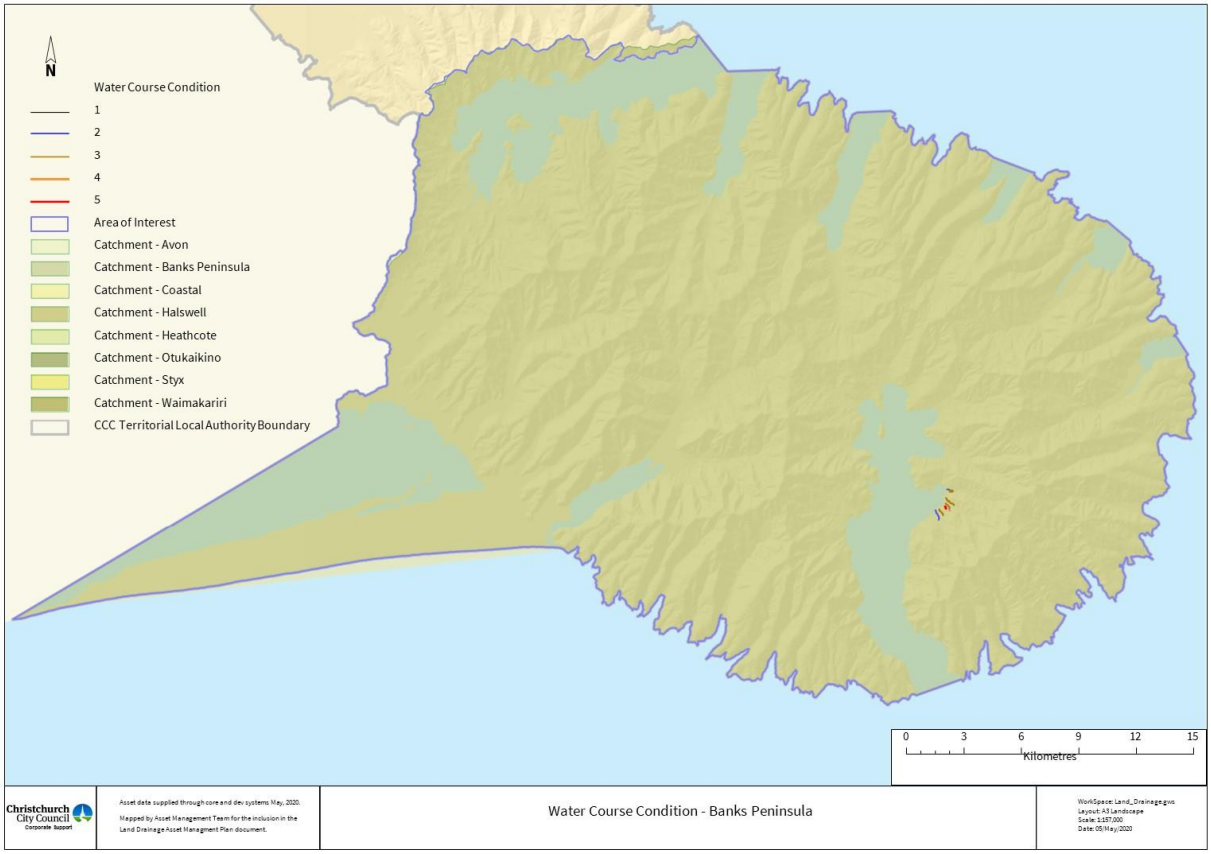


Figure 8-22: Watercourse Condition Grading – Banks Peninsula

Renewal Plan

As discussed above, the linings model that was created to set the renewals profile for the 2018 AMP has been reused as this is the most current source of information despite its shortfalls, with the processes not yet in place to provide better renewals programming.

The length of linings that can be renewed in a single financial year is difficult to predict as historically renewals were being undertaken through Operations, which masked the true CAPEX cost and may have resulted in continued renewal

The majority of the grade 5 linings identified in the 2015/2016 inspections have been/or are currently being designed to be renewed. These linings have been removed from the model, leaving the assessed grade 4's for renewal. As previously noted a proportion of the timber lining (the lining type that makes up the majority of the short to medium term renewals required) that is currently condition grade 3 will have become condition grade 4 given that condition grade 3 timber lining has an estimated remaining useful life of around 7 years.

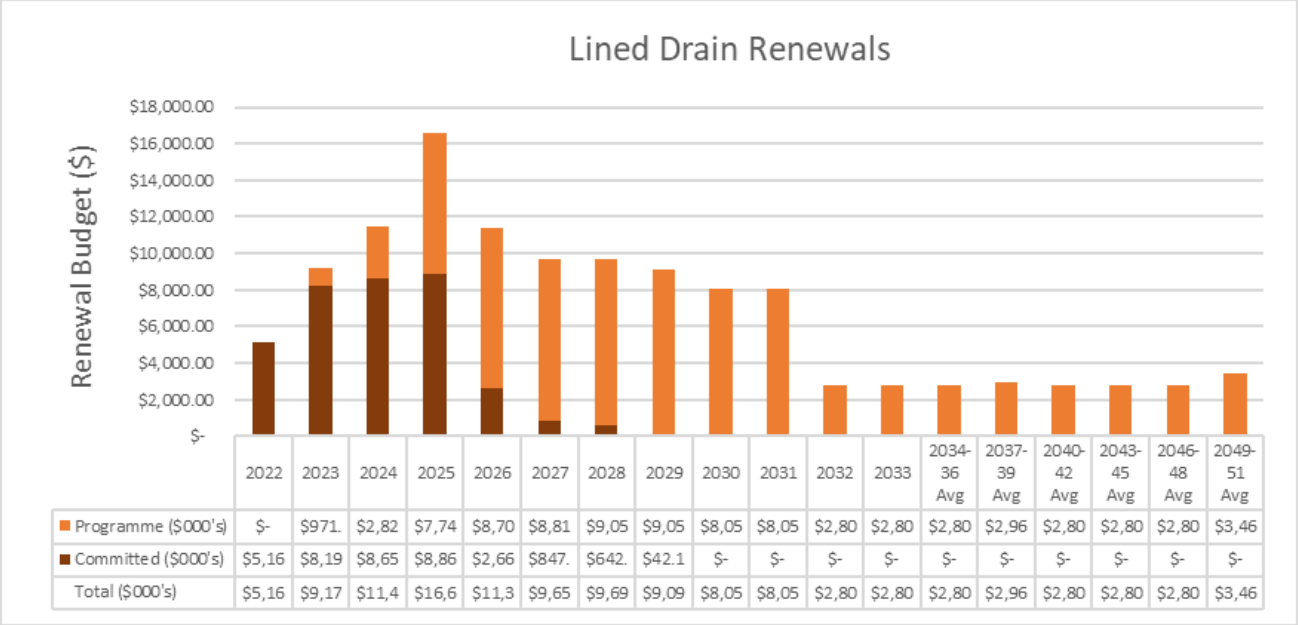
It will not be practical to only renew the sections of lining that are condition grade 4 or 5 as this would leave isolated sections that are in better condition. Renewal lengths scoped for projects will generally be continuous from one point to another to allow the best renewal option to be implemented to achieve the best long term solution. This is particularly important with naturalisation as this often involves work beyond the physical extent of the existing lining (e.g. re-grading of banks, land purchase to allow for meandering rather than straight waterway alignment etc.)

The linings recommended for renewal are not due to be theoretically replaced until FY23-28, however due to their assessed condition they are to be renewed ahead of the end of their remaining useful life. There is 5.75km of current grade 4 lining at a cost of approximately $12.1M.

This is the basis for the 3-year funding requirement for the programme level budget (i.e. not yet allocated to specific projects). There are numerous candidates identified in the waterway lining renewal programme and candidates

recommended by the Operations and Maintenance team that will utilise this funding. There are numerous candidates identified in a future waterway lining renewal programme and candidates recommended by the Operations and Maintenance team that will utilise this funding.

The Renewal Profile in Figure 8-23 is based on the figures that were approved in the 2018 AMP. This works well to smooth of some of the predicted spikes in the linings reaching the end of their remaining useful life within the 10-year period. Table 8.3 shows the programme level funding, and some of the projects that are committed and proposed to be funded from that programme level budget. As required by the Project Management Office team, all funding from the programme for FY21-FY23 was required to be drawn down into projects by mid-2020. This has reduced the value of the first 3-years of the LTP.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034-36 Avg	2037-39 Avg	2040-42 Avg	2043-45 Avg	2046-48 Avg	2049-51 Avg
Programme ($000's)	$-	$971.	$2,82	$7,74	$8,70	$8,81	$9,05	$9,05	$8,05	$8,05	$2,80	$2,80	$2,80	$2,96	$2,80	$2,80	$2,80	$3,46
Committed ($000's)	$5,16	$8,19	$8,65	$8,86	$2,66	$847.	$642.	$42.1	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Total ($000's)	$5,16	$9,17	$11,4	$16,6	$11,3	$9,65	$9,69	$9,09	$8,05	$8,05	$2,80	$2,80	$2,80	$2,96	$2,80	$2,80	$2,80	$3,46

Figure 8-23: Waterway lining renewals cost scenarios and proposed expenditure graph

Table 8-2 - Summary of waterway lining renewal programme and major projects and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
984	Waterway Lining Renewals PRG	3.79	63.26	121.76
	Committed Projects			
33828	Canal Reserve Drain, Marshland Rd – Timber Lining Renewal	3.55	5.92	5.92
49716	SW Mairehau Dr, Westminster to Crosby - 430m timber lining renewal	2.74	2.74	2.74
55103	SW Dudley Creek, Scotston Avenue Waterway Lining Upgrade	0.24	0.24	0.24
55105	SW Papanui Creek, Paeroa Street Waterway Lining Upgrade	0.25	0.25	0.25
55112	SW Dudley Creek, Paparoa Street to PS219 Waterway lining Upgrade	2.51	2.51	2.51
60215	SW - Jacksons Creek Lower Water Course Renewal Project	1.06	3.03	3.03
60217	SW Dudley Creek - 27-39 Ranger Street, Mairehau	0.97	1.09	1.09
60218	SW Dudley Creek - 2/75 Harris Crescent, Papanui`	0.19	0.19	0.19
60231	SW - No 2 Drain Rural Renewal	1.52	4.23	4.23

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
60289	SW St Albans Creek – 1/58-2/58 Innes Road, St Albans	0.17	0.17	0.17
60290	SW - St Albans Creek - Knowles to Innes Road Renewal, St Albans	0.55	0.55	0.55
60291	SW - Waimairi and Fendalton Stream lining and enhancement work package, Fendalton	0.78	0.78	0.78
60292	SW Harbour Rd Drain over Styx River, Brooklands	0.4	0.14	0.14
60335	SW Waimari Stream - 118 Straven Road to 17 Rochdale St, Fendalton	0.33	0.35	0.35
60336	SW Goodmans Drain – Prestons Road to 318 Marshland Road, Marshland	0.76	0.78	0.78
60337	SW Jardines Drain from Nuttall Drive through to Heathcote River , Hillsborough Drain Renewal	1.63	2.14	2.14
60338	SW Faulls Drain lining renew between Hills and Walters Road, Marshland	2.71	2.75	2.75
60339	SW Addington Brook - Hagley Park South Lining Renewal	0.55	5.85	5.85
60342	SW - Dry Stream/Victory Branch Drain, St Martins - lining renewal	0.95	0.95	0.95
61942	SW Treleavens Drain Timber Lining Renewal 143 Lower Styx Road	0.42	0.42	0.42

8.1.3 Open Waterway Assets

The asset types included in this group are covered by the Stormwater Drainage Activity and all open waterways currently in the Council assets systems are incorporated. The District Plan waterway classification with a brief description are:

1. Downstream Waterway - Downstream sections of large rivers with wide beds, continuous flow, extensive floodplains and, in many cases, tidal reaches.
2. Upstream Waterway - The upper to middle reaches of rivers and major streams with wide floodplains. The upper reaches may be intermittently dry but the middle reaches have continuous flow.
3. Environmental Asset Waterway - Tributary or engineered waterways with some identifiable ecological and amenity values and/or a strong potential for enhancement. Some are intermittently dry.
4. Network Waterway - Generally engineered or modified waterways with limited existing ecological values but some potential for enhancement. There are instances of networks waterways that have high ecological significance, such as Canal Reserve Drain where Lamprey have been found
5. Hill Waterway - Steep waterways sometimes with seasonally dry channels with potentially lower wildlife values
6. Banks Peninsula waterway - This is an interim classification for rivers and streams on Banks Peninsula that do not meet the definition of hill or networks waterways and have not already been otherwise classified

Based on data held in GIS exported in October 2017[18], the total length (included piped sections) of classified open waterways is 2,449km and the total length of unclassified waterways is 310km.

The total length of classified open waterways physically inspected through LDRP 98 to assign a drainage condition grade was approximately 415km.

A Drainage condition grade was assigned to 52% of the CCC open waterway network and a condition using CCC's other 5 waterway values was assigned to 42% of the network using CCC's other 5 waterway values (Ecological, Cultural, Recreation, Heritage and Landscape values). The resulting grades by length are summarised in Table 8.3. Drainage and

[18] 2018 Land Drainage AMP - Watercourse Classification Data 20171017 TRIM://18/662558

Ecological condition achieved the highest condition grades followed by Landscape. For all of the remaining values, more than 50% of the waterways assessed were assigned condition grade 4 or 5.

Details of how the grades were assigned is included in the Open Channels Condition Assessment Specification[19] that was developed for the project a as non-drainage value grading was not available nationally. Further details can also be found in the LDRP 98 Data Summary Report[20] and LDRP 98 Tech Summary Document[21].

Table 8-3 - Open waterway 6 values average grade (by length)

Value	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Total
Drainage	22,340	242,066	135,805	13,403	791	414,783
Ecology	507	46,722	227,168	42,289	3,472	320,158
Cultural	9,115	51,915	70,748	97,781	109,361	338,920
Recreation	33,161	54,391	68,199	69,068	117,182	342,001
Heritage	24,067	36,748	48,762	104,536	111,896	326,009
Landscape	14,106	53,781	109,372	98,333	65,686	341,278

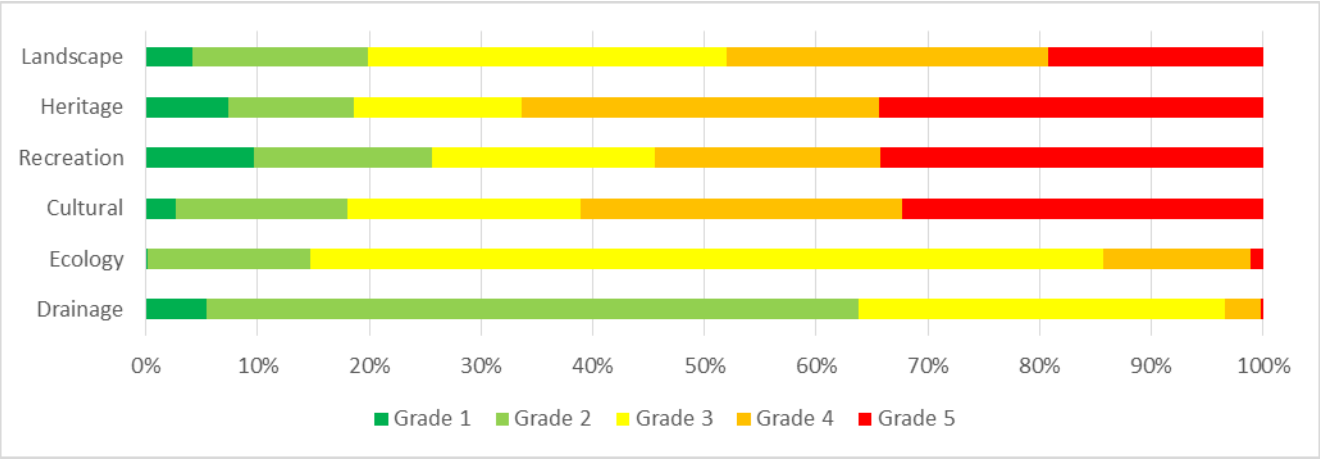


Figure 8.24: Open waterways 6 values average grade proportions

Renewal Plan

To date, while the valuation contains items such as plantings and walkways, there are no significant part of the waterway asset to allow a practical "remaining useful life" to be applied to this asset class. Additionally, the renewals of any portions of the open watercourse network has been historically carried out as reactive work under the maintenance contract. Therefore, working out a facts based renewals budget is difficult, relying on a short amount of historic cost data and list of projects nominated by the Operations and Maintenance Team.

The previous LTP funding proposal budget was based on funding to remain at the same level as in previous years. However, two open water way renewal/naturalisation projects were cancelled in 2018 (CPMS 37149 Stormwater Renewal Rhodes Drain & CPMS 33826 Okeover Stream Naturalisation of 130m of timber lining) due to insufficient construction budget. Therefore the current budget is insufficient to carry out project works of any reasonable size and it is recommended that an increase is provided for the 2021 LTP period to allow known projects to be constructed. The budget proposed for beyond the 3-year period is an estimate to allow one minor project a year to be completed.

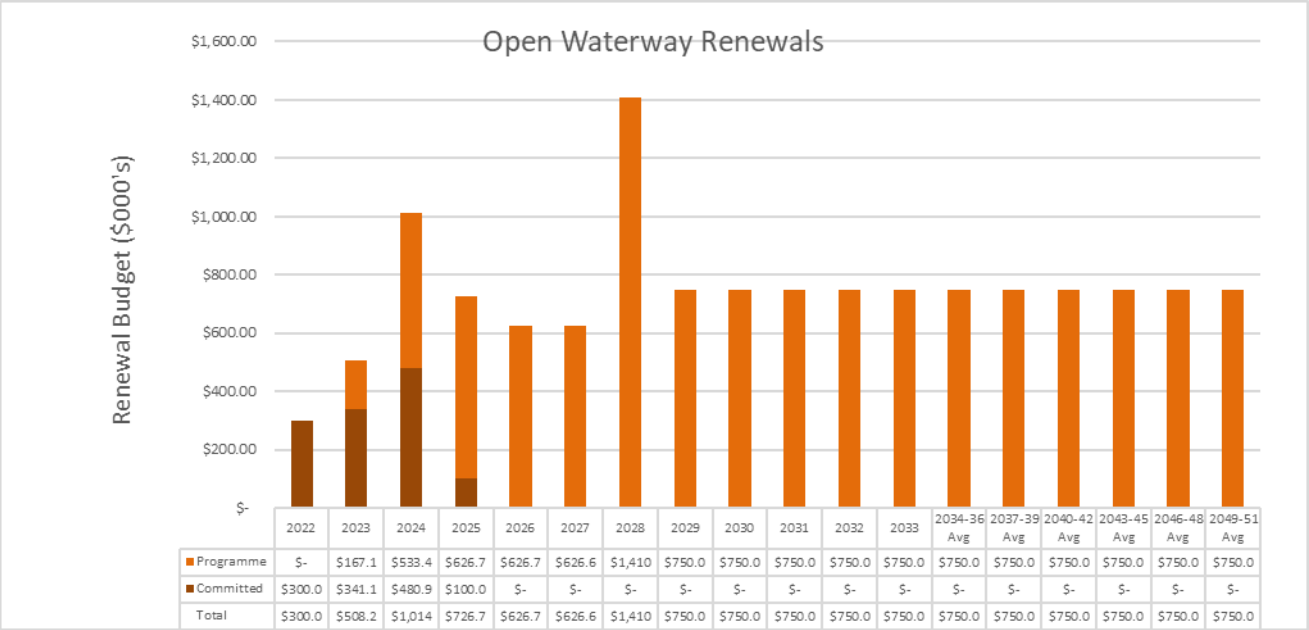
[19] Open Channels Condition Assessment Specification Rev 8 TRIM://15/724077

[20] LDRP 98 - Condition Assessment Data Summary Report_FINAL_20170130_City Wide TRIM://16/1441588

[21] LDRP 98 - Condition Assessment Technical Summary Report_FINAL_20170209_City Wide TRIM://17/101090

It is also anticipated that over the intial 3-year financial period, future renewal canididates will be able to be better scoped following discussion with the Operation and Miantenace team and the maintenance provider to inform the budget for the next LTP.

The required funding for the 2021 LTP budget is shown in Figure 8-25, with the nominated programme and projects in Table 8-4 below. Please note that spike in FY28 is a result of needing to balance the wider activity funding across the 10 and 30 year periods, so the amounts for the preceding 4 years have been reduced and the budget shortfall applied into FY28.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034-36 Avg	2037-39 Avg	2040-42 Avg	2043-45 Avg	2046-48 Avg	2049-51 Avg
Programme	$-	$167.1	$533.4	$626.7	$626.7	$626.6	$1,410	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0
Committed	$300.0	$341.1	$480.9	$100.0	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Total	$300.0	$508.2	$1,014	$726.7	$626.7	$626.6	$1,410	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0	$750.0

Figure 8-25: Open waterway renewal proposed expenditure graph

Table 8-4 - Summary of recommended open waterway renewal programme cost ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
388	Open Waterway Renewals PRG	0.70	6.24	21.24
	Committed Projects			
60340	SW Arran Drain Realignment, 521 Ferry Road, Linwood	0.3	0.3	0.3
61929	SW - Hays Bay Drain No 2 Renewal, Black Rock	0.01	0.01	0.01
62242	SW - Opara Stream Naturalisation Renewal Works, Okains Bay	0.1	0.1	0.1
62243	SW - Steamwharf Stream, Palinurus to Dyers Bank Renewal Works	0.15	0.15	0.15
62244	SW - Avon River , 85 Avonhead Road Bank Renewal Works	0.19	0.24	0.24
62245	SW - Smacks Creek, 30R Wilkinsons Road Renewal Works	0.24	0.24	0.29
62246	SW - Kaputone Creek, 26 Springwater Avenue Bank Renewal Works	0.14	0.14	0.14

8.1.4 Open Waterway Structures Assets

The assets within this group are those associated with the in-channel waterway structures that are covered by the Stormwater Drainage Activity, which include;

- Weirs
- Boat ramps

- Flumes
- Fords
- Gross debris traps (e.g. debris racks and debris poles)
- Ladders

Generally, there is a low confidence with the data contained in CCC's asset systems on structures within waterways. Many unrecorded structures were identified as part of LDRP 98, but no additional data has been collected to allow any assessment of remaining useful life using type and age.
However, due to the importance of debris racks and poles in terms of environmental issues and blockage prevention, the provisional data for these specific asset types is summarised below. Weirs have also been included as there are a significant number of them. Structures such as jetties, board walks and viewing platforms are not included in this AMP.

Gross Debris Traps

Debris racks

For the purposes of this plan, debris racks are defined as follows;

'A free standing structure (not fixed to an inlet or outlet) located in an open waterway for the purpose of collecting debris'.

The debris rack material and numbers are summarised in figure 8-26. There are currently estimated to be 42 debris racks in service.

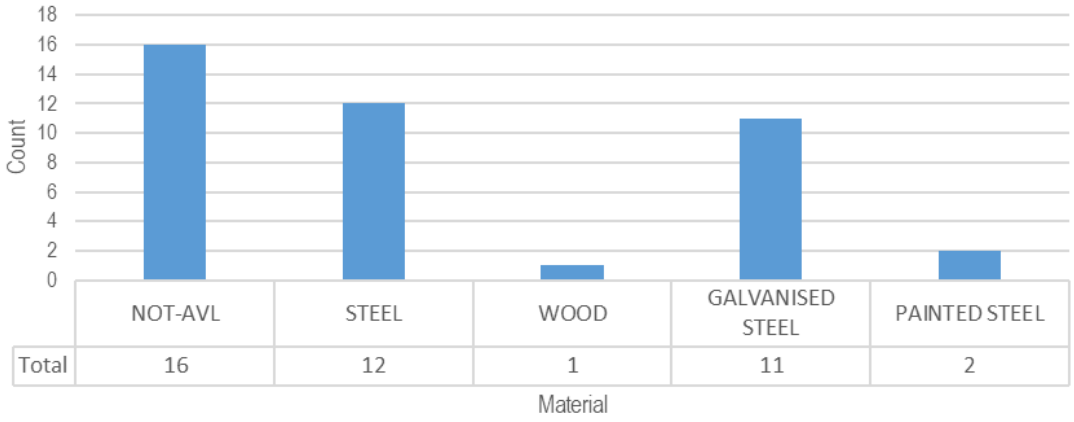


Figure 8-26: Debris rack provisional data summary (refer to TRIM://18/661552 for source data)

Debris Poles

Provisional asset data indicates that there are 10 locations where debris poles are used.

Weirs

The weir types and count are summarised in Figure 8-27. Despite the scores in the valuation table in Table 7.2, there is a low level of confidence in the data held for weirs. During the collection of the site data ownership wasn't fully considered, therefore some weirs can be considered as "private" as they serve no function for Council, and are ornamental likely installed by residents, or in some cases not constricted weirs at all i.e. just a pile of rocks instream. A project is currently being undertaken to confirm ownership and purpose of the weirs in the collected data to rationalise the number of assets identified, however it was not completed before this AMP was written. Once the data is "cleansed' it can better inform renewals and valuations.

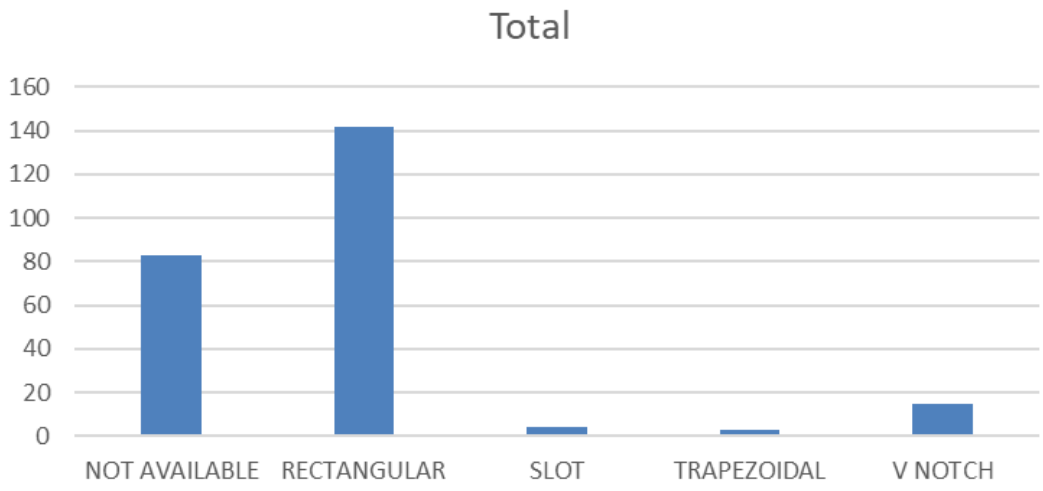


Figure 8-27: Weir provisional data summary (refer to TRIM://18/673311 for source data)

Condition Data

Condition grades have been assigned to some of the assets through LDRP 98. This replicates the data in the 2018 AMP as no further data collection or analysis has been carried out since then. This may under report the current condition.

140 of the 247 weirs have been assigned condition grades through physical inspection, as have 15 of the 42 debris racks. The results are shown in Figure 8-28. As shown, weirs that have been assessed are generally in good condition with only 4% assessed as condition grade 4 or 5. Four of the 42 debris racks have been assessed as condition grade 4.

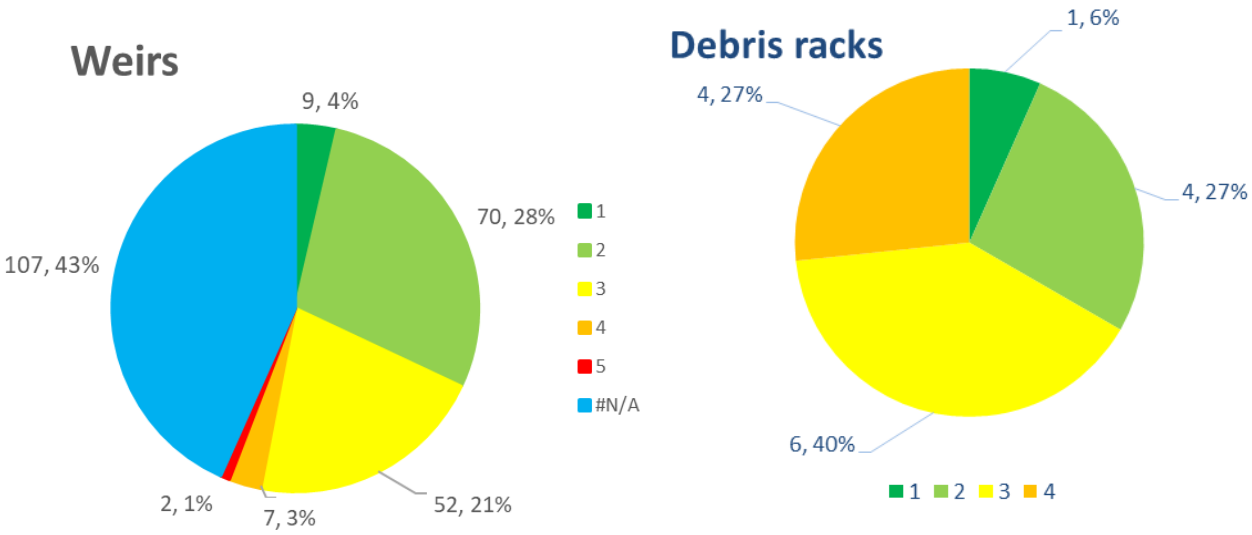


Figure 8-28 - Weir and debris racks physical inspection condition grades (refer to TRIM://18/673311 for Weir and TRIM://18/661522 for Debris Rack source data)

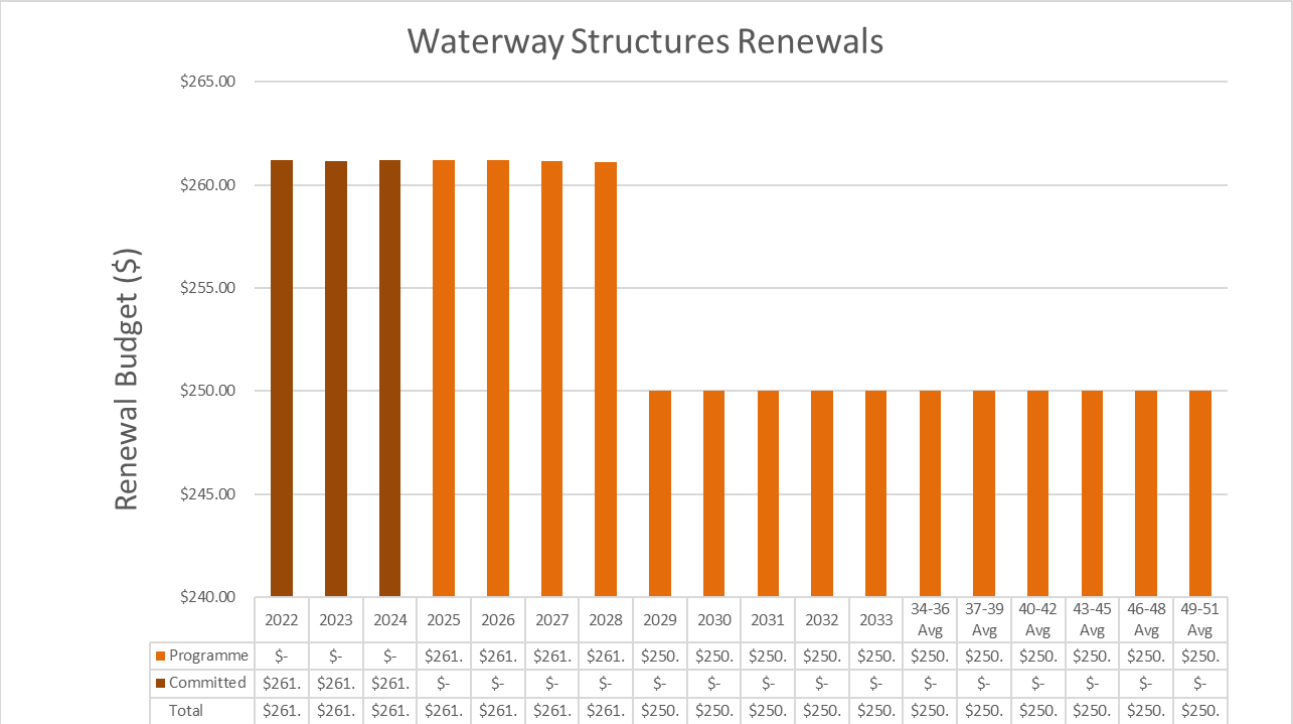
Renewal Plan

Costs are based on estimates for renewal of debris traps traps and structures that are a barrier to fish passage.

The renewals programme is based on a coarse assessment on renewal age of the various assets in this class, the valuation data and the quantites from the LDRP 98 inspection. Unfortunately there is a low level of confidence with these variables e.g. private vs public installed weir, unknown life projection for assets, undefined details used for the valuations. Improvement items have been identified in Section 10 which will verify some of the data confidence issues allowing for improved projections in future LTP periods.

Other renewal works are to debris racks identifed under LDRP 98 and gauge boards.

A summary of total costs for the proposed funding for the 2021 LTP budget are shown in Figure 8.29 below and further details of the recommended costs for individual programmes and projects are included in Table 8.5 below.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	34-36 Avg	37-39 Avg	40-42 Avg	43-45 Avg	46-48 Avg	49-51 Avg
Programme	$-	$-	$-	$261.	$261.	$261.	$261.	$250.	$250.	$250.	$250.	$250.	$250.	$250.	$250.	$250.	$250.	$250.
Committed	$261.	$261.	$261.	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Total	$261.	$261.	$261.	$261.	$261.	$261.	$261.	$250.	$250.	$250.	$250.	$250.	$250.	$250.	$250.	$250.	$250.	$250.

Figure 8-29: Waterway Structure proposed expenditure graph

Table 8-5 - Summary recommended waterway structure renewal programme costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
481	Waterway Structure Renewals PRG	0.00	1.79	6.79
	Committed Projects			
49778	Waterway structures renewal work package	0.78	0.78	0.78

8.1.5 Monitoring & Hydrometric Equipment Assets

The hydrometric network is vital for Council's role in Civil Defence, as it informs the potential flooding situation and determines the response and as such needs to have a high level of performance. There is also an increased future need for hydrometric equipment with new flood storage facilities in the Henderson Basin area having outlet conditions controlled by water levels in the Heathcote River. As such the rainfall and water level sites are telemetered to allow for physical issues (blockages and power supply problems) to be notified and rectified earlier. Additionally, Council has taken over the network of groundwater piezometers installed by EQC following the Canterbury Earthquake sequence. These will better inform CCC's understanding of the behaviour of shallow groundwater.

The assets are not condition assessed as is the case with other asset groups. As per the existing maintenance contract with NIWA, all sites are regularly visited and inspected so that equipment can be calibrated, site maintenance can be undertaken such as equipment repairs and so that data can be downloaded. Site visits involve checking radios/cellular phones, aerials, cabling, solar panels, batteries, voltage regulators, data logger units and telemetry housing for damage and faults. Urgent faults affecting the functionality of the network are reported to Council as they occur, otherwise faults, maintenance and details of the information collected is provided in quarterly reports to Council.

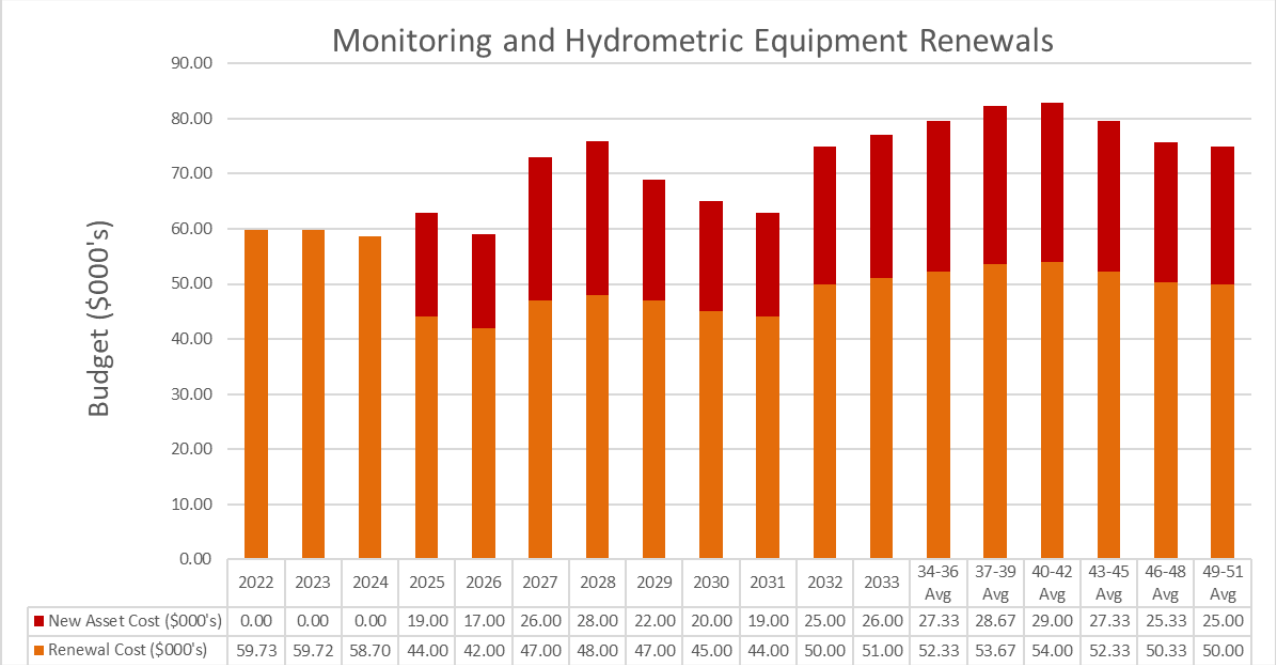
Renewal Plan

The life cycle of these assets are not well understood and future projections of the monitoring equipment and renewal costs have been based on historic budgets. Initial investigations indicate that this asset base has been predominantly replaced on a reactive basis. As more automation is proposed in the operation of detention devices e.g. Henderson's Stormwater Basins Project linking the operation of gates to existing water level gauges in the Heathcote River, budget will be required to renew assets in a timely manner.

To be part of a resilient city, we need to gather more information to better understand the dynamic links between the city's piped network, open drainage system and ground water levels, there will likely be an increase in the number of monitoring sites to better calibrate the various stormwater and hydrological models of the city as well as better understand the effects of major rainfall events, which could result in increased future costs.

The first 3 years of budget has been cut, and the annual spend for the 10 years has been manipulated to allow the meeting of 3 Waters & Waste budget targets.

A summary of total costs for the proposed funding for the 2021 LTP budget are shown in Figure 8.30 below and further details of the recommended costs for individual programmes are included in Table 8.6 below.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	34-36 Avg	37-39 Avg	40-42 Avg	43-45 Avg	46-48 Avg	49-51 Avg
New Asset Cost ($000's)	0.00	0.00	0.00	19.00	17.00	26.00	28.00	22.00	20.00	19.00	25.00	26.00	27.33	28.67	29.00	27.33	25.33	25.00
Renewal Cost ($000's)	59.73	59.72	58.70	44.00	42.00	47.00	48.00	47.00	45.00	44.00	50.00	51.00	52.33	53.67	54.00	52.33	50.33	50.00

Figure 8-30: Monitoring and hydrometric equipment renewal proposed expenditure

Table 8-6 - Summary of recommended monitoring and hydrometric equipment renewal programmes and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
37852	SW New Technical Equipment PRG	0.00	0.14	0.69
327	SW Technical Equipment - Replacement	0.18	0.35	0.85
37851	SW Hydrometrics Equipment Replacement PRG	0.00	0.15	0.68

8.1.6 Pumping Station Assets

At the time of data export (19th November 2019) there were 50 individual stations located across the city including the Woolston Barrage. Three stations, PS0202, PS0205 and PS0219, are deemed to be of high criticality due to their pumping capacity and the size of catchment areas they serve.

Pump stations typically comprise the asset groups and components shown in Table 8-7.

Table 8-7 - Pumping station asset groups and components

Pumping Station Asset Group	Asset type	
Electrical	• Motor Starters • Engine Starters • Harmonic Filters	• Switchboards • Cables • Valve Actuators
Mechanical	• Pumps • Compressors • Motors • Engines • Alternators • Pipework	• Valves • Well Headworks • Cranes • Fuel Tanks • Fans
Civil & structures	• Buildings • Cabinets • Structures • Chambers	• Land • Reservoirs • Tanks • Wet wells
ICA	• Remote Telemetry Units (RTU)/Programmable Logic Controllers (PLC)/Data Loggers • Radios/Cellular Data Blocks • Software	• Measurement Instruments • Human Machine Interfaces (HMI)

Due to the number of asset groups and components within a pump station, a specific remaining useful life cannot be provided for the “pump station”. The renewal planning process is therefore generally managed at the asset group level based on the asset life for each component. There is a need for a condition assessment to be carried out for the larger mechanical, civil and structural items. It is anticipated that this Improvement Item will be written in the Operations and Maintenance Contract.

Christchurch stormwater pump stations range in age from 1 to 51 years (based on commissioning date). The commissioning date profile is shown in Figure 8-31 and pump station locations are shown in Figure 8-32.

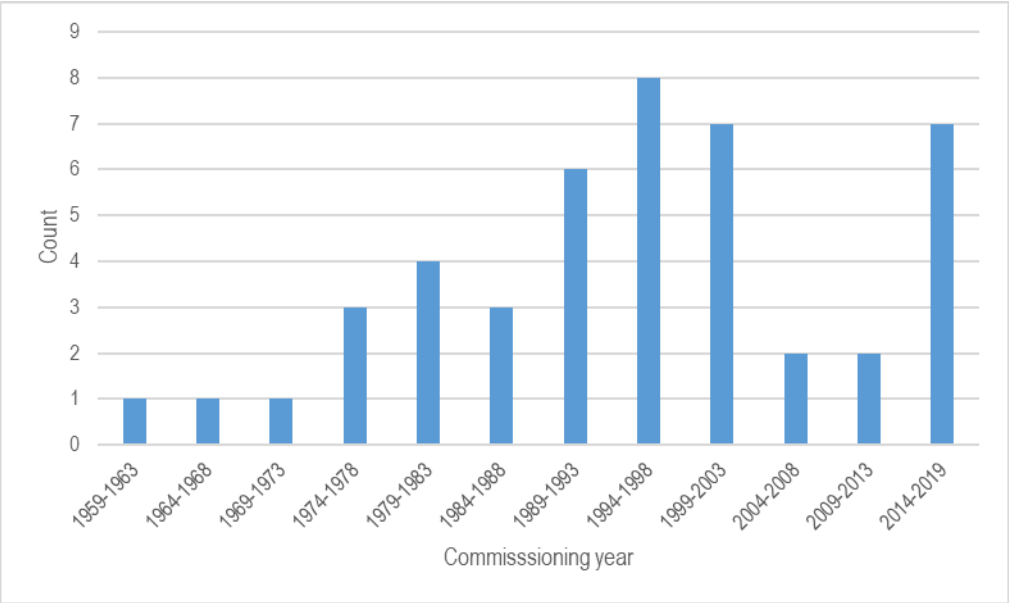


Figure 8-31: Stormwater pump station commissioning years

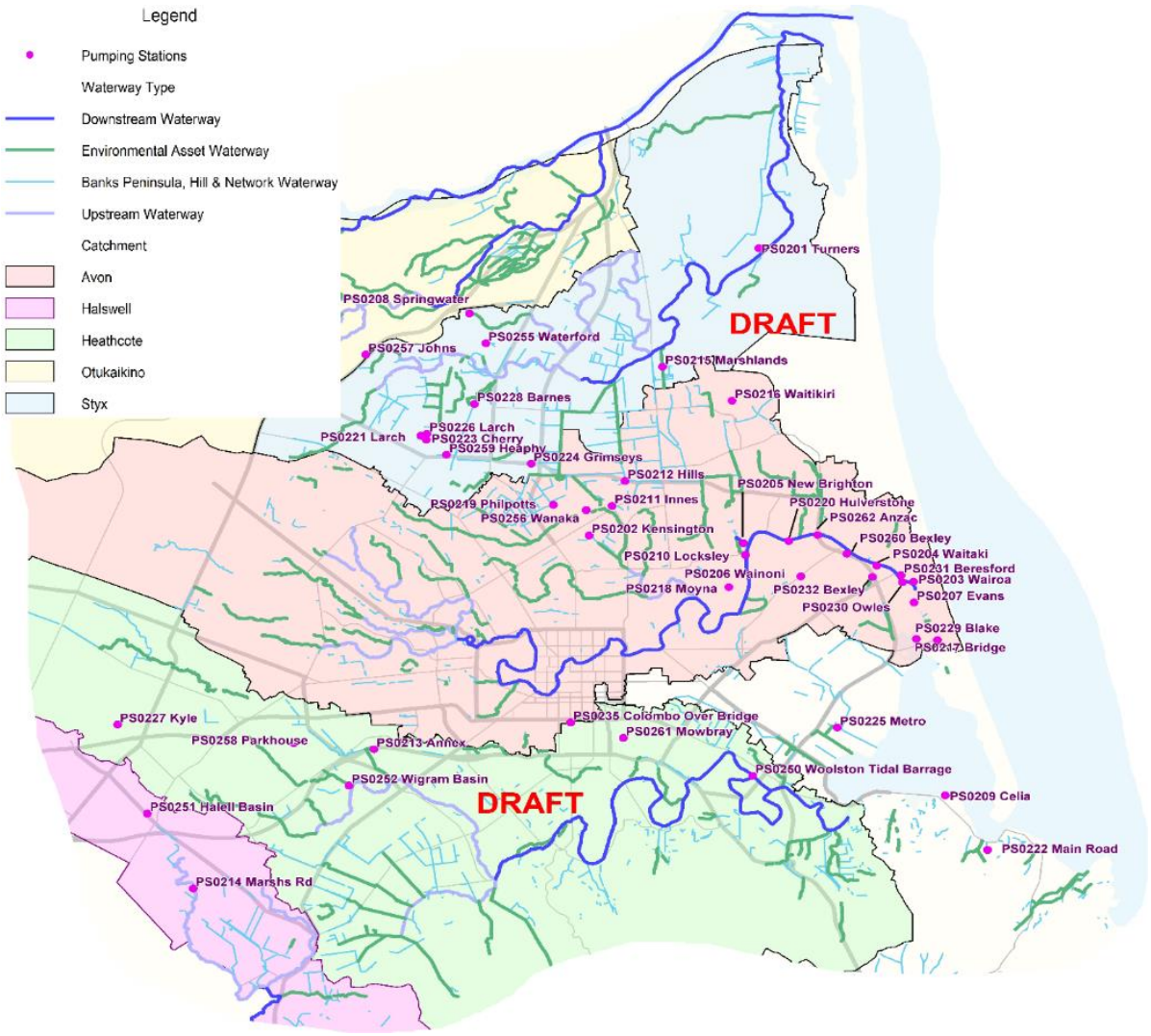


Figure 8-32 Pump station location plan (the 'draft' labels relate to the river catchments)

Following the earthquakes and the recovery of the city, new pump stations have been constructed for residential areas, subdivisions and include associated stormwater treatment facilities;

- PS0233 Richardson SW
- PS0234 Russley SW
- PS0237 Ferry (Edmonds Park) SW
- MV6301 Winters SW
- MS6401 East Ellington SW

There are six existing pump stations, located in the residential red zone of the eastern suburbs servicing only a small number of properties, further work is required to determine the future purpose of these stations.

- PS 203 Wairoa Street
- PS 204 Waitaki Street
- PS 206 Wainoni Road
- PS 210 Locksley Ave

- PS 218 Moyna Ave
- PS 220 Hulverstone

The base lives and age stored in the CCC SAP asset database were used to estimate the percentage of remaining asset life and an inferred condition grade was then assigned.

Condition and performance assessments are not carried out at the station level and as such the condition of the assets is not well understood. The installation age and age profiles used for valuations information are used for condition at present and are tabulated in table 8-8. Long and medium range forecasting utilises this information exclusively as a proxy for condition. Short term forecasting and project selection is generated by visiting the stations identified through conversations with operations and maintenance staff as well as from the asset database data set. Once a list of possibilities is identified programmes of work are generated to maximise the work at each station by covering off all aspects identified. This leads to stations being upgraded and refurbished based on the most important issues identified and any other asset that are found to be requiring replacement at the station included in a larger project of works for the site.

Asset condition is measured using a 1 – 5 grading system. The general meanings of the grades are as follows:

Table 8-8 - Asset Grading System

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

The condition profile of our assets and location of poor condition assets is shown in Figure 8-33 and 8-34.

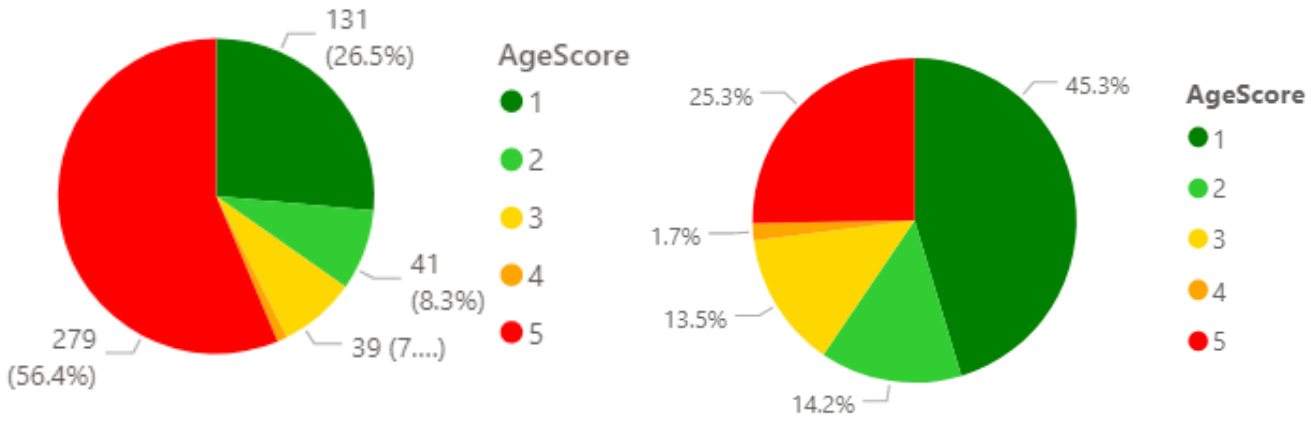


Figure 8–33 - Condition 1-5 by the number of assets (left) and value (right).

The percentage distribution of asset and component condition are shown in Figure 8-34 below. Of note are the high percentage of poor and fail condition grades for the pumps and Instrumentation & Control assets.

Over 90% of pumps are considered to have reached a 'Fail' condition grade, this is due to the pumps being near to or exceeding the design base life of 40 years. The continued operation of the pumps and risk of failure is mitigated by an ongoing fixed time inspection regime to identify and rectify faults and issues, as well as SCADA alarm and fault identification. A programme of pump and motor replacements is planned and is to be developed based on criticality and physical condition assessments to prioritise renewals.

The results also show that there is also a high percentage of Instrumentation & Control assets in a Fail condition grade, it is considered that the high percentage is due to the relatively short design life of these components. The replacement of

instruments and controls is typically driven by serviceability, obsolescence and criticality.

Council does not hold any mechanical spares in the event of station failure as it has been deemed too expensive, and many parts are generally available within a few days (excluding pumps and motors which may take some time to procure). There are a number of electrical parts held for the telemetry equipment and instrumentation as these are common across all 3-waters pump stations.

Council has also made the decision that stormwater pump stations are not to have pump redundancy provided. This is due the associated cost of the large pumps often needed in the stations.

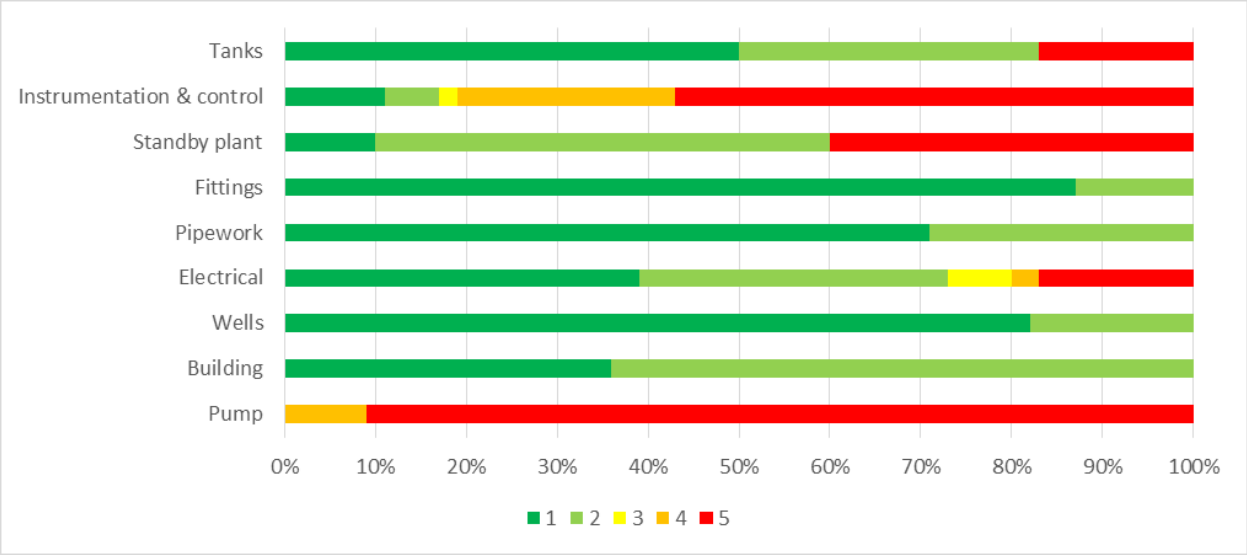


Figure 8-34: Pump station component inferred condition (refer to TRIM://18/715680 for source data)

Pumping & Storage Electrical Renewals

Key issues include;

- Switchboards have very old isolators which have been noted to fail on operation and also in some cases have had several safety warning notices released by the New Zealand Electrical Workers Registration Board (EWRB). These switchboards have been prioritised for replacement first.
- Failing starters that are now obsolete and thus cannot be easily repaired on failure causing large down times while replacements are sourced.
- With the advent of advanced starters for assisted starting, which are now a requirement from the electrical lines company (Orion), the useful life is much shorter as they are made up of active electronic components. This will lead to a steady increase in replacement costs as more of the older style DOL starters are phased out.

Pumping & Storage Mechanical Renewals

Operations have also identified that several of the very old pump sets are now becoming unreliable and difficult to repair and source replacement parts for. This has been factored into the short term budgets to allow for the replacement of the assets that have the poorest condition.

Future physical condition assessments and risk based prioritising of pump renewals will provide a better tool to optimise the renewal of the aging stormwater pumps.

Pumping & Storage Civils & Structures Renewals

There are several structures that were damaged in the 2011 earthquakes, however most have been renewed in previous LTP periods except;

- PS210 Electrical Cabinet

PS210 while not having so much of a lean, is putting mechanical stress on the main power cable and remedial work is required to ensure the safety of the asset. However, as the stations future is no longer certain. This work has been delayed until a clearer understanding of the long term plan for the red zone is realised. In addition to this earthquake damage, there is evidence that several of the older structures are likely degrading. However, at present a good set of condition data for these structures is not currently available.

Pumping & Storage instrumentation, control & automation (ICA) Renewals

There are three main issues in this space. The primary risk is around the software asset base, which has not previously been identified as an asset, but recent investigations confirm that a significant resource is being expended in updating, maintaining and replacing this component of the pumping stations. Research shows that other Australasian water authorities have identified software as a significant asset, which should be included in the asset register and future valuations.

Another major issue identified is the aging asset stock of the RTU (Remote Telemetry Unit) and HMI (Human Machine Interface) equipment with much of it well outside of its replacement cycle. This has been managed by the operations team by using the spares that they have and with repairs. However, the repair of the units is now no longer possible and as such the only replacements left are from spares. This require a steady supply of spares to be generated from replacements of operational units prior to failure.

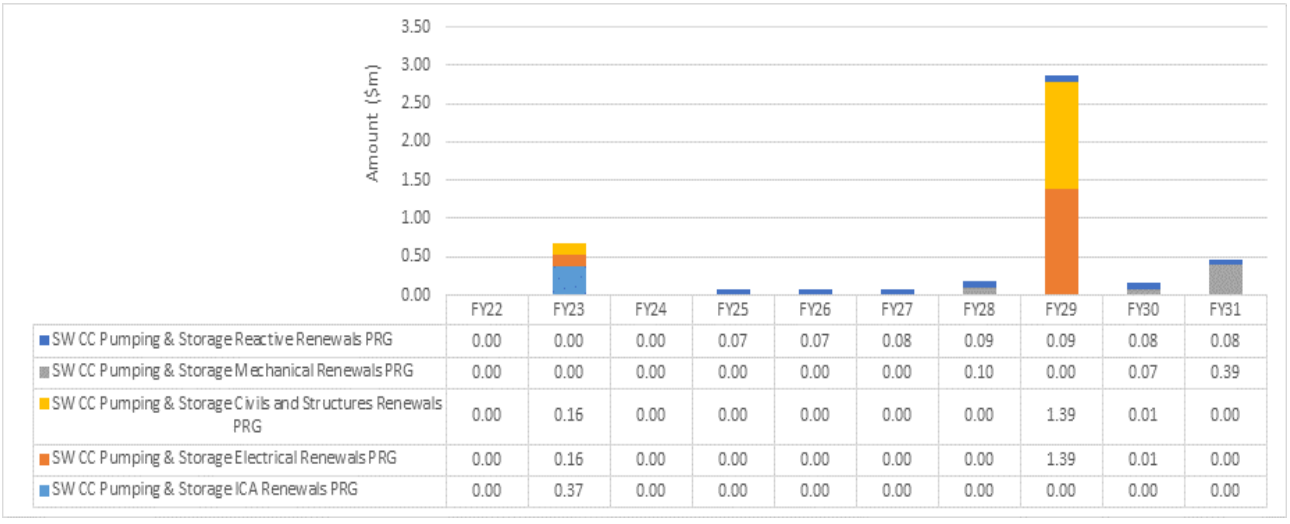
Pumping Reactive Renewals

Presently it is difficult to obtain accurate data on the frequency and cause of asset failures due to poor documentation of issues and storage of relevant data. Reactive budgets for this programme are based on spending in the FY19 period and have been increased slightly to cover the absence of planned renewals over the next LTP period due to poor asset information.

Work is continuing to ensure that all reactive asset replacements are accurately captured within this programme code, as at present several of the replacements are being funded through operational budgets which is further reducing visibility of failure rates and the impact that this is having on the business.

Renewal Plan

Further details of the pumping station renewal funding requirements are shown in Figure 8-35. This forecasts the total ongoing renewals for the storm water pumping and storage assets over the next 100 years based on current asset information and valuations (only 30 years of funding detailed to match the LTP funding period). Additional funding has been budgeted for issues identified during the LTP cycle with a much reduced base line into the future, with the expectation that the investment should reduce over time as legacy issues are resolved. The proposed programme items are detailed in Table 8-9 with proposed 2021 LTP expenditure shown in Figure 8-35.



	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
SW CC Pumping & Storage Reactive Renewals PRG	0.00	0.00	0.00	0.07	0.07	0.08	0.09	0.09	0.08	0.08
SW CC Pumping & Storage Mechanical Renewals PRG	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.07	0.39
SW CC Pumping & Storage Civils and Structures Renewals PRG	0.00	0.16	0.00	0.00	0.00	0.00	0.00	1.39	0.01	0.00
SW CC Pumping & Storage Electrical Renewals PRG	0.00	0.16	0.00	0.00	0.00	0.00	0.00	1.39	0.01	0.00
SW CC Pumping & Storage ICA Renewals PRG	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Figure 8-35: Pump station renewal cost breakdown

Table 8-9 - Summary of Pumping Station renewal programmes and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
37843	SW Pumping Reactive Renewals PRG	0.00	0.57	4.26
41868	SW Pumping & Storage Civils & Structures Renewals PRG	0.16	1.56	4.12
41869	SW Pumping & Storage ICA Renewals PRG	0.37	0.37	1.02
41870	SW Pumping & Storage Electrical Renewals PRG	0.16	1.56	4.12
41871	SW Pumping & Storage Mechanical Renewals PRG	0.00	0.55	6.47
42003	SW H&S Renewals PRG	0.00	0.02	0.12

8.1.7 Flood Protection Structures Condition

The asset types in this group include valves (including all non-return valves, tide gates, penstocks etc.), stop banks, flood bunds and dams.

The primary purpose of assets within this group is to provide a flood or tidal protection function and as such they are covered by the Flood Protection & Control Works Activity. Pump stations are also (generally) flood protection structures, but due to their complexity and the fact that they are managed under a separate maintenance contract, they are considered separately (refer to Section 8.1.6 - Pumping Station Assets).

These asset groups have not had any assessment for remaining useful life. There is a wide variety of expected life given the variety in materials, design, location and use. There is a reliance on visual condition inspections to assess renewal works.

Stop banks

There is 12.1km of stop banks along the Avon River and estuary areas. These comprise both temporary structures constructed in the post-quake period and permeant pre-quake works. Several stop bank contracts have been carried out over the previsions LTP period by the LDRP team. The stop banks have not been incorporated into a formal asset management process for applying a condition rating or assessing remaining useful life, which is made more difficult being that some of the stop banks are only classed as temporary with an expected 20-year life expectancy. OPEX funding for data quality improvements were applied for, but not approved in the LTP process.

Condition data is not available for stop banks, but regular inspections are programmed to be carried out to meet a level of service performance measure.

Valves

All valves are included within this asset group and are typically associated with a reticulation asset, such as an outlet.

Again, there is an issue with the corporate data management of valves, which needs to be resolved within a programme of work to be done by AMU. Some work has been done over the last financial year to compile a complete data set from asset data held in the CCC asset systems, CCC Operations staff files and held by City Care. While there still may need to be some data checks and cleansing, the single valve data set which is the current best estimate at the asset base as shown in Figure 8-36 below.

Inferring condition based on install date (where known), the standard base life of 100 years from the 2020 valuation and a standard assumed deterioration rate (same as used for Pumping Station assets) does not identify any assets with a condition grade higher than 3, although there are known defects with some valves not performing as required.

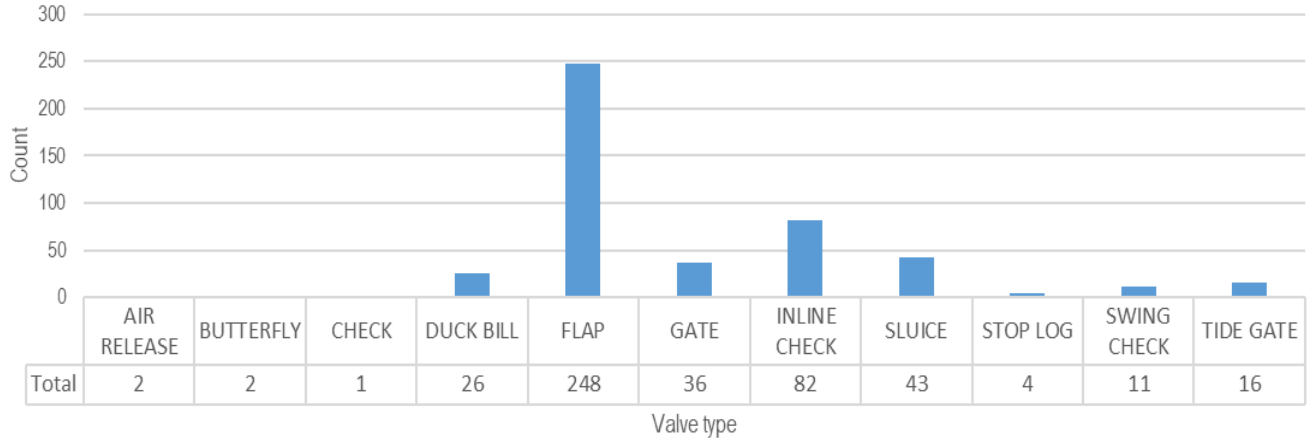


Figure 8-36: Valve data summary (refer to TRIM://18/673503 for source data)

Renewal Plan

The funding model proposed is suitable given the currently knowledge of the corporate data. This is in keeping with the previous funding model approved in the previous AMP. It is anticipated that once the data compilation project to be carried out by AMU and inspections have been carried out to assess asset condition, the budgets for future years will be better informed.

The required funding and 2021 LTP budget is shown in Figure 8-37 and Table 8-10 below.

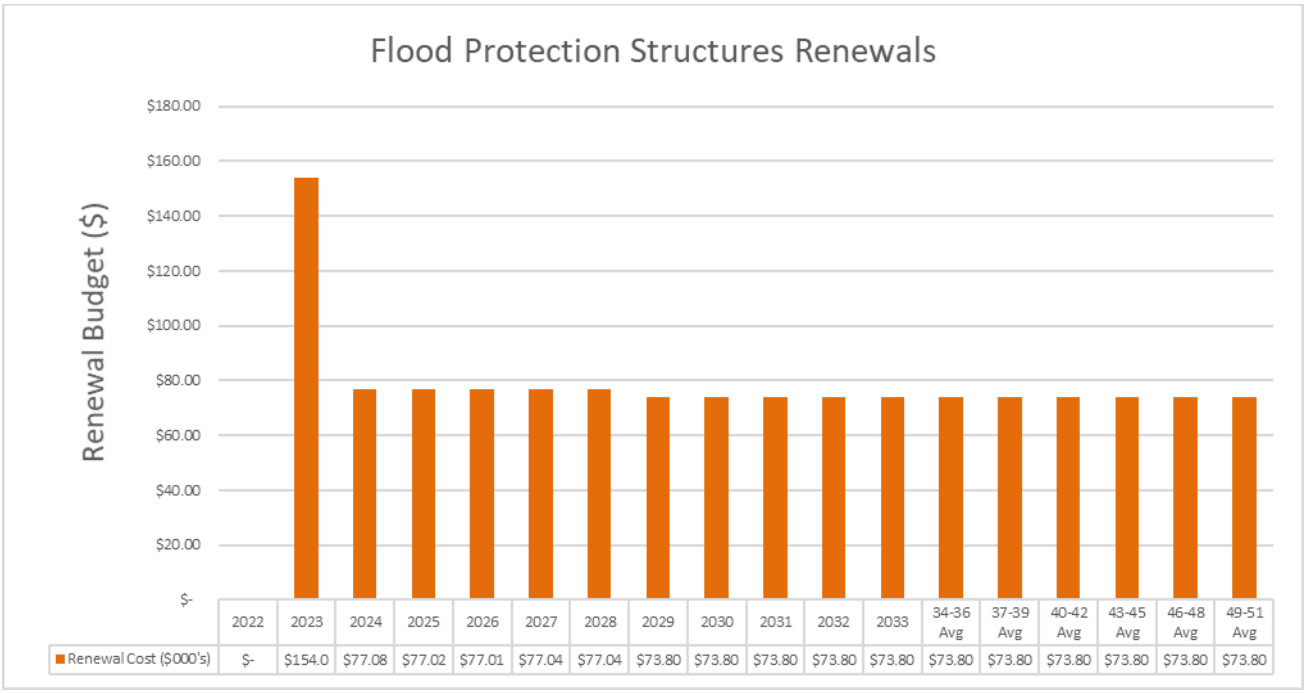


Figure 8-37: Flood Protection Structure recommended expenditure graph

Table 8-10 - Summary of recommended flood protection structures renewal programme and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
41968	Flood Protection Structure Renewals PRG	0.23	0.76	2.24

8.1.8 Treatment and Storage Facilities

The corporate asset data for treatment and storage facilities is limited. A project has been carried out to assess treatment facility condition on 5 basins with known faults due to either insufficient investment in maintenance, or due to design or construction issues. Unfortunately, this project was not of a suitable scope to allow better prediction of condition or remaining asset life for renewals spend profiles beyond what was done for the 2018 AMP. Therefore, the data used for the remaining useful life and condition tables below use is based on the same base data as that used for the 2018 AMP. There will be some facilities that have been completed and in service that are not captured in the data sets. It is hoped that the data improvements can be ascertained before the next AMP, however this is dependent on finding suitable funding within the constrained OPEX budgets of the Asset Management Team.

Currently, the corporate data stores all pipe/nodes/structure data within other renewal programmes, leaving only the linings as a renewable component. There is a project within the AMU to link all parts of the basin to the basin ID to allow a better valuation for each facility to be prepared. This AMU project had been scoped and budget figures provided for approval as part of an LTP bid, however funding was not approved.

As no inspection condition data is available for basins or soakpits, the remaining useful life has been estimated based on the install date and base life used in the 2017 valuation and these are shown in Figure 8-38 and 8-39.

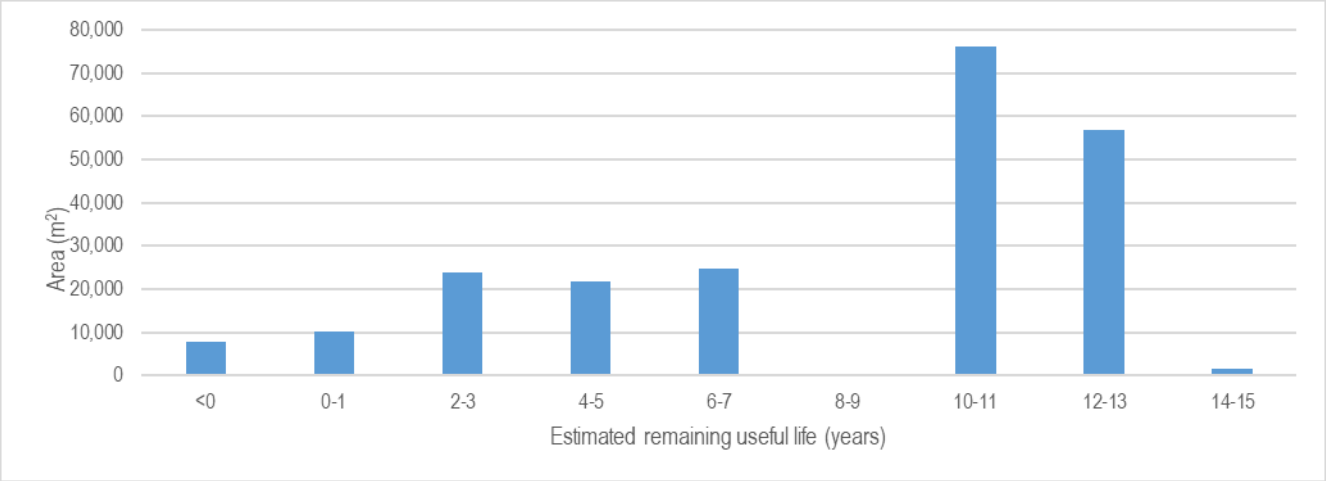


Figure 8.38: Storage and treatment facility lining remaining useful lives

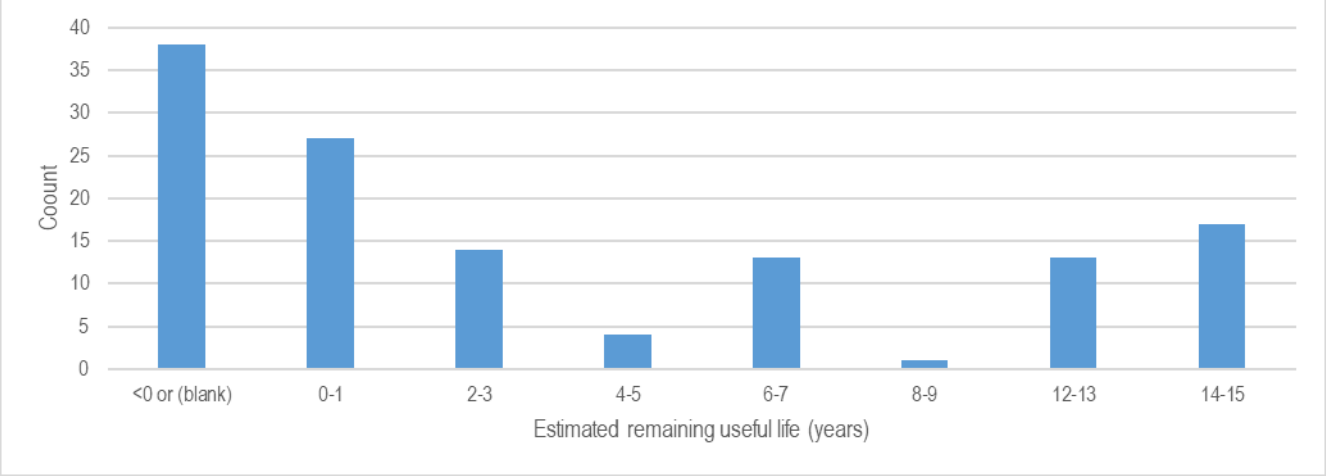


Figure 8.39 Storage and treatment facility soakpit remaining useful lives

Treatment Facilities with Dam Designation

As discussed in *Table 5.3 – Business Unit Identified Risk Items* and *Section 5.4 – Summary of Risk and Resilience Improvements* Council has legal requirements under the Building Act to assess the stormwater treatment facilities against the definition of a "Dam" and to accord with the NZSOLD guidelines. Until recently this classification has not been considered for basins as generally the basin is empty and not considered a "water retaining structure" as compared to a water impoundment dam.

A new proposal for Dam legislation was published to industry in June 2019 by MBIE. The definition for Dam, and critical dam was updated, and the operation of a prudent operator was laid out as MBIE's expectations. The proposed changes to the assessment criteria of a "Classifiable Dam" presented were:

A dam that has either:

1. A height of 4 or more metres and holds 20,000 or more cubic metres volume of water or other fluid; or
2. A height of less than 4 meters and holds 30,000 or more cubic metres volume of water or other fluid.

Although the proposed changes do not appear to have been bought into action (at the time of writing), as prudent asset owners/operators, Council should be working towards compliance for our critical dams to ensure that the risk to public health is well understood and appropriate safety management plans are prepared and reviewed/updated, and the structures are regularly inspected. This will ensure that the public risk is understood and managed, and Council increases its awareness and management capability for these assets, also provides ELT with surety, should a failure take place, that appropriate care can be demonstrated in terms of asset review, reporting, and decision-making.

A small number of the larger facilities in the South-west of the city have been assessed against the NZSOLD guidelines for applicability as a "Dam" as part of the relevant LDRP projects (e.g. Wigram Flood Detention Basin). However, this only covers a very small percentage of the facilities owned and operated by Council.

While it is not expected that there are many facilities that meet the criteria listed above a programme of works needs to be set up to carry out the assessment of all facilities to ascertain which of them fit the definition as a dam, classify the dam according to the potential impact of a dam failure, develop dam safety assurance programmes for relevant facilities (those with a medium or high impact of failure), and carryout improvement works. There is ongoing monitoring of the facilities and reviews of safety plans required.

The initial part of the project will require data collection, including storage of 3d models of facilities where available from consultants, and data interpretation of facility volumes depths and downstream conditions. This will require dedicated, suitably qualified staff to complete this initial work followed by the contracting of a suitable consultant to carry out the assessment, modelling safety reports and ongoing inspections and report updating.

An OPEX bid has been made by the Asset Management 3-Waters team to fund this work, however it was not approved. This may leave Council liable in the event that there is a failure of one of our facilities and damage is caused.

Condition Data

There is limited condition data available for this asset group and currently no formal condition monitoring in place. Inspections and maintenance is being undertaken on a reactive basis only.

A more detailed methodology needs to be developed to accurately assess the physical condition and performance of treatment and storage facilities. This will consider factors such as the percentage of volume lost due to sedimentation build-up and achieving target infiltration and treatment rates.

The condition of infiltration media and impermeable lining has been inferred (using a model[22]) for basins using age, base life from the 2017 valuation (20 years) and an assumed linear deterioration with time. A similar approach was used for soakpits and the results are shown in Figure 8-40.

[22] 2018 Land Drainage AMP – SWBasin Renewals Model TRIM://17/318556

This methodology indicates that 45% of lining and 62% of soakpits are condition grade 3 - 5. Physical inspections and testing are required to validate this.

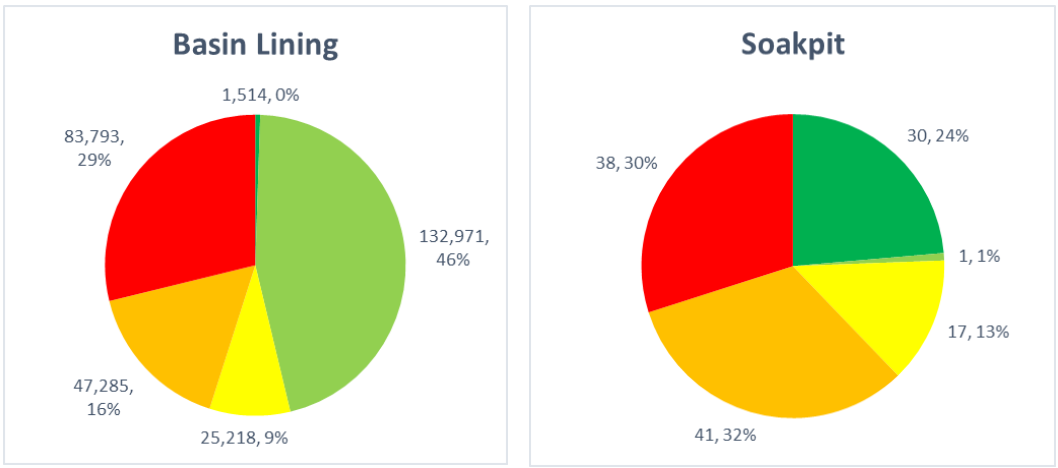


Figure 8-40: Inferred basin lining and soakpit condition grades

CCC is currently developing a process/model whereby lifecycle costs, condition estimation and renewal strategies can be prepared for all Sustainable Drainage Systems (SuDS) in the city. This will include basins, swales, rain gardens, soakage devices etc. In addition to the condition assessment benefits, recommendations will be provided for industry standard maintenance practices to be considered for inclusion in the future Operations and Maintenance contract.

Renewal Plan

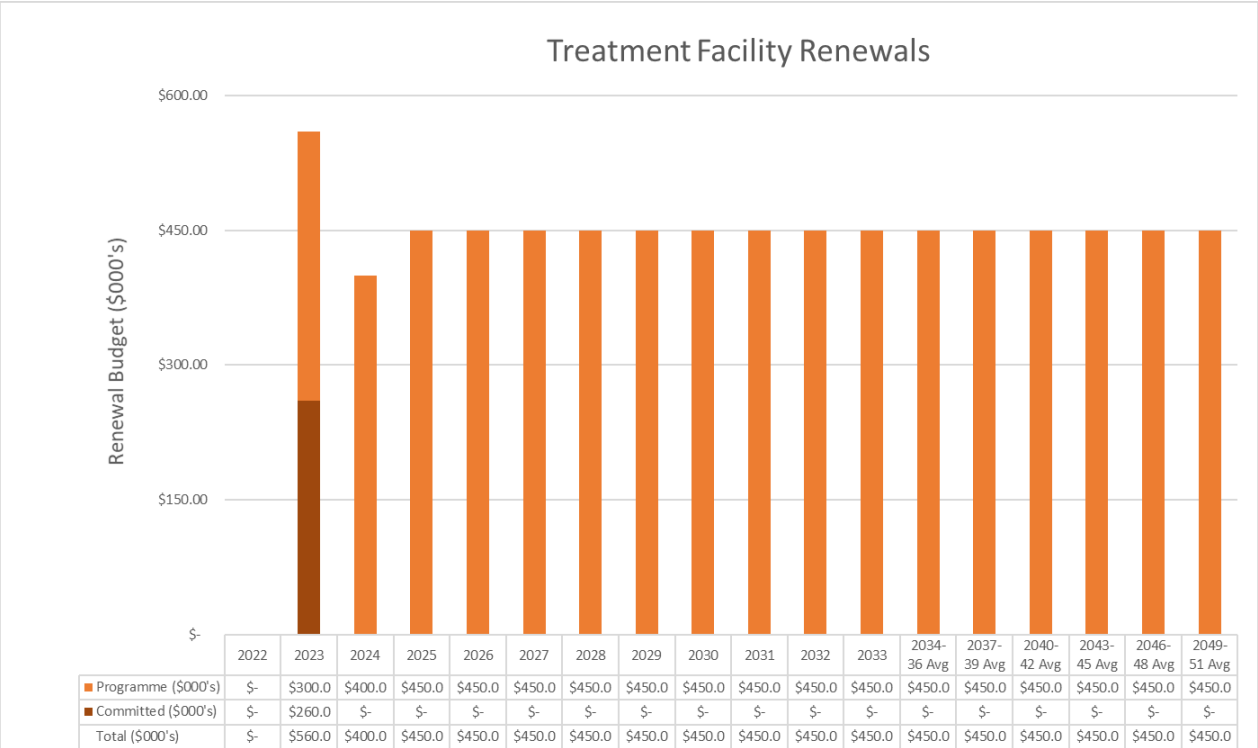
As discussed above, all pipe and node assets associated with basins are scheduled for renewed under a different asset class. Therefore, this renewal plan is based on only replacing the impermeable liner or infiltration media where present. Details on the lining are limited within CCC's data structure, relying on other data based sources and/or engineering judgement to provide the renewal material quantities and type.

The renewal plan for soak pits, as discussed above, is based on the age of the asset only as no condition information is available.

The rates for renewal are based on the 2017 valuation with a multiplier provided by finance. A smoothing has been applied to renewals rates to spread the financial outlay over a longer period of time.

Due to a lack of condition data to schedule renewals, a reliable long-term renewals plan is difficult to provide. It is therefore proposed that the budget for the first two years of the funding period is set to renew basins that have known issues that need remediating. The budget for year 3 will be based on funding required to renew the number of identified assets based on remaining useful life. To better inform a renewal plan for the next LTP period, it is proposed that during FY21/22, in addition to the CAPEX renewal works identified, further investigation is carried out into performance and condition of the treatment facilities (also identified as part of Improvement Item LD-04 in Section 10). If this investment in OPEX is not made, then it CCC will continue to make uninformed renewal decisions, while the assets deteriorate, potentially leading to non-compliances with water quality outcomes.

The required funding and 2021 LTP budget are shown in Figure 8-41 and table 8-11 below.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034-36 Avg	2037-39 Avg	2040-42 Avg	2043-45 Avg	2046-48 Avg	2049-51 Avg
Programme ($000's)	$-	$300.0	$400.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0
Committed ($000's)	$-	$260.0	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Total ($000's)	$-	$560.0	$400.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0	$450.0

Figure 8-41 - Storage and treatment facility renewals proposed expenditure graph

Table 8-11 - Summary of recommended storage and treatment facility renewal programme and cost ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
510	Treatment & Storage Facility Renewals PRG	0.70	3.85	12.85
	Committed Projects			
60214	SW Mackinder Drainage Basin Renewal - 250R Wigram Rd	0.26	0.26	0.26

8.1.9 Reactive Budgets

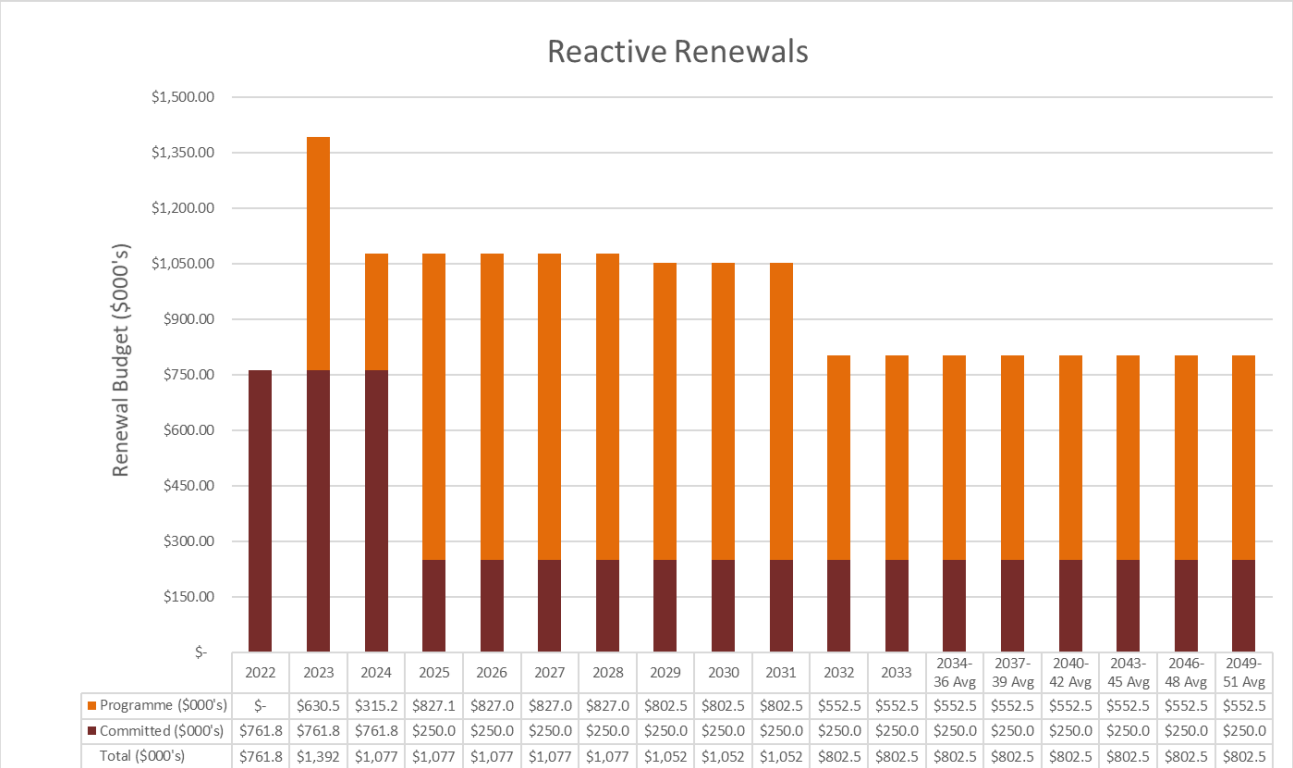
Reactive budgets are required to cover unforeseen failures. In the 2018 AMP, this issue was dealt with by the creation of reactive budgets. The continuation of these budgets is essential to allow for minor reactive works to be carried out, otherwise the works would need to be deferred until they could be fitted into the capital works programme, which could be 3-4 years given the direction from management to empty budgets from the programme into projects at least 2 years ahead of the current financial year. Deferral leads to more costly repairs and a much greater risk of failure causing additional public and private costs.

Renewal Plan

It is recommended that the existing approved budget is maintained for this LTP period, and the actual spend is monitored for further assessment in the next AMP.

As the reactive budgets for the 2018 LTP period have been suitable, it is recommended that the same budgets be continued for the 2021 LTP budget, excluding the Banks Peninsula SW Reactive Renewals. Some of the budgets have been manipulated within the first 3 and 10 years to assist with balancing the 3waters financial cap. Some of the programme level funding has already been drawn down in to projects as can be seen below.

The required funding and 2021 LTP budget are shown in Figure 8-42 and table 8-12 below.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034-36 Avg	2037-39 Avg	2040-42 Avg	2043-45 Avg	2046-48 Avg	2049-51 Avg
Programme ($000's)	$-	$630.5	$315.2	$827.1	$827.0	$827.0	$827.0	$802.5	$802.5	$802.5	$552.5	$552.5	$552.5	$552.5	$552.5	$552.5	$552.5	$552.5
Committed ($000's)	$761.8	$761.8	$761.8	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0	$250.0
Total ($000's)	$761.8	$1,392	$1,077	$1,077	$1,077	$1,077	$1,077	$1,052	$1,052	$1,052	$802.5	$802.5	$802.5	$802.5	$802.5	$802.5	$802.5	$802.5

Figure 8-42 – Reactive renewals proposed expenditure graph

Table 8-12 - Summary of recommended reactive renewal programmes and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
41967	Flood Protection Asset Reactive Renewals (excl PS's) PRG	0.20	0.64	1.89
41866	Stormwater Drainage Reactive Renewals PRG	0.00	3.52	13.32
43802	SW Mains Renewals Affiliated with Roading Works PRG	0.75	2.50	2.50
	Committed Projects			
50348	SW REACTIVE Stormwater Drainage Asset Renewals	1.53	1.53	1.53
50366	SW Mains Renewals Affiliated with Roading Works	0.75	2.50	7.50

8.2 Management Plan – Asset Creation, Improvement and Floodplain

Asset Creation and Improvement Works

Creation of new assets is strongly linked to growth across the City and is managed by the Land Drainage Planning Team. The Stormwater Management Plans (Huritini/Halswell River Area and Puharakekenui/Styx River Areas) provide a "blueprint" for the required infrastructure to meet the demands of growth within the urban boundary, and to ensure compliance with the Comprehensive Stormwater Discharge Consent[23]. The Stormwater Management Plans (SMP) are living documents and can change to reflect changes in development patterns, types of development and new stormwater mitigation technologies. Additionally, projects to create new assets are prioritised according to the programmes delivering Area Plans, the Urban Development Strategy and the Land Use Recovery Programme. It is these plans, programmes and strategies which drive the development of the asset creation plan and interaction with developers.

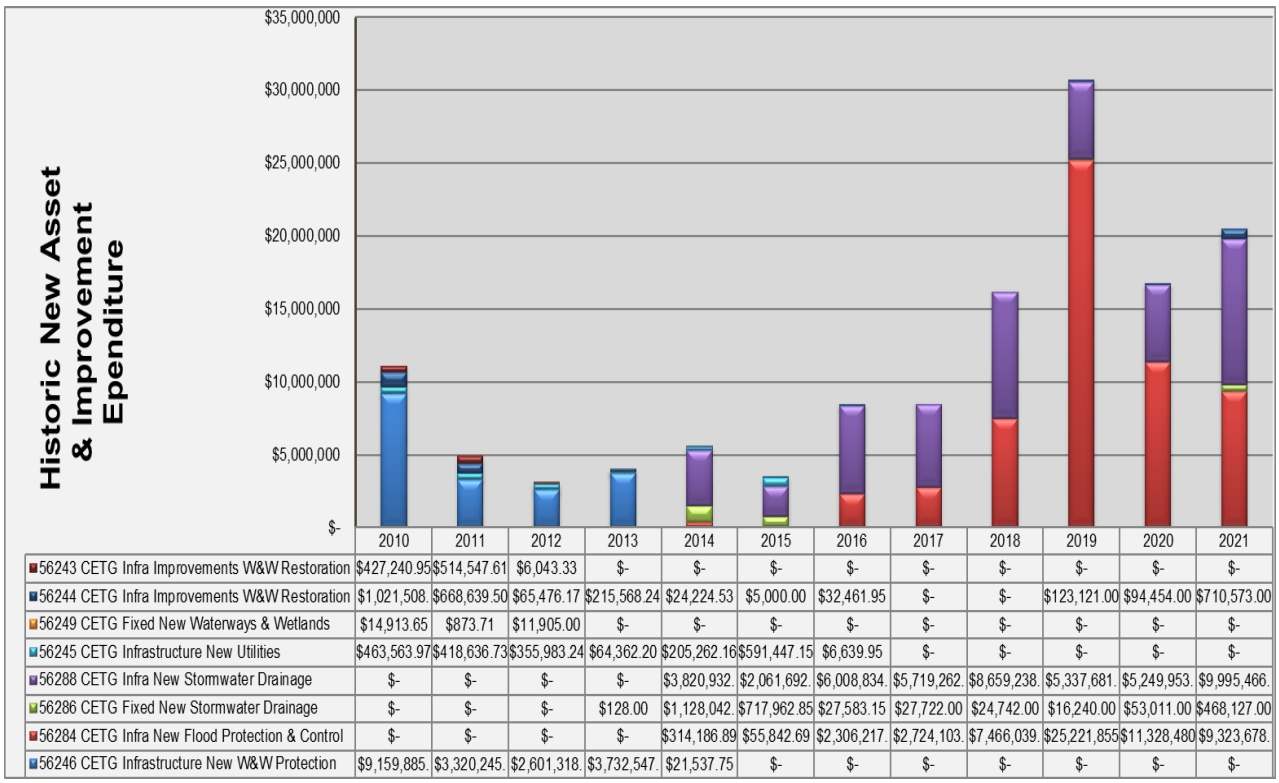
New assets fall under the following categories; New Services, Improved Level of Service and Growth based Projects and can be either council funded (funded and constructed by CCC) or developer funded (funded by developers as part of subdivisions or developer contributions).

Assets creation is also considered based on a need or gap where levels of service will be unable to meet future demand, or as identified by a risk assessment. Areas identified by CCC as requiring capital works to solve a problem undergo different processes depending on the significance of the problem. Projects are selected from a range of options with the intention of optimising the four community well-beings; social, economic, environmental and cultural.

The timing of the delivery of new infrastructure to meet the needs of growth is difficult to manage. Council must monitor developer activity through the pre-application and application processes that exist within Council for potential applicant and maintain a good working relationship with local developers in order to anticipate where new development will occur in the future. There is some ability to reshuffle capital projects to suit new development, and where capital projects cannot be reshuffled, there are options for developers to provide temporary, interim mitigation within their own sites, usually at no cost to the Council.

Figure 8-43 below details the historic expenditure on new and upgraded assets over the previous 12 years. Until 2013, the largest proportion of expenditure was for new Waterways & Wetland Protection and since 2013 this has been renamed Stormwater Drainage. The intention of W&W Protection was to purchase (protect) land for stormwater mitigation projects. Thus the projects in both profit centres included development of stormwater detention and treatment facilities and land purchases. The Utilities profit centre includes the construction of new utility infrastructure such as culverts, sumps and pipes. The results for FY19 are somewhat misleading as there is a single payment made for retrospective land purchases for $10.8M to facilitate the flood protection works in Cranford Basin.

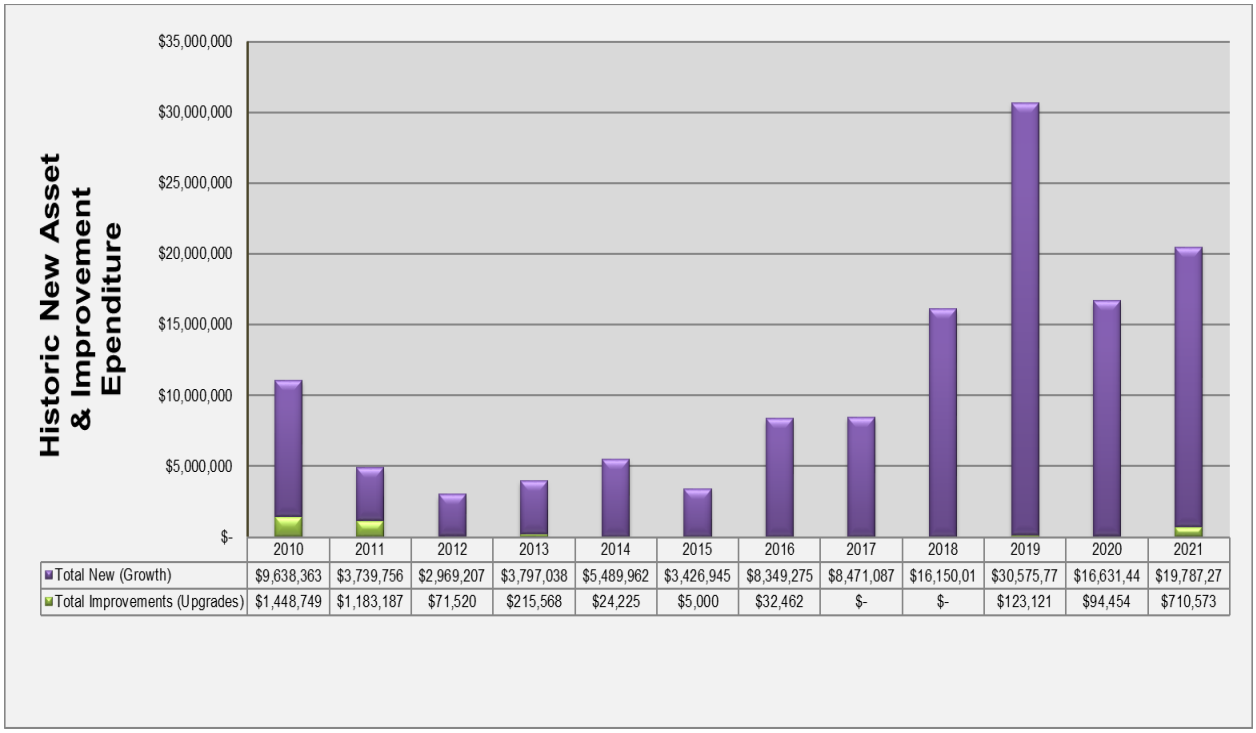
[23] CRC190445 CNSDC Comprehensive Network Stormwater Discharge Consent - *TRIM://19/168116*



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
56243 CETG Infra Improvements W&W Restoration	$427,240.95	$514,547.61	$6,043.33	$-	$-	$-	$-	$-	$-	$-	$-	$-
56244 CETG Infra Improvements W&W Restoration	$1,021,508.	$668,639.50	$65,476.17	$215,568.24	$24,224.53	$5,000.00	$32,461.95	$-	$-	$123,121.00	$94,454.00	$710,573.00
56249 CETG Fixed New Waterways & Wetlands	$14,913.65	$873.71	$11,905.00	$-	$-	$-	$-	$-	$-	$-	$-	$-
56245 CETG Infrastructure New Utilities	$463,563.97	$418,636.73	$355,983.24	$64,362.20	$205,262.16	$591,447.15	$6,639.95	$-	$-	$-	$-	$-
56288 CETG Infra New Stormwater Drainage	$-	$-	$-	$-	$3,820,932.	$2,061,692.	$6,008,834.	$5,719,262.	$8,659,238.	$5,337,681.	$5,249,953.	$9,995,466.
56286 CETG Fixed New Stormwater Drainage	$-	$-	$-	$128.00	$1,128,042.	$717,962.85	$27,583.15	$27,722.00	$24,742.00	$16,240.00	$53,011.00	$468,127.00
56284 CETG Infra New Flood Protection & Control	$-	$-	$-	$-	$314,186.89	$55,842.69	$2,306,217.	$2,724,103.	$7,466,039.	$25,221,855	$11,328,480	$9,323,678.
56246 CETG Infrastructure New W&W Protection	$9,159,885.	$3,320,245.	$2,601,318.	$3,732,547.	$21,537.75	$-	$-	$-	$-	$-	$-	$-

Figure 8 .43: Historic asset creation and improvement expenditure by Activity

Error! Reference source not found. clearly shows that the historic expenditure has focused on asset improvements and shows there has no real funding of improvement works during the previous LTP periods since the earthquakes, with the focus on recovery and constructing works in areas where rapid urban spread was required such as the Preston and Wigram areas.



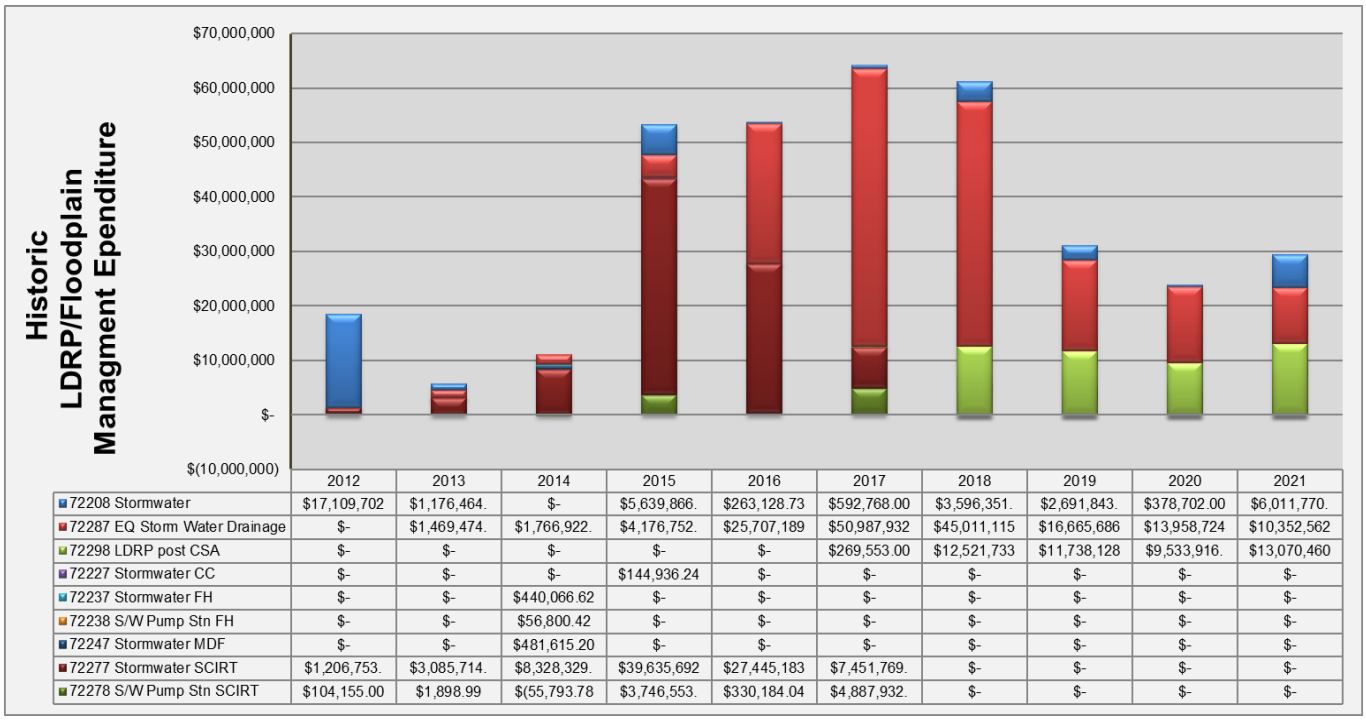
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total New (Growth)	$9,638,363	$3,739,756	$2,969,207	$3,797,038	$5,489,962	$3,426,945	$8,349,275	$8,471,087	$16,150,01	$30,575,77	$16,631,44	$19,787,27
Total Improvements (Upgrades)	$1,448,749	$1,183,187	$71,520	$215,568	$24,225	$5,000	$32,462	$-	$-	$123,121	$94,454	$710,573

Figure 8 .44: Historic asset creation and improvement expenditure (combined summary)

Floodplain Management (FM) Works

As discussed in *Section 6.1 – Historical Context* the Land Drainage Recovery Programme (LDRP) was established by Council in 2012 to return the "likelihood of house flooding" caused by the Canterbury Earthquake sequence to pre-earthquake levels. By the end of 2019, project objectives had been met in some of the worst flooded affected areas (e.g. Flockton Basin and Upper Dudley Creek, Opawhao/Heathcote catchments) and flood mitigation/storage projects in the upper Opawhao /Heathcote catchments had either been completed or were substantially complete. The business agreed to bring the LDRP team into the planning team with a "business as usual" focus on floodplain management thorough the city. The programme of works has been renamed "Floodplain Management Planning (FMP)" with a shift of focus to backlog upgrade works. There are a number of historic LDRP projects in this LTP that are still funded under the LDRP title, and will remain so until they are completed.

Figure 8-45 below details the historic expenditure on flood mitigation works, which includes funding provided to SCIRT for projects such as new pump stations, over the LDRP's 10-year operational period.



	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
72208 Stormwater	$17,109,702	$1,176,464.	$-	$5,639,866.	$263,128.73	$592,768.00	$3,596,351.	$2,691,843.	$378,702.00	$6,011,770.
72287 EQ Storm Water Drainage	$-	$1,469,474.	$1,766,922.	$4,176,752.	$25,707,189	$50,987,932	$45,011,115	$16,665,686	$13,958,724	$10,352,562
72298 LDRP post CSA	$-	$-	$-	$-	$-	$269,553.00	$12,521,733	$11,738,128	$9,533,916.	$13,070,460
72227 Stormwater CC	$-	$-	$-	$144,936.24	$-	$-	$-	$-	$-	$-
72237 Stormwater FH	$-	$-	$440,066.62	$-	$-	$-	$-	$-	$-	$-
72238 S/W Pump Stn FH	$-	$-	$56,800.42	$-	$-	$-	$-	$-	$-	$-
72247 Stormwater MDF	$-	$-	$481,615.20	$-	$-	$-	$-	$-	$-	$-
72277 Stormwater SCIRT	$1,206,753.	$3,085,714.	$8,328,329.	$39,635,692	$27,445,183	$7,451,769.	$-	$-	$-	$-
72278 S/W Pump Stn SCIRT	$104,155.00	$1,898.99	$(55,793.78	$3,746,553.	$330,184.04	$4,887,932.	$-	$-	$-	$-

Figure 8-45: Historic LDRP and Floodplain Management Expenditure (combined summary)

Expenditure Plan

The majority of the forecast spend is based on development as a result of the area plans for the south west of the City and the Styx area. There are a small number of committed projects that will reach completion during the 2021 LTP period, but the majority of the works are either those that extend through the 10-year period, or long-term programmes that continue through the 30-year Infrastructure Strategy period.

As can be seen in Figure 8.45 below, the portion of expenditure identified for asset improvements is very minor as compared to the value identified for growth. While this is to be expected to meet the demands of growth in the city (as discussed in Section 4.0 Demand for our services) this does little to provide the advancements needed to meet Councils strategic direction for health water bodies and high quality ground water. To meet the council legislated directions, as well as Freshwater Quality requirements as legislated by Central Government, a more comprehensive programme for waterway improvements are recommended. To improve the state of the city's waterways additional waterway enhancement projects have been proposed divided into catchments. However, due to the current financial constraints, these additional projects are not to commence until after this 3-year LTP period.

A number of programmes to start planning for climate change adaptation were proposed in the original recommended funding option including coastal flood management, groundwater management monitoring and lower river erosion and

deposition management. However due to the financial constraints applied to LTP budgets, and Councils Climate Change strategies not being developed enough to provide clear guidance for infrastructure decisions to be made, these programmes of work have not been funded apart from $500,000.00 in the Flood Mitigation programme in FY's 2030 & 2031.

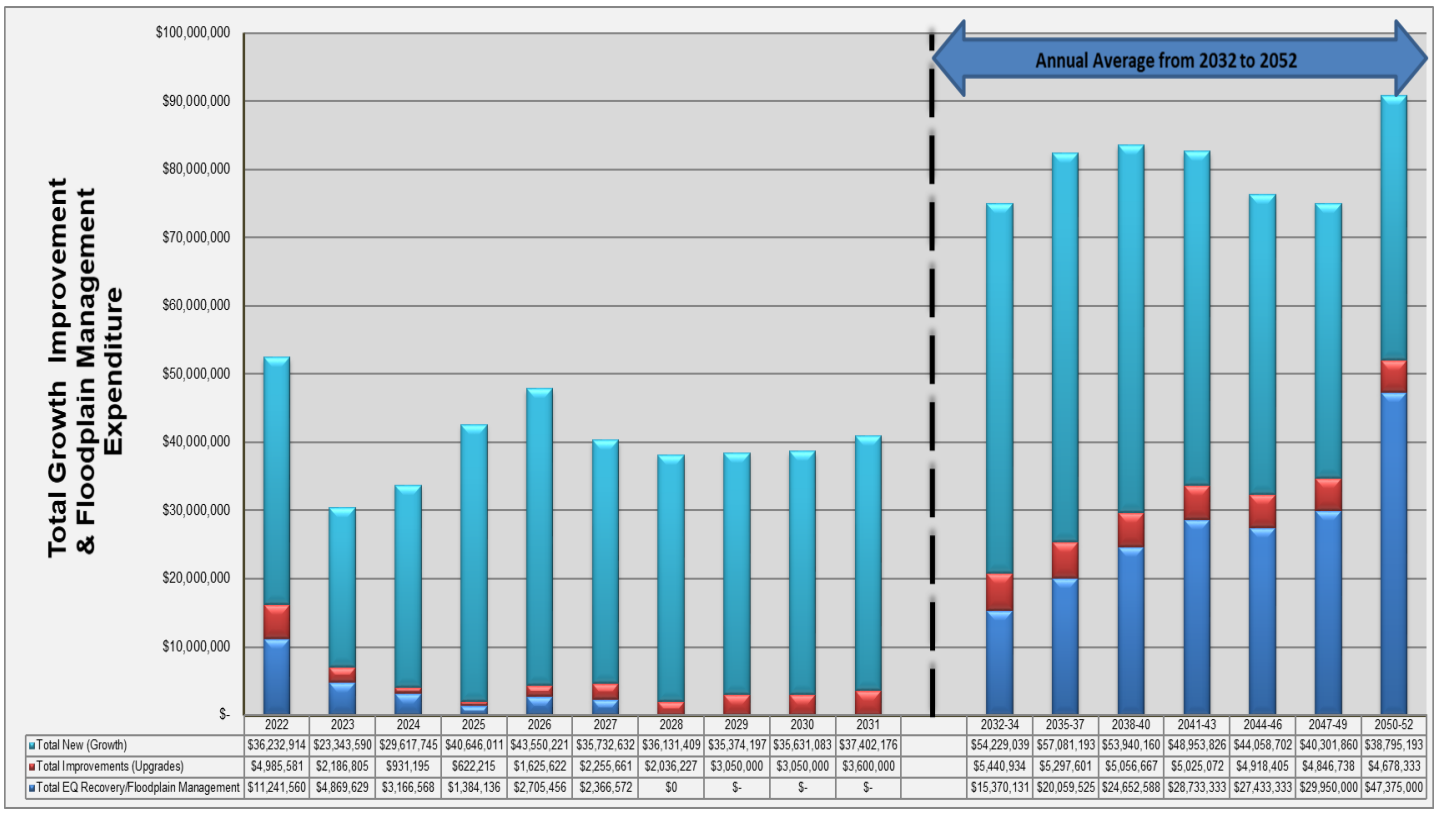
In addition to the historic LDRP projects a number of new Floodplain Management Programmes and projects have been nominated for funding as part of this LTP. The new projects focus is on addressing the backlog of upgrades required to resolve areas of flooding caused by undersized pipes and increased urban density. The initial outputs of the City Wide Model were used to predict flooding for the 10 year and 50 year events, and from this a prioritised list of 16 candidates for upgrade has been proposed. Like the LDRP projects, the FMP projects were prioritised based on qualitative and quantitative assessment criteria. However, as mentioned above, a number of the FMP projects were deferred to meet budget constraints, with 2 of the 16 projects commencing with the 3-year forecast, 11 either complete or started within the 10-year forecast and 4 outside the 10-year forecast.

The majority of the works requiring funding to fulfil the stormwater and waterways functions in the Otakaro-Avon River Corridor works sits outside the 10-year Infrastructure Strategy period. A memo was prepared by the Planning Team in March 2020 which proposed and accelerated programme of works to meet the floodplain and ecological infrastructure requirements in the corridor, with delivery within the 10-year period. This would also ensure that there would be full integration and a co-ordinated development approach with works from other Council activities such as Roading and Parks. This funding model was carried forward into the original recommended LTP funding option. Again budget constraints mean that this accelerated programme was not possible, resulting in the majority of the works being deferred outside of the 10-year Infrastructure Strategy period with only 3 projects being funded (Waitaki Wetland with permanent stopbanks and Waikakiriki/Horseshoe Lake treatment facility) and some funding for future and cross activity planning.

One area of funding well planned for is the creation, completion, upkeep and operation of models for water quantity and quality/treatment management. While the Planning team has been operating and using flood depth models for advice on finished floor levels etc. for some time, this has not extended to hydraulic catchment or water quality models. While the City Wide Catchment Models have been progressed under the former LDRP team, these models (Avon catchment and Heathcote/Halswell catchments) are "standalone" with discrete boundaries between them. Further work on model development is still required, including the development of the Styx Catchment model. Additionally, the models are to be used by the business teams to assist decision making throughout the asset lifecycle; for growth & network planning, operations and maintenance, and asset management & renewal. A comprehensive programme of works has been developed by the Hydraulic Modelling Manager (refer to Flood Modelling Projects Programme[24] for source data).

A summary of the asset creation improvement and floodplain management costs are shown in Figure 8-46, with the major programmes and projects in Tables 8-13 to 8-15 divided into relevant portfolios below.

[24] Flood Modelling Projects and Categories for LTP Data TRIM://20/104905



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
Total New (Growth)	$36,232,914	$23,343,590	$29,617,745	$40,646,011	$43,550,221	$35,732,632	$36,131,409	$35,374,197	$35,631,083	$37,402,176	$54,229,039	$57,081,193	$53,940,160	$48,953,826	$44,058,702	$40,301,860	$38,795,193
Total Improvements (Upgrades)	$4,985,581	$2,186,805	$931,195	$622,215	$1,625,622	$2,255,661	$2,036,227	$3,050,000	$3,050,000	$3,600,000	$5,440,934	$5,297,601	$5,056,667	$5,025,072	$4,918,405	$4,846,738	$4,678,333
Total EQ Recovery/Floodplain Management	$11,241,560	$4,869,629	$3,166,568	$1,384,136	$2,705,456	$2,366,572	$0	$-	$-	$-	$15,370,131	$20,059,525	$24,652,588	$28,733,333	$27,433,333	$29,950,000	$47,375,000

Figure 8-46: Summary of new asset creation, improvement and floodplain management costs

Table 8-13 - Summary of major new asset creation programmes/projects and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
369	Piped Systems - Pipe Drains (New)	0.30	3.80	20.83
973	South West SMP - Defined Projects - Waterways Detention and Treatment Facilities	0.01	10.36	45.86
990	Open Water Systems - open drains reactive	0.40	3.14	13.14
2415	STYX SMP - Defined Projects - Waterway Detention and Treatment Facilities	0.02	39.73	294.41
2416	AVON SMP - Defined Projects - Waterways Detention and Treatment facilities	1.38	21.50	160.91
3412	Programme - Waterways & Wetlands Land Purchases	0.00	5.25	56.00
19398	Heathcote SMP	0.20	22.51	153.56
32243	SW Sutherlands Basin (Welsh) Stormwater Treatment	19.17	19.17	19.17
33975	SW Spreydon Lodge - Infrastructure Provision Agreement (IPA)	3.52	3.97	6.97
33976	SW Rossendale - Infrastructure Provision Agreement (IPA)	2.34	4.02	4.02
36063	SW Coxs - Quaifes Facility	0.80	0.80	0.80
37343	SW Highsted Land Purchase & Construction of Waterways, Basins & Wetlands	1.78	1.78	1.78
38022	SW Blakes Road Stormwater Facility (Works 1)	5.41	5.76	5.76
38088	SW Gardiners Stormwater Facility	2.72	2.72	2.72

38090	SW Greens Stormwater Facility	1.10	13.70	13.70
38091	SW Otukaikino Stormwater Facility	3.74	17.81	17.81
41896	SW Styx Centre Cost Share	2.50	2.50	2.50
41899	SW Carrs Corridor - Stage 2	0.00	0.54	0.54
41900	SW Creamery Ponds	0.00	1.25	1.25
41987	SW Addington Brook and Riccarton Drain Filtration Devices	1.60	9.78	20.01
41988	SW Treepits and Raingardens New Brighton Suburban Centre	0.00	0.00	0.98
41998	Estuary and Coastal SMP	0.00	24.10	30.59
41999	Outer Christchurch Otukaikino SMP	0.00	1.59	6.49
42000	Banks Peninsula Settlements SMP	0.00	1.56	6.49
42008	Lyttelton Stormwater Improvements	0.26	2.41	2.41
44417	SW Guthries Thompson Basins	0.00	0.60	0.60
44421	SW Kainga Basins	0.55	10.01	10.01
44577	SW Highsted Styx Mill Reserve Wetland	2.35	11.85	11.85
44585	SW Highsted Wetland, Highams Basin & Styx Stream	9.79	13.89	13.89
53890	SW Copper Ridge PDA	0.24	0.24	0.24
56116	SW Snellings Drain Enhancement at Prestons South	1.36	1.36	1.36
56166	SW Waikākāriki - Horseshoe Lake Stormwater Treatment Facility - Stage 1 (OARC)	2.62	12.16	12.16
56168	SW Open Drains Reactive Rolling Project	0.15	0.15	0.15
56178	SW Piped Systems Reactive Rolling Project	0.15	0.15	0.15
56179	SW Waterways & Wetlands Land Purchases Reactive Rolling Project	0.98	0.98	0.98
56950	South New Brighton Set-back Bund – Bridge St to Jetty	0.37	0.37	0.37
57718	SW Waikākāriki - Horseshoe Lake Stormwater Treatment Facility - Stage 2 (OARC)	0.05	12.08	12.08
60036	SW Horners Kruses Land Purchase	4.72	6.80	6.80
60055	SW Dudley Diversion Basins	0.00	0.00	18.00
60230	SW Dudley Diversion Wetlands	0.00	0.00	15.00
60265	SW Quaifes Murphys Extended Detention Basin	0.05	0.73	0.73
60436	Programme - SW Fish Passage Barrier Remediation	1.15	3.15	8.15
45210	South West SMP - Provisional Projects - Waterways & Treatment Facilities	0.00	0.00	0.00
45211	STYX SMP - Provisional Projects - Waterways & Treatment Facilities	0.00	0.00	0.00
45212	AVON SMP - Provisional Projects - Waterways Detention and Treatment facilities	0.00	0.00	0.00
60357	SW Multi-Use Arena MUA Stormwater System Upgrades	0.00	0.00	7.25
60356	SW Port Hills and Lyttelton Harbor Erosion and Sediment Control Programme	0.50	3.30	36.40

63038	Programme Flood and Stormwater Priority Works (OARC)	4.10	20.00	20.00
60355	CHAP Coastal Flood Management Programme	0.00	0.50	0.50
60354	CHAP Lower River Erosion and Deposition Management Programme	0.00	0.00	0.00
60347	CHAP Groundwater Management Programme	0.00	0.00	0.00
60376	Programme - Stormwater (Quantity) Modelling Programme	1.00	2.73	7.21
60378	Programme - Stormwater (Quality and Treatment) Modelling Programme	0.27	0.93	2.82
60386	SW FM Flood Model Build Styx and Citywide Renewals	0.63	0.90	0.90
62924	SW Flood Management Avon River Flood Modelling	1.20	1.20	1.20

Table 8-14 - Summary of recommended waterway ecology improvement programmes/projects and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
989	Programme – SW Waterway Ecology and Water Quality Improvement	0.00	0.00	40.80
44457	Open Water Systems - Utility Drain Improvements	0.00	9.62	45.62
56115	SW Sutherlands Road Waterway Enhancements (IPA)	0.23	0.23	0.23
56318	SW Cashmere Stream Enhancement - 564 Cashmere Road	5.35	5.35	5.35
56343	SW Quarry Road Drain Conveyance Improvements & Sutherlands Road Culverts	2.52	2.52	2.52
60455	SW WE St Albans Creek Naturalisation	0.00	1.70	3.17
60456	SW WE Upper Dudley Creek Naturalisation	0.00	1.85	9.47
60457	SW WE Jacksons Creek Naturalisation	0.00	1.00	2.52
60458	SW WE Brittans Drain Naturalisation	0.00	0.40	3.24
60460	SW WE Lower Styx Tributaries Naturalisation	0.00	1.67	1.74

Table 8-15 - Major Floodplain Management programmes/projects and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
26599	LDRP 500 Cashmere Worsleys Flood Storage	4.02	4.52	4.52
26891	LDRP 515 Estuary Drain	0.47	0.47	0.47
28741	LDRP 506 Dudley Creek tributaries	0.00	0.00	23.02
28744	LDRP 505 Sumner Stream and Richmond Hill Waterway	0.00	0.00	9.31
29076	LDRP 531 Charlesworth Drain	2.00	2.00	2.00
33259	LDRP 510 Wairarapa, Wai-iti and Tributaries	0.46	4.26	4.26
35140	LDRP 518 Mid Heathcote Bank Stabilisation	0.08	0.08	0.08

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
35900	LDRP 513 PS205	2.88	2.88	2.88
41638	LDRP 511 Upper Avon	0.00	2.15	2.15
41639	LDRP 521 Avon Floodplain Management Implementation (OARC)	0.00	0.00	325.00
44056	LDRP 509 Knights Drain Ponds	6.06	6.06	6.06
45455	LDRP 526 Curletts Flood Storage	0.59	0.59	0.59
46181	LDRP 527 Heathcote Dredging	0.37	0.37	0.37
46688	LDRP 529 Heathcote Low Stopbanks	0.00	0.00	26.83
48918	LDRP 530 Upper Heathcote Storage Optimisation	0.45	0.45	0.45
55592	LDRP 533 Halswell Modelling	0.55	0.55	0.55
57329	LDRP 534 St Albans Creek Slater to Hills	0.13	0.13	0.13
61639	SW Remediation to Earthquake Related Damaged Drain Linings - Dudley Creek	1.23	1.23	1.23
60235	SW FM Bishopdale Flood Management	0.00	5.24	5.24
60237	SW FM Cross and Taylors Stream Flood Management	0.00	0.00	13.49
60238	SW FM Wilderness Drain Catchment Flood Management	0.00	0.00	20.75
60239	SW FM Moncks Bay Flood Management	0.00	0.00	5.55
60241	SW FM Paparua Stream Flood Management	0.00	0.75	0.75
60242	SW FM Riccarton Main Drain Flood Management	0.00	0.15	22.10
60243	SW FM McCormacks Bay Flood Management	0.00	0.75	0.75
60245	SW FM Pope's Stream Flood Management	0.00	0.00	1.18
60246	SW FM Lower Heathcote Valley Flood Management	0.00	0.82	0.82
60247	SW FM Weir Place Flood Management	0.12	0.14	0.14
60249	SW FM Greenpark Flood Management	0.00	0.45	0.45
60251	SW FM Hillsborough Flood Management	0.00	1.62	3.34
60252	SW FM Marion St Flood Management	0.00	0.90	1.90
60254	SW FM Briggs Road Flood Management	0.00	0.26	0.36
60255	SW FM Remuera Avenue Flood Management	0.00	0.35	0.35
60256	SW FM Redcliffs North Flood Management	0.00	0.15	0.60
61615	SW Flood Mitigation South New Brighton / Southshore	3.30	6.10	6.10
62925	SW Flood Management LDRP 521 Stage 1 Waitaki Street (OARC)	8.20	9.20	9.20

8.3 Operations and Maintenance Plan

Historic actual operations and maintenance expenditure has been recorded in SAP and is shown in Figure 8-47 below (refer to OPEX & Historic CAPEX Financial Data[25] for source data). The following costs have been included for the historic cost and future projections -

- Activity Costs – Direct Operating Costs, Direct Maintenance Costs, Staff and Contract Personnel costs, Disposal costs.
- Total Overheads – Corporate Overheads, Internal costs, Service Level Agreements, Insurance, Rates, Depreciation, Debt Servicing and Interest.
- Revenue – Fees and Charges, Grants and Subsidies, Cost Recoveries, Capital Revenues.

The major changes over time indicated by the SAP data is to the maintenance costs and depreciation figures. The maintenance costs increased rapidly in 2011/2012 to a peak of $16.1M following the Canterbury Earthquake Sequence before reducing and fluctuating at around $9M-$10M. There has been a reduction in maintenance spend from 2018-2020 as directed by 3-Waters Management to balance some of the costs of overspend in the Water and Wastewater maintenance budgets. The maintenance figures shown below for 2021 reflect the budget figures as should be spent to maintain the asset base, not what is actually being spent i.e. $ 6.7M actual in 2020 vs. $12.4M required in 2021.

To manage the reduction in money available over the 2018-2020 period the Maintenance teams:

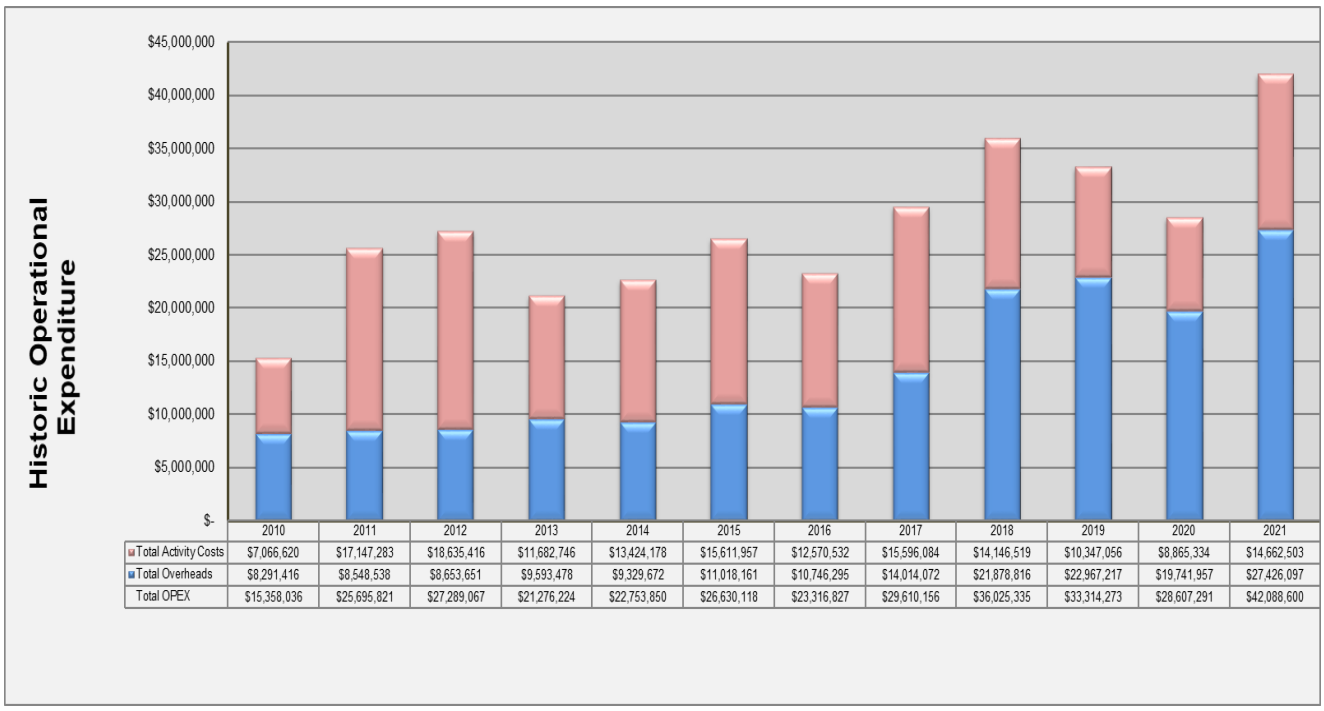
- Significantly reduced the amount of urgent reactive repair works being carried out,
- Deferred less urgent reactive works/repairs,
- Reduced the amount of planting or bank naturalisation carried out,
- Trailed a “no-cutting” philosophy for river bank works, and
- Minimised the amount of maintenance works carried out on stormwater treatment/attenuation facilities.

This deferral of maintenance works has been a “false economy” as this approach has led to a more costly repair when funding was released. As the Op’s team carried out the repairs rather than the Capital works team, the cost savings by not doing the work when required was exceeded by the more expensive repairs. The river banks no-cutting philosophy resulted in an increase of customer complaints and a lower satisfaction response in the annual customer survey.

There was a marked increase in the depreciation figures from 2018 resulting from two sources. The first was due to the 2017 valuation having identified a greater number of assets than previously realised, and due to the number of large works being constructed by the former LDRP team.

Total expenditure has increased from $15.3M in 2010 to a peak of $36.0M in 2018 before being constrained to $28.6M in 2020. The final spend for 2021 is yet to be realised.

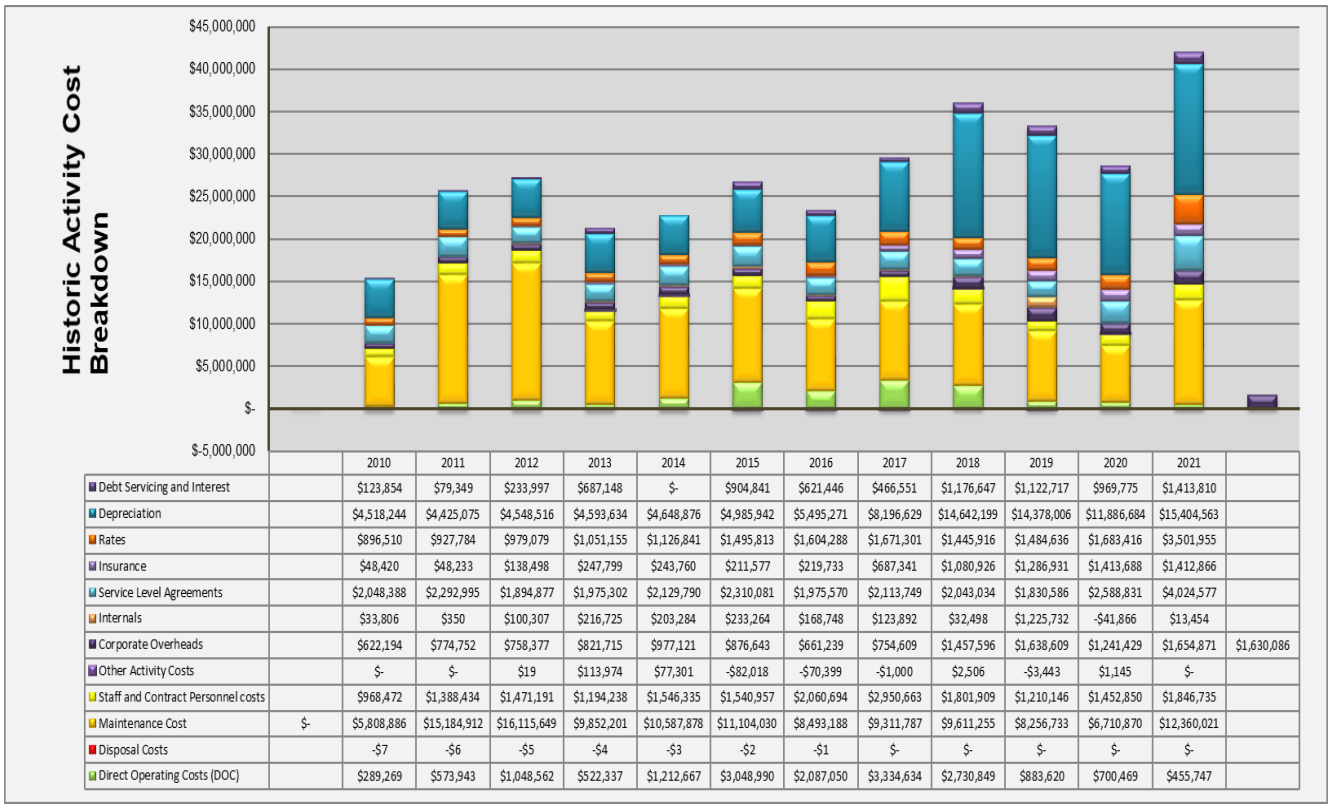
[25] 2018 Land Drainage AMP OPEX & Historic CAPEX Financial Data TRIM://17/1335590



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total Activity Costs	$7,066,620	$17,147,283	$18,635,416	$11,682,746	$13,424,178	$15,611,957	$12,570,532	$15,596,084	$14,146,519	$10,347,056	$8,865,334	$14,662,503
Total Overheads	$8,291,416	$8,548,538	$8,653,651	$9,593,478	$9,329,672	$11,018,161	$10,746,295	$14,014,072	$21,878,816	$22,967,217	$19,741,957	$27,426,097
Total OPEX	$15,358,036	$25,695,821	$27,289,067	$21,276,224	$22,753,850	$26,630,118	$23,316,827	$29,610,156	$36,025,335	$33,314,273	$28,607,291	$42,088,600

Figure 8-47 Historic Total Operations and Maintenance Expenditure

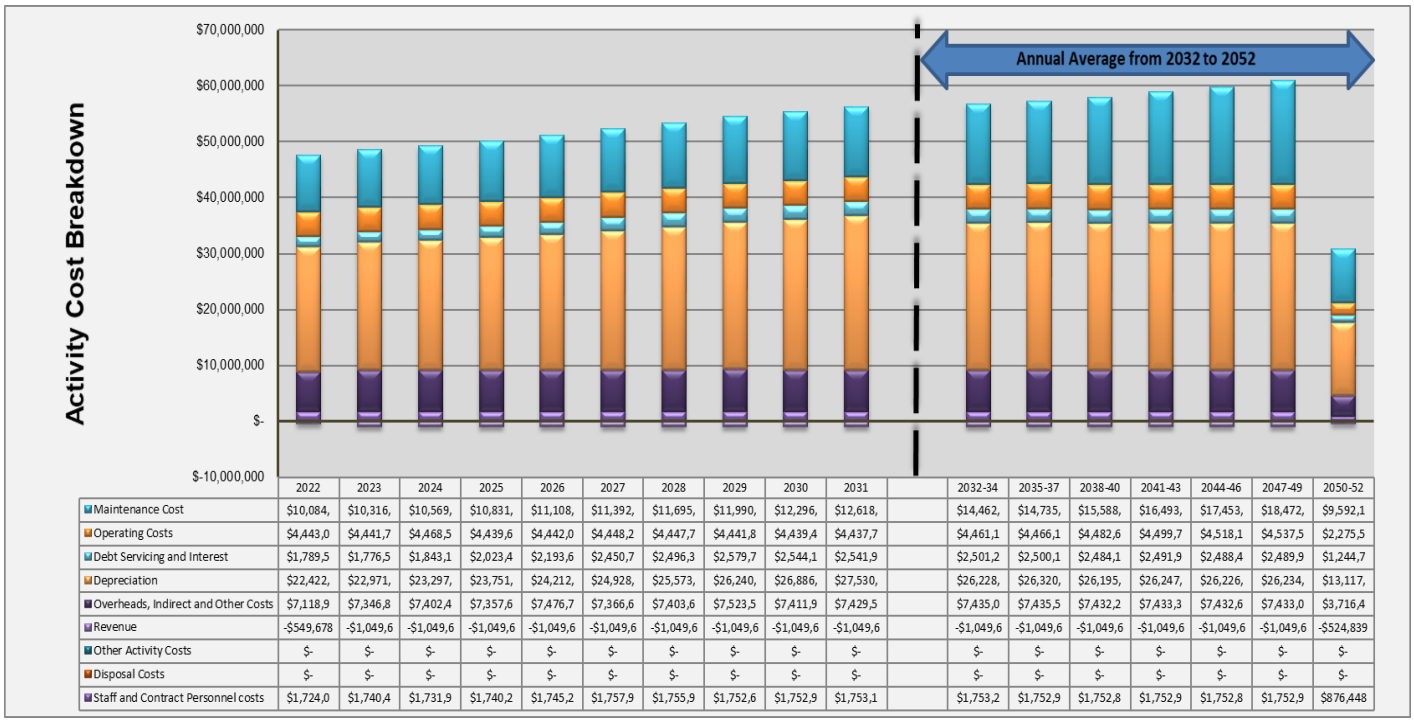
Figure 8-48below shows breakdown of the specific Operation and Maintenance components. The data needed to be mined from various Council financial systems and combined manually into a single data set in a spreadsheet. It is hoped that this process will become more streamlined for the next LTP process.



		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Debt Servicing and Interest		$123,854	$79,349	$233,997	$687,148	$-	$904,841	$621,446	$466,551	$1,176,647	$1,122,717	$969,775	$1,413,810	
Depreciation		$4,518,244	$4,425,075	$4,548,516	$4,593,634	$4,648,876	$4,985,942	$5,495,271	$8,196,629	$14,642,199	$14,378,006	$11,886,684	$15,404,563	
Rates		$896,510	$927,784	$979,079	$1,051,155	$1,126,841	$1,495,813	$1,604,288	$1,671,301	$1,445,916	$1,484,636	$1,683,416	$3,501,955	
Insurance		$48,420	$48,233	$138,498	$247,799	$243,760	$211,577	$219,733	$687,341	$1,080,926	$1,286,931	$1,413,688	$1,412,866	
Service Level Agreements		$2,048,388	$2,292,995	$1,894,877	$1,975,302	$2,129,790	$2,310,081	$1,975,570	$2,113,749	$2,043,034	$1,830,586	$2,588,831	$4,024,577	
Internals		$33,806	$350	$100,307	$216,725	$203,284	$233,264	$168,748	$123,892	$32,498	$1,225,732	-$41,866	$13,454	
Corporate Overheads		$622,194	$774,752	$758,377	$821,715	$977,121	$876,643	$661,239	$754,609	$1,457,596	$1,638,609	$1,241,429	$1,654,871	$1,630,086
Other Activity Costs		$-	$-	$19	$113,974	$77,301	-$82,018	-$70,399	-$1,000	$2,506	-$3,443	$1,145	$-	
Staff and Contract Personnel costs		$968,472	$1,388,434	$1,471,191	$1,194,238	$1,546,335	$1,540,957	$2,060,694	$2,950,663	$1,801,909	$1,210,146	$1,452,850	$1,846,735	
Maintenance Cost	$-	$5,808,886	$15,184,912	$16,115,649	$9,852,201	$10,587,878	$11,104,030	$8,493,188	$9,311,787	$9,611,255	$8,256,733	$6,710,870	$12,360,021	
Disposal Costs		-$7	-$6	-$5	-$4	-$3	-$2	-$1	$-	$-	$-	$-	$-	
Direct Operating Costs (DOC)		$289,269	$573,943	$1,048,562	$522,337	$1,212,667	$3,048,990	$2,087,050	$3,334,634	$2,730,849	$883,620	$700,469	$455,747	

Figure 8-48: Historic Operations Expenditure by Activity

The proposed operating and maintenance budget for this LTP is as per Figure 8-49 below.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
Maintenance Cost	$10,084,	$10,316,	$10,569,	$10,831,	$11,108,	$11,392,	$11,695,	$11,990,	$12,296,	$12,618,	$14,462,	$14,735,	$15,588,	$16,493,	$17,453,	$18,472,	$9,592,1
Operating Costs	$4,443,0	$4,441,7	$4,468,5	$4,439,6	$4,442,0	$4,448,2	$4,447,7	$4,441,8	$4,439,4	$4,437,7	$4,461,1	$4,466,1	$4,482,6	$4,499,7	$4,518,1	$4,537,5	$2,275,5
Debt Servicing and Interest	$1,789,5	$1,776,5	$1,843,1	$2,023,4	$2,193,6	$2,450,7	$2,496,3	$2,579,7	$2,544,1	$2,541,9	$2,501,2	$2,500,1	$2,484,1	$2,491,9	$2,488,4	$2,489,9	$1,244,7
Depreciation	$22,422,	$22,971,	$23,297,	$23,751,	$24,212,	$24,928,	$25,573,	$26,240,	$26,886,	$27,530,	$26,228,	$26,320,	$26,195,	$26,247,	$26,226,	$26,234,	$13,117,
Overheads, Indirect and Other Costs	$7,118,9	$7,346,8	$7,402,4	$7,357,6	$7,476,7	$7,366,6	$7,403,6	$7,523,5	$7,411,9	$7,429,5	$7,435,0	$7,435,5	$7,432,2	$7,433,3	$7,432,6	$7,433,0	$3,716,4
Revenue	-$549,678	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$524,839
Other Activity Costs	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Disposal Costs	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Staff and Contract Personnel costs	$1,724,0	$1,740,4	$1,731,9	$1,740,2	$1,745,2	$1,757,9	$1,755,9	$1,752,6	$1,752,9	$1,753,1	$1,753,2	$1,752,9	$1,752,8	$1,752,9	$1,752,8	$1,752,9	$876,448

Figure 8-49: Operations and Maintenance Expenditure by Activity

Operating and maintenance issues

The general day-to-day operation and maintenance of the land drainage assets is suitable to meet the majority of Councils levels of service that need to be reported to the Department of Internal Affairs. However, this is due to many of the "reported on" levels of service mainly focus on discrete events such as flooding and enforcement/prosecution notices.

The main Operational issues are:

- Data management – fault information is not accurately reported on by the maintenance provider, fault information is not logged against the actual asset ID and the costs are not correctly lodged against the asset in SAP.
- Maintenance Contract – is not prescriptive enough, not all tasks are quantified and there are not sufficient reporting requirements.
- Loss of institutional knowledge from within Council and its maintenance provider.

In discussion with the Council Operations staff, the loss of institutional knowledge, both within Council as well as with the current maintenance provider's staff needs to be addressed urgently. For example, while the mechanical operation of the Woolston Barrage is understood, the parameters for when the barrage should be opened/closed with respect to tidal and river levels is less well understood. This also pertains to inter-catchment relationships where it may not be clear where flood water may spill between catchments due to restrictions etc. These issues may be able to be mitigated by holding workshops where information is provided by key staff such that the local industry knowledge is captured in documentation such as operational Piping & Instrumentation diagram, catchment overview maps etc.

The Maintenance issues generally relate to funding, which if not resolved will likely impact on levels of service. The most pressing deficiencies, both existing and forecast are:

- Budgets not keeping up with increased non-materials costs e.g. fish removal, sediment control measures, traffic management.

- Insufficient budgets to maintain new assets, especially stormwater basins provided as part of development where Council has insufficient interdepartmental transparency.
- Urban encroachment of waterways makes access for maintenance very difficult (see section 4.1.5 for further discussion).

One major issue that has arisen over in recent time is the lack of funding for basin maintenance. This was raised as part of a recent report into determining responsibilities and communication pathways needed for the provision of stormwater facilities both internally, and externally for acceptance by Council. It was determined that the majority of the basins that had been accepted from developers did not have an OPEX budget assigned leading to shortfalls in overall maintenance budgets e.g. lawn mowing, weeding and litter removal. In 2018 the Parks Department secured some additional funding for mowing, which will need to be increased further to match future growth.

8.4 Disposal Plan

Assets identified for possible decommissioning and disposal are shown in Figure 8-49 and Table 8-16, together with estimated annual savings from not having to fund operations and maintenance of the assets. The assets nominated for disposal are all located within the residential red zone and are therefore not being utilised. While the draft Otakaro-Avon river corridor masterplan is available, it is not at any sufficient detail to ascertain what assets in the red zone around the Avon will be reused/replaced. It is therefore assumed all assets in the red zone areas (Avon River, Brooklands and the Port Hills). A comprehensive development plan for the red zone land is needed to be adopted by Council to provide direction for an asset improvement strategy in these areas.

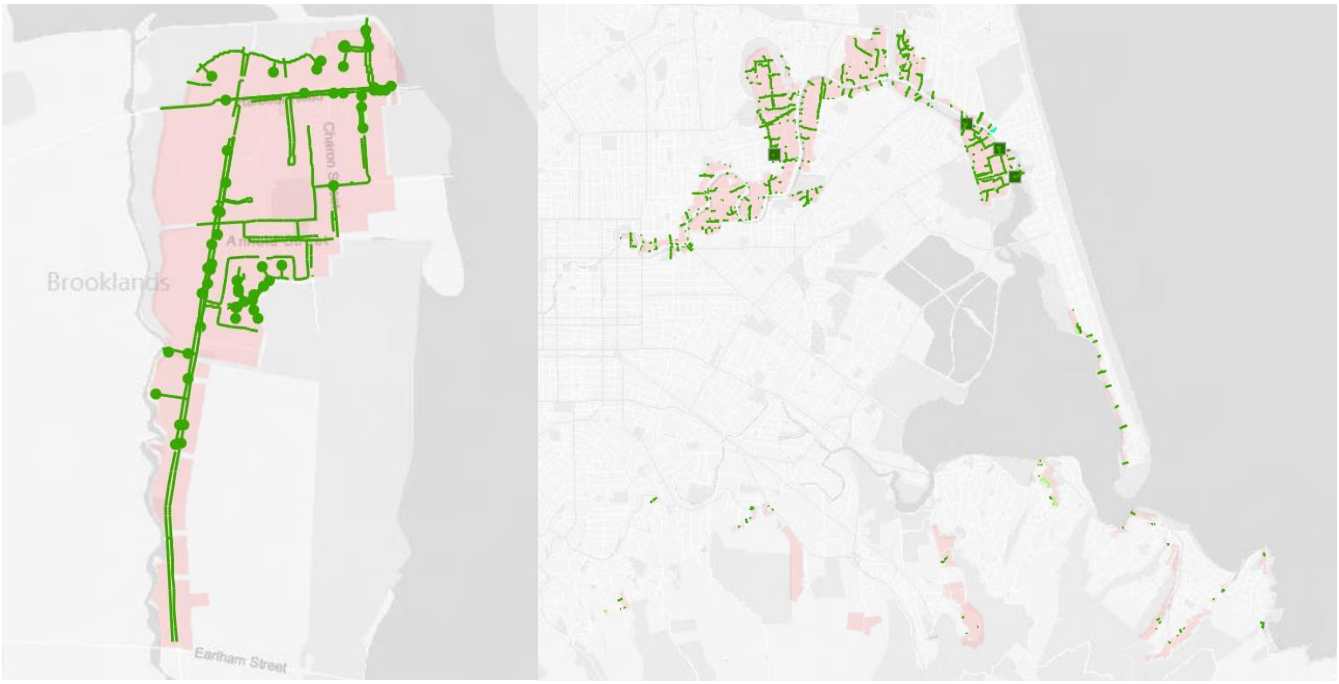


Figure 8-49: Red Zone Assets

Where cash flow projections from asset disposals are not available, these will be developed in future revisions of this asset management plan.

Table 8-16 - Assets Identified for Disposal

Asset	Reason for Disposal	Timing	Disposal Book Value*	Operations & Maintenance Annual Savings
Piped reticulation, including manholes, connections and outlets	Assets located within the Residential Red Zone	TBC – potentially within next 3 years	$10,704,376	Nil – Red Zone Assets not being maintained
3 Pump Stations	Assets located within the Residential Red Zone	TBC – potentially within next 3 years	$1,086,740	Nil – Red Zone Assets not being maintained

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* Data provided based on SAP extraction 30 April 2020.

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

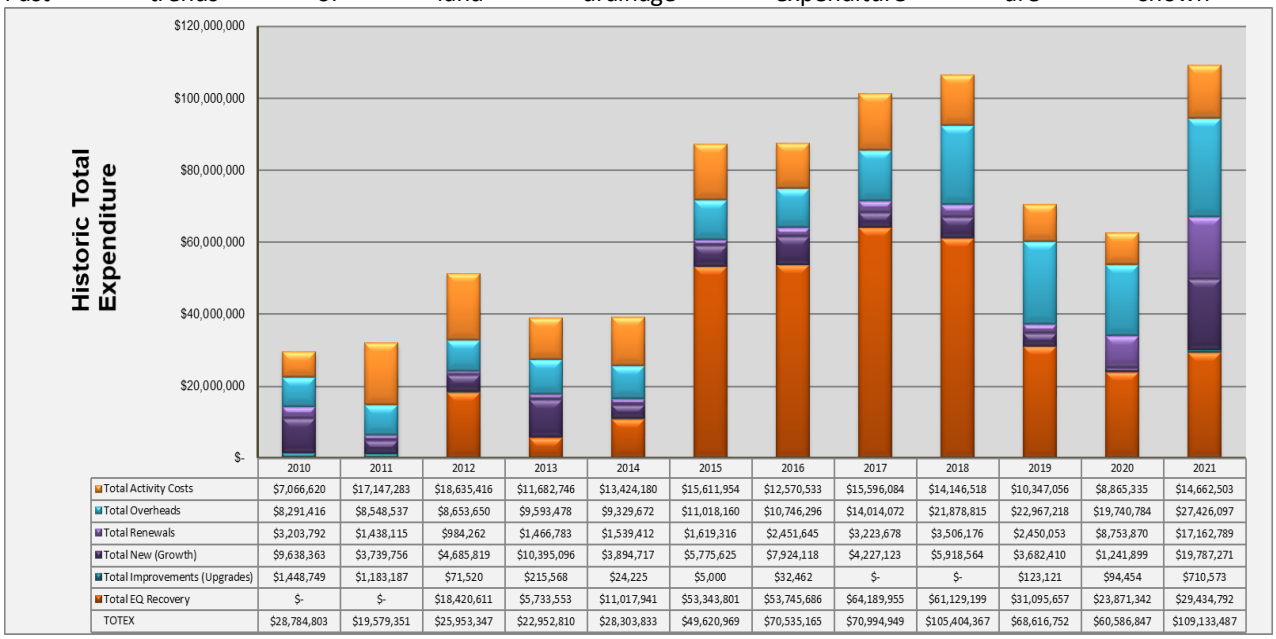
The financial projections shown in the sections below are for projected operating (operations and maintenance) and capital expenditure (renewal and upgrade/improvement/new assets). The financial statements are in 2020 dollars excluding inflation.

The recommended capital costs presented at the time of writing are based on using a plain asset management process of renewals based on the AAIF process or remaining useful life, providing growth in areas to suit the adopted SMP's and upgrade works to meet current backlog requirements only. There has not been any "lens" applied to the forecasts to consider the effects of any adaptation to climate change, the effects of OPEX reductions to minimise rates increases or the effects of Covid-19.

For further details of figures used, refer to the Financial Data[26].

9.1.1 Past trends (10yrs)

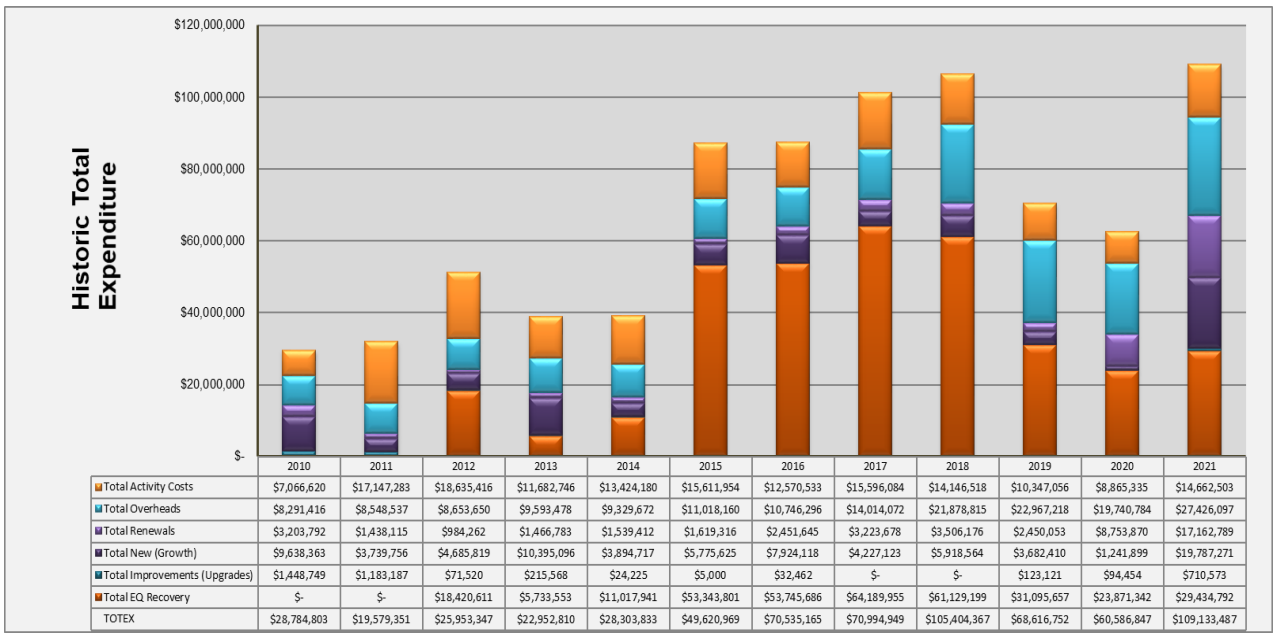
Past trends of land drainage expenditure are shown in



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total Activity Costs	$7,066,620	$17,147,283	$18,635,416	$11,682,746	$13,424,180	$15,611,954	$12,570,533	$15,596,084	$14,146,518	$10,347,056	$8,865,335	$14,662,503
Total Overheads	$8,291,416	$8,548,537	$8,653,650	$9,593,478	$9,329,672	$11,018,160	$10,746,296	$14,014,072	$21,878,815	$22,967,218	$19,740,784	$27,426,097
Total Renewals	$3,203,792	$1,438,115	$984,262	$1,466,783	$1,539,412	$1,619,316	$2,451,645	$3,223,678	$3,506,176	$2,450,053	$8,753,870	$17,162,789
Total New (Growth)	$9,638,363	$3,739,756	$4,685,819	$10,395,096	$3,894,717	$5,775,625	$7,924,118	$4,227,123	$5,918,564	$3,682,410	$1,241,899	$19,787,271
Total Improvements (Upgrades)	$1,448,749	$1,183,187	$71,520	$215,568	$24,225	$5,000	$32,462	$-	$-	$123,121	$94,454	$710,573
Total EQ Recovery	$-	$-	$18,420,611	$5,733,553	$11,017,941	$53,343,801	$53,745,686	$64,189,955	$61,129,199	$31,095,657	$23,871,342	$29,434,792
TOTEX	$28,784,803	$19,579,351	$25,953,347	$22,952,810	$28,303,833	$49,620,969	$70,535,165	$70,994,949	$105,404,367	$68,616,752	$60,586,847	$109,133,487

Figure . For more information on historic CAPEX and OPEX spend refer to relevant sections of the Lifecycle Management Plan.

[26]2021 Land Drainage AMP Financial Data trim://20/410580



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total Activity Costs	$7,066,620	$17,147,283	$18,635,416	$11,682,746	$13,424,180	$15,611,954	$12,570,533	$15,596,084	$14,146,518	$10,347,056	$8,865,335	$14,662,503
Total Overheads	$8,291,416	$8,548,537	$8,653,650	$9,593,478	$9,329,672	$11,018,160	$10,746,296	$14,014,072	$21,878,815	$22,967,218	$19,740,784	$27,426,097
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Total New (Growth)	$9,638,363	$3,739,756	$4,685,819	$10,395,096	$3,894,717	$5,775,625	$7,924,118	$4,227,123	$5,918,564	$3,682,410	$1,241,899	$19,787,271
Total Improvements (Upgrades)	$1,448,749	$1,183,187	$71,520	$215,568	$24,225	$5,000	$32,462	$-	$-	$123,121	$94,454	$710,573
Total EQ Recovery	$-	$-	$18,420,611	$5,733,553	$11,017,941	$53,343,801	$53,745,686	$64,189,955	$61,129,199	$31,095,657	$23,871,342	$29,434,792
TOTEX	$28,784,803	$19,579,351	$25,953,347	$22,952,810	$28,303,833	$49,620,969	$70,535,165	$70,994,949	$105,404,367	$68,616,752	$60,586,847	$109,133,487

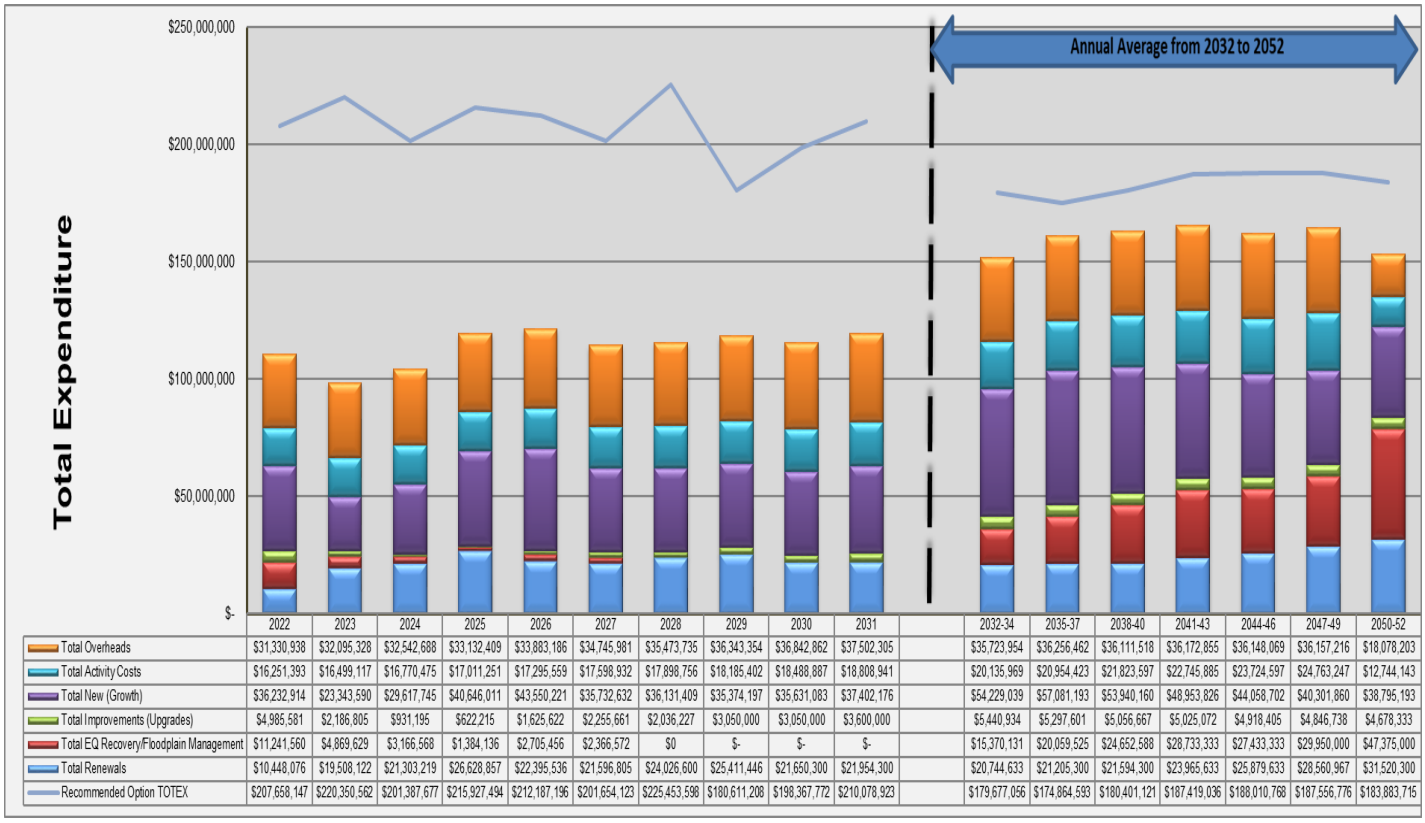
Figure 9-1: Historic expenditure

9.1.2 Cash flow forecast

The bars in 9-2 shows the total adopted land drainage budgets (expenditure) from the 2021 LTP and the lines shown the total budget originally recommended for approval from the Lifecycle Management Section of the AMP.

As has been commented multiple times in this document, the funding option that is going out for consultation is based on financial constraints bought about by the fall-out from the Covid-19 pandemic and a desire to keep any rates rise to a minimum. Therefore, the budgets available for the LTP period were reduced significantly from the recommended option.

The reductions have affected the rate of network renewals, the delivery of the stormwater assets in the Otakaro Avon river corridor, delays to flood mitigation works, delays in delivering growth projects and delay in providing any funding for Coastal Hazard Adaptation.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
Total Overheads	$31,330,938	$32,095,328	$32,542,688	$33,132,409	$33,883,186	$34,745,981	$35,473,735	$36,343,354	$36,842,862	$37,502,305	$35,723,954	$36,256,462	$36,111,518	$36,172,855	$36,148,069	$36,157,216	$18,078,203
Total Activity Costs	$16,251,393	$16,499,117	$16,770,475	$17,011,251	$17,295,559	$17,598,932	$17,898,756	$18,185,402	$18,488,887	$18,808,941	$20,135,969	$20,954,423	$21,823,597	$22,745,885	$23,724,597	$24,763,247	$12,744,143
Total New (Growth)	$36,232,914	$23,343,590	$29,617,745	$40,646,011	$43,550,221	$35,732,632	$36,131,409	$35,374,197	$35,631,083	$37,402,176	$54,229,039	$57,081,193	$53,940,160	$48,953,826	$44,058,702	$40,301,860	$38,795,193
Total Improvements (Upgrades)	$4,985,581	$2,186,805	$931,195	$622,215	$1,625,622	$2,255,661	$2,036,227	$3,050,000	$3,050,000	$3,600,000	$5,440,934	$5,297,601	$5,056,667	$5,025,072	$4,918,405	$4,846,738	$4,678,333
Total EQ Recovery/Floodplain Management	$11,241,560	$4,869,629	$3,166,568	$1,384,136	$2,705,456	$2,366,572	$0	$-	$-	$-	$15,370,131	$20,059,525	$24,652,588	$28,733,333	$27,433,333	$29,950,000	$47,375,000
Total Renewals	$10,448,076	$19,508,122	$21,303,219	$26,628,857	$22,395,536	$21,596,805	$24,026,600	$25,411,446	$21,650,300	$21,954,300	$20,744,633	$21,205,300	$21,594,300	$23,965,633	$25,879,633	$28,560,967	$31,520,300
Recommended Option TOTEX	$207,658,147	$220,350,562	$201,387,677	$215,927,494	$212,187,196	$201,654,123	$225,453,598	$180,611,208	$198,367,772	$210,078,923	$179,677,056	$174,864,593	$180,401,121	$187,419,036	$188,010,768	$187,556,776	$183,883,715

Figure 9-2: Total expenditure

As the financial caps have been applied to the activity rather than the activity proposing various funding options for consideration, there is only limited information provided for assessment on Figure 9-2. The previously approved 2018 LTP budgets are also not shown as they would be superfluous in this situation, only again showing the budget shortfalls.

9.1.3 Financial indicators

Financial indicators are provided in Table 9-1 and give the figures used in calculating the metrics discussed in this section. These financial indicators are based on the IPWEA recommendations and are intended to provide an overview of short, medium and long term implication of funding decisions. The source data can be found in the 'Financial Indicators' tab of the Financial Data[27]. Note: The indicators in Table 9-1 compare the recommended option with the constrained option required to meet the Financial Strategy. As a result, the asset renewal funding ratios (G1-G3) reflect the differences between the two financial options. These figures will undoubtedly change once the LTP budgets have been signed-off following public consultation.

9.1.3.1 *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 (i.e. those associated with the recommended option) that will receive LTP funding. The ratio has been calculated as **54.3%**, which indicates that overall funding received is just over half of that recommended and this represents a funding shortfall (B) of **$947M** over the first 10 years of the LTP period.

9.1.3.2 *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 has been calculated as 0.95%.

[27] Land Drainage 2020 AMP Graphs Data Enty Template V4.0 2018 Land Drainage AMP Financial Data TRIM://20/410580

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 reason for this is that there is a tendency to push spend out beyond the first three years at each LTP and so by using only the first three years, the ratio is likely to be more realistic than using a longer time period. The rate of asset renewal has been calculated as 0.81%, which is 85% the rate of consumption (F). If the assets are undervalued, the rate of annual asset renewal will be over-estimated.

Historically the 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 was 54.1% for the last ten years i.e. half of what should have been spent.

9.1.3.3 *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 has been calculated as 1.52%.

9.1.3.4 *Asset renewal funding ratio*

The asset renewal funding ratio (G1-G3) shows the percentage of renewal costs (i.e. those associated with the recommended option) that will receive LTP funding. The ratio has been calculated using the average costs and expenditure over the first three, five and ten years of the LTP period. And the results are shown below.

- Three year 64.5%
- Five year 51.1%
- Ten year 62.7%

This shows that there are short term renewals funding shortfalls as funding has been pushed out to later years to suit the constrained finances. It is anticipated that more funding should be available in the 11-30-year horizon of the LTP (as long as it is not pushed out again through subsequent LTP's).

9.1.3.5 *Renewal to depreciation ratio*

The renewal to depreciation ratio gives (H1) an indication of whether renewals investment is at an appropriate level and for the ten-year period has been calculated as **165.7%,** which is due to the significant increase in renewals expenditure. While this may look like there is potentially greater investment in renewals than required, the additional renewal funding requirement is partially due to historic underfunding (backlog), assets missing from the valuations and is required to reach a sustainable position. The renewal to depreciation ratio for the previous 10 years (H2) was **54.1%**.

It should be noted that the projected renewal budget for the largest asset group considers the actual deliverability of the renewals over the actual backlog. As discussed in Section 8.1, the backlog has been smoothed over the first 10 years to ensure that there is sufficient time for the initial investigation/design phases to be completed, and the market to "ramp up" for the delivery.

Table 9-1 – Financial Indicators

Summary				
Ref	**Indicator**	**Calculation**	**Description**	**$ or %**
	10 year total **cost**	Recommended 10yr total OPEX, CAPEX renewal & CAPEX		$ 2,073,676,701
	10 year average **cost**			$ 207,367,670
	10 year total LTP budget **expenditure**	Proposed 10yr total OPEX, CAPEX renewal & CAPEX upgrade		$ 1,126,433,953
	10 year average LTP **expenditure**			$ 112,643,395
A	10 year total average funding ratio	10yr total average expenditure / 10yr total average cost	Shows percentage of total recommended cost that	54.32%
B	10 year total average funding shortfall	10yr total average cost - 10yr total average expenditure	Quantifies overall underfunding	$ 947,242,748.3
Value				
	Current optimised replacement cost (ORC)			$ 2,121,505,000
	Depreciable amount	ORC - RV (residual value) - Assumed same as ORC (ie RV = 0)		$ 2,121,505,000
	Optimised depreciated replacement cost (ODRC)			$ 1,423,905,000
	Annual depreciation expense (AD)			$ 20,106,000
C	Rate of annual asset consumption (AD / ODRC)	Annual depreciation / depreciated replacement cost	How much of the asset stock is being used up each	0.95%
D	Rate of annual asset renewal (FY2019-2021)	Average FY2019-2021 renewal expenditure / annual depreciable	How much of the asset stock is being renewed /	0.81%
E	Rate of annual asset new+upgrade (FY2019-2021)	Average FY2019-2021 new+upgrade expenditure / annual	How much is being added to the asset stock each	1.52%
	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	84.98%
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	64.53%
G2	5yr asset renewal funding ratio	5yr renewal expenditure / 5yr renewal cost	What percentage of the 5yr recommended renewal	51.08%
G3	3yr asset renewal funding ratio	3yr renewal expenditure / 3yr renewal cost	What percentage of the 3yr recommended renewal	62.72%
	Long term – lifecycle costs			
	Lifecycle **cost**	Average 10yr projected O&M + depreciation cost		$ 70,045,817.6
	Lifecycle **expenditure**	Average 10yr O&M + renewals expenditure		$ 73,362,476.0
	Lifecycle funding gap	Lifecycle expenditure - Lifecycle cost, -ve = gap	10yr average annual lifecycle underfunding (sum)	$ 3,316,658.4
	Lifecycle funding indicator	Lifecycle expenditure / Lifecycle cost	10yr average annual lifecycle underfunding	104.7%
	Medium term – 10 year financial planning			
	10yr average O&M + renewal **cost**			$ 83,244,310.3
	10yr average O&M + renewal **expenditure**			$ 73,362,476.0
	10yr financial shortfall	10yr average O&M + renewal expenditure - 10yr average O&M +	Difference between 10yr O&M + Renewal cost and	-$ 9,882,434.3
	10yr financial ratio	10yr average O&M + renewal expenditure / 10yr average O&M +		88.1%
	Short term – 5 year financial planning period			
	5yr average O&M + renewal **cost**			$ 78,866,785.6
	5yr average O&M + renewal LTP **expenditure**			$ 69,419,230.7
J2	5yr financial shortfall	5yr average O&M + renewal expenditure - 10yr average O&M +	Difference between 5yr O&M + Renewal cost and	-$ 9,447,554.9
K2	5yr financial ratio	5yr average O&M + renewal expenditure / 10yr average O&M +		88.0%
H1	10yr forecast renewals to depreciation ratio	10 yr renewal expenditure / 10 depreciation expenditure		165.65%
Historic trends (2011 to 2020)				
Ref	**Indicator**	Calculation	Description	**$ or %**
	Historic 10 year total **expenditure**	Historic 10yr total OPEX, CAPEX renewal & CAPEX upgrade costs		$ 608,949,265
	Historic 10 year average **expenditure**			$ 60,894,926
	Historic 10yr average depreciation			$ 7,975,585
	Historic 10yr average renewals expenditure			$ 4,315,798
H2	Historic 10yr forecast renewals to depreciation ratio	FY2011-2020 average renewal expenditure / FY2011-2020		54.1%

9.1.4 Expenditure by Service Group

Operations & maintenance expenditure

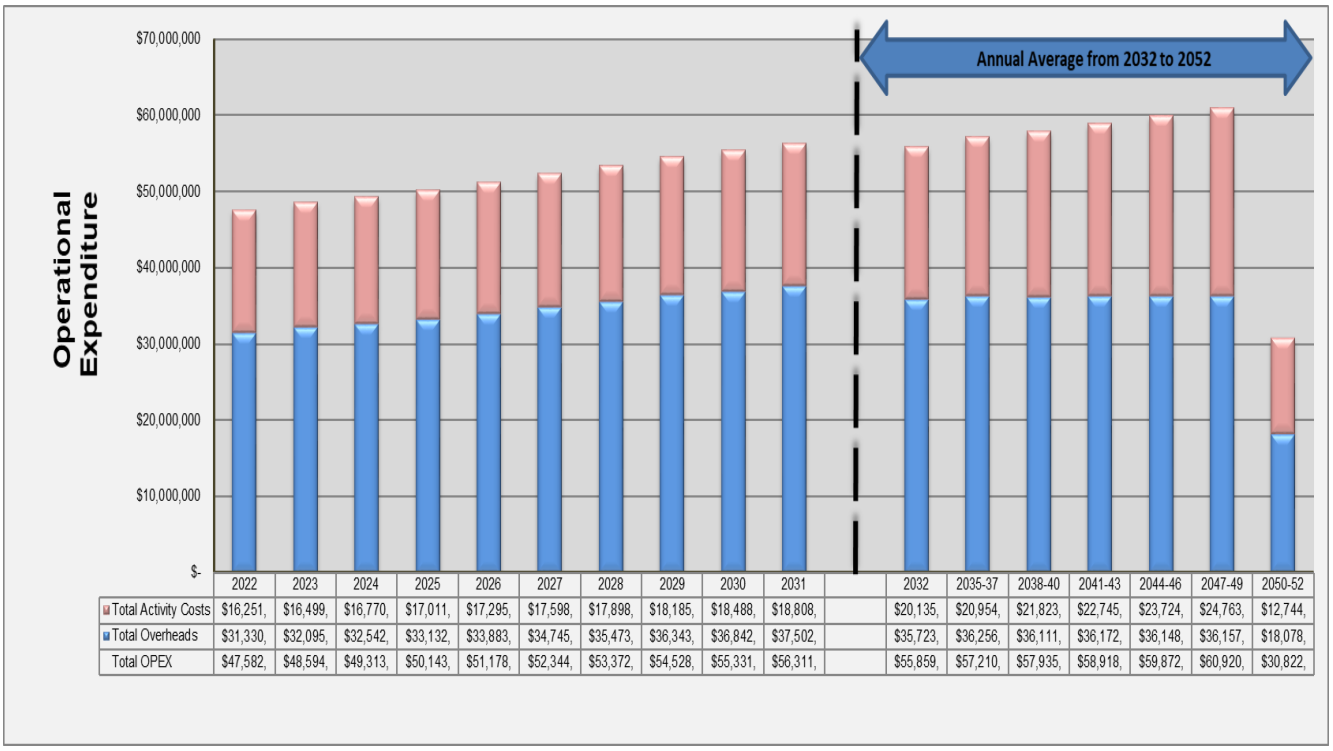
The future operational and maintenance costs have been developed by the Finance Team based on "Zero Based" budget method, looking at the required financing for the Operations and Maintenance of the asset base, information held within SAP plus a review of requirements by the Operations Team and the results are shown in Figure 9-5. Refer to Forecast OPEX Costs[28] for source data.

The total combined operations and maintenance projected expenditure approved for consultation from Finance through the LTP is shown in Figure 9-2.

The link between additional operational cost in-lieu of deferred capital replacement/renewal works is not well linked in any of Councils data systems. Therefore, given the shortfall of renewal expenditure (as discussed in section 9.1.3 above) it is likely that there will be an increased OPEX spend required to keep the assets that have past their remaining useful life "patched" up. This is a risk that cannot be accurately defined or allowed for.

The total projected operational and maintenance expenditure approved through the 2021 LTP is shown in Figure 9-2.

Maintenance costs are expected to steadily increase over the LTP period due to the increased asset base that will be completed and handed over for maintenance (either through Capital works projects of development), but this is not reflected in the proposed LTP expenditure. This will start to apply pressure to the OPEX budget over the next few years.

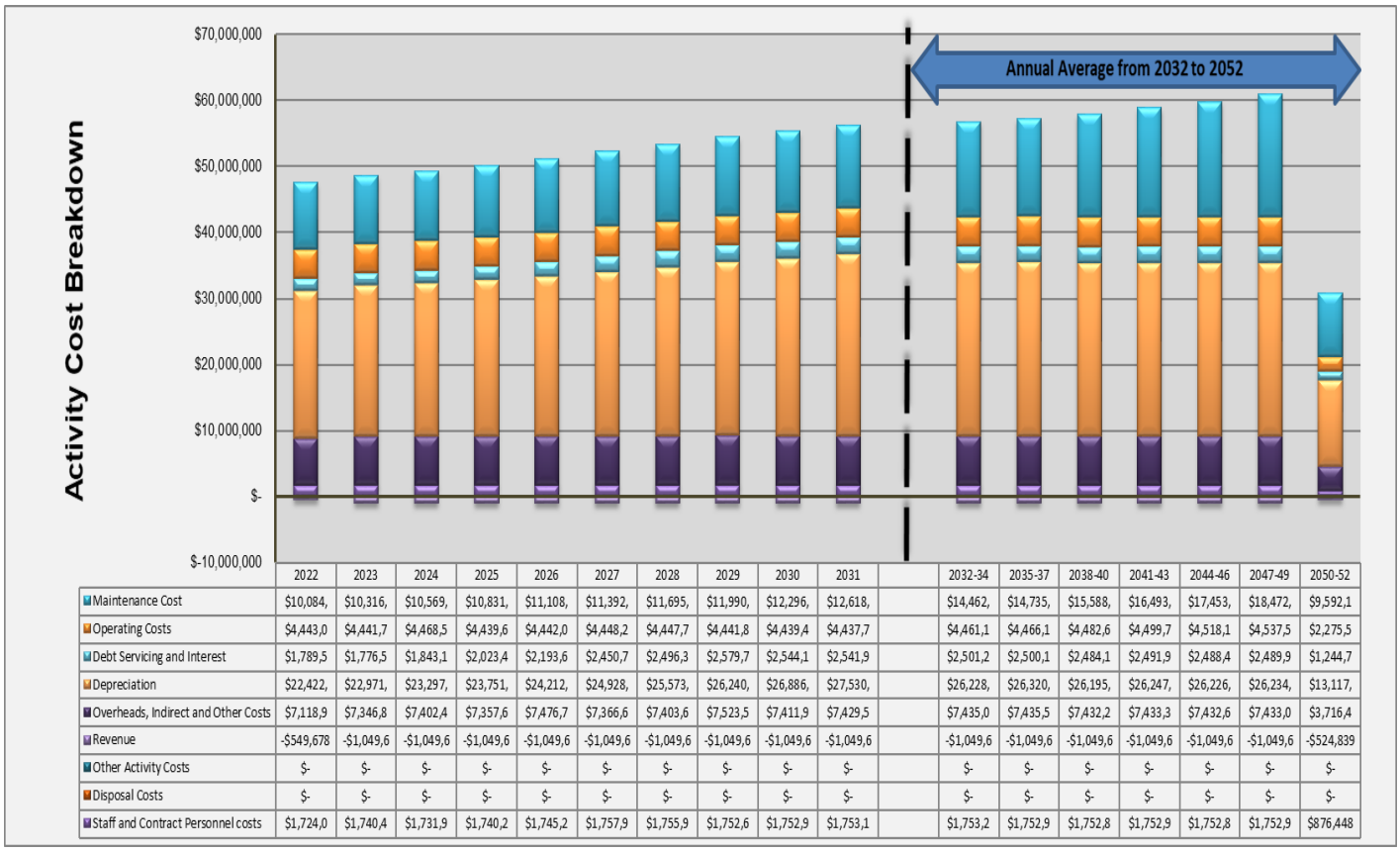


	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		2032	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
Total Activity Costs	$16,251,	$16,499,	$16,770,	$17,011,	$17,295,	$17,598,	$17,898,	$18,185,	$18,488,	$18,808,		$20,135,	$20,954,	$21,823,	$22,745,	$23,724,	$24,763,	$12,744,
Total Overheads	$31,330,	$32,095,	$32,542,	$33,132,	$33,883,	$34,745,	$35,473,	$36,343,	$36,842,	$37,502,		$35,723,	$36,256,	$36,111,	$36,172,	$36,148,	$36,157,	$18,078,
Total OPEX	$47,582,	$48,594,	$49,313,	$50,143,	$51,178,	$52,344,	$53,372,	$54,528,	$55,331,	$56,311,		$55,859,	$57,210,	$57,935,	$58,918,	$59,872,	$60,920,	$30,822,

Figure 9-2: Combined operations and maintenance expenditure

Further details and cost breakdowns are detailed in Figure 9-6. All figures use present day costs and do not include inflation. Note, no Operation and Maintenance budget figures have been provided for FY-51 or 52 which skews the results of the final bar in Figures 9-5 & 9-6.

[28] 2021 Land Drainage AMP – Forecast OPEX Costs - TRIM://18/99899



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
Maintenance Cost	$10,084,	$10,316,	$10,569,	$10,831,	$11,108,	$11,392,	$11,695,	$11,990,	$12,296,	$12,618,		$14,462,	$14,735,	$15,588,	$16,493,	$17,453,	$18,472,	$9,592,1
Operating Costs	$4,443,0	$4,441,7	$4,468,5	$4,439,6	$4,442,0	$4,448,2	$4,447,7	$4,441,8	$4,439,4	$4,437,7		$4,461,1	$4,466,1	$4,482,6	$4,499,7	$4,518,1	$4,537,5	$2,275,5
Debt Servicing and Interest	$1,789,5	$1,776,5	$1,843,1	$2,023,4	$2,193,6	$2,450,7	$2,496,3	$2,579,7	$2,544,1	$2,541,9		$2,501,2	$2,500,1	$2,484,1	$2,491,9	$2,488,4	$2,489,9	$1,244,7
Depreciation	$22,422,	$22,971,	$23,297,	$23,751,	$24,212,	$24,928,	$25,573,	$26,240,	$26,886,	$27,530,		$26,228,	$26,320,	$26,195,	$26,247,	$26,226,	$26,234,	$13,117,
Overheads, Indirect and Other Costs	$7,118,9	$7,346,8	$7,402,4	$7,357,6	$7,476,7	$7,366,6	$7,403,6	$7,523,5	$7,411,9	$7,429,5		$7,435,0	$7,435,5	$7,432,2	$7,433,3	$7,432,6	$7,433,0	$3,716,4
Revenue	-$549,678	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6		-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$1,049,6	-$524,839
Other Activity Costs	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-		$-	$-	$-	$-	$-	$-	$-
Disposal Costs	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-		$-	$-	$-	$-	$-	$-	$-
Staff and Contract Personnel costs	$1,724,0	$1,740,4	$1,731,9	$1,740,2	$1,745,2	$1,757,9	$1,755,9	$1,752,6	$1,752,9	$1,753,1		$1,753,2	$1,752,9	$1,752,8	$1,752,9	$1,752,8	$1,752,9	$876,448

Figure 9-6: Detailed Activity Breakdown of Forecast Operational Costs

Summary of future operations and maintenance expenditure

Costs have increased steadily since 2010 and this is continuing over the LTP period. The costs to the business are constantly increasing from multiple fronts. For example, within the operation space, this is due to the on-going increases in overheads such as insurance costs and electricity, while the staff and personal costs need to increase due to the additional pressures on the Planning unit to meet the requirements of the Comprehensive Stormwater Consent.

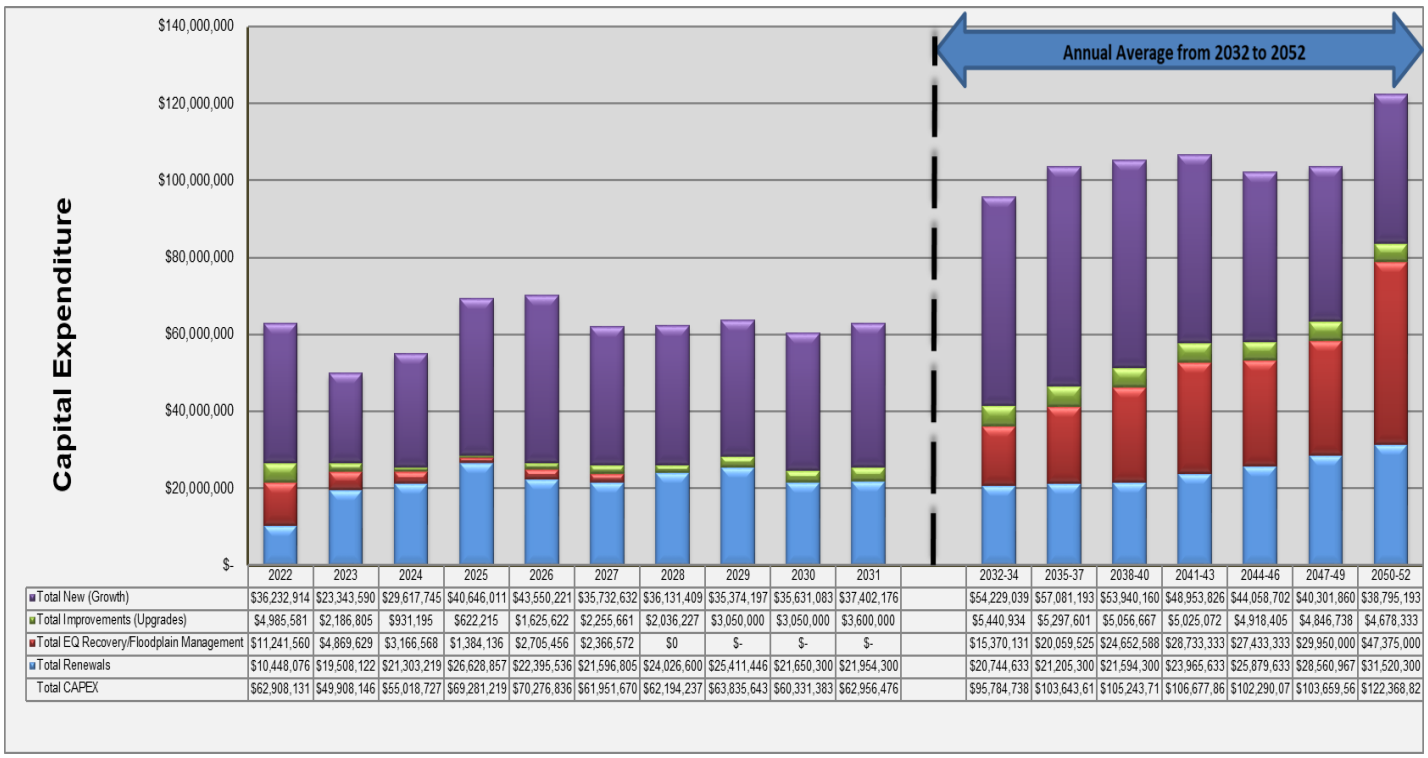
The maintenance portions of the budgets need to increase to meet the increase in assets that are coming on line from the various flood mitigation schemes such as Upper Heathcote Storage Scheme, treatment devices to meet water quality outcomes such as the proposed Addington Brook treatment facility and large wetlands/basins for growth. There is a large capital works programme proposed from the Planning unit for growth and Floodplain management, there needs to be the corresponding OPEX provided to ensure the new works are maintained as required.

There are also additional costs being incurred for Heritage, Ecological and Iwi consultation and monitoring requirements. For the 30 year forecast, much of the increase in expenditure is based on likely scenario forecasting rather than clear asset data. Looking beyond 2031, the forecast is very much based on broad assumptions.

Capital Works Expenditure

The projected renewals expenditure is shown in Figure 9-. All budgets have been capped as advised by the finance team. Initially the cap was applied to the initial 10 years of the LTP, but this meant that the year 11-30 were increased to a point where year 11 would not have been realistically met by the market due to the large increase. The second funding cap was then applied to the whole LTP period. This has required careful planning with all aspects of the activity to manage the risks associated with underfunding.

The details on the effects of the various funding streams of the activity (Renewals, Growth, Improvement, and Floodplain Management) are discussed in greater detail in Section 8.



	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032-34	2035-37	2038-40	2041-43	2044-46	2047-49	2050-52
Total New (Growth)	$36,232,914	$23,343,590	$29,617,745	$40,646,011	$43,550,221	$35,732,632	$36,131,409	$35,374,197	$35,631,083	$37,402,176	$54,229,039	$57,081,193	$53,940,160	$48,953,826	$44,058,702	$40,301,860	$38,795,193
Total Improvements (Upgrades)	$4,985,581	$2,186,805	$931,195	$622,215	$1,625,622	$2,255,661	$2,036,227	$3,050,000	$3,050,000	$3,600,000	$5,440,934	$5,297,601	$5,056,667	$5,025,072	$4,918,405	$4,846,738	$4,678,333
Total EQ Recovery/Floodplain Management	$11,241,560	$4,869,629	$3,166,568	$1,384,136	$2,705,456	$2,366,572	$0	$-	$-	$-	$15,370,131	$20,059,525	$24,652,588	$28,733,333	$27,433,333	$29,950,000	$47,375,000
Total Renewals	$10,448,076	$19,508,122	$21,303,219	$26,628,857	$22,395,536	$21,596,805	$24,026,600	$25,411,446	$21,650,300	$21,954,300	$20,744,633	$21,205,300	$21,594,300	$23,965,633	$25,879,633	$28,560,967	$31,520,300
Total CAPEX	$62,908,131	$49,908,146	$55,018,727	$69,281,219	$70,276,836	$61,951,670	$62,194,237	$63,835,643	$60,331,383	$62,956,476	$95,784,738	$103,643,61	$105,243,71	$106,677,86	$102,290,07	$103,659,56	$122,368,82

Figure 9-7: Capital Works Expenditure

9.1.5 Disposal Expenditure

As shown in **Error! Reference source not found.** disposals are normally covered as part of a capital project or included in maintenance contract costs for small or reactive renewals; therefore there are typically no disposal projects planned.

9.2 Funding Strategy

9.2.1 Expenditure Funding Strategy

Funding for land drainage 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[29].

9.2.2 Proposed Cash Flow Management

Cash Flow Management was not considered for this LTP due to the cap applied by the Finance Team. There was some smoothing applied between the activities of 3 Waters and Waste within each individual financial year which gave flexibility for one activity to be slightly over the “individual activity cap” but still conform.

9.3 Valuation Forecasts

Valuation forecasts will not be made in the AMP’s as these are calculated outside of this process and incorporated at a future stage for input into the LTP; however, in general both values and annual depreciation are expected to increase due to increasing construction costs and increases in the accuracy of the asset register.

9.4 Assumptions, Risk and Confidence Levels

9.4.1 Key Assumptions and Risk

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

[29] Financial Strategy 2021-2031 - TRIM://20/1244349

Renewal costs are a key assumption and risk. Reticulation renewals costs used in the model are based on replacement value tools prepared for the valuation and adjusted to align with current construction costs. No adjustments have been made to allow for inflation or other increases in costs with time. While Council is going through the process to improve the valuation tools, this had not been completed by the time this was written.

The forecasts prepared are on the basis that the Section 17A review will not affect the way the business is financed within the short/medium term. It is considered appropriate that the Stormwater services will stay with Council, and will not be absorbed within the Parks or Transport portfolios.

9.4.2 Input Data Confidence Levels

Advanced asset management is dependent on accurate knowledge of assets. 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. This reduces the confidence level in the input data.

The asset summary data included in **Error! Reference source not found.** provides an indication of the confidence placed in the existing asset data and estimates the completeness of that data over the asset group. This has been extracted from the 2020 stormwater valuation report[30]. Although the numbers of most reticulation assets and asset types are available, details of open waterways and associated assets is commonly lacking despite some of the confidence ratings in the valuation report.

9.4.3 Financial Forecast Confidence Levels

Given the above assumptions and reservations over the input data, there is a risk that the financial forecast is incorrect. However, comparison with historic financial data, and the knowledge that Council has moved away from reference to "earthquake recovery" and the assets are generally being maintained to the required standards, lends confidence to the financial forecasts above.

[30] CCC Three Waters Valuation Report 2020-06-30 - TRIM://20/1536135

10 Continuous Improvement

10.1 Overview of the Improvement Programme

Council has made a strong commitment to 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 Land Drainage activity improvement programme.

10.2 Current Asset Management Maturity

An independent assessment of current asset management practice was undertaken in October/November 2020.

The baseline maturity assessment was predominantly achieved through onsite interviews, with a cross-section of participants within the activity. Future maturity level was also set based on best appropriate practice and considering the agreed business drivers. Strength and opportunities for improvement area 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'.

A summary of the assessment results for this activity and the scores are shown in Figure 10.1. The maturity assessment shows that many of the criteria have scored well resulting in a general "Intermediate' level of maturity (11 of the 16 criteria). Some of the scores appear optimistic, particularly the Demand Forecasting, Asset Register Data, Asset Condition Assessment, Decision Making, Operational Planning & Reporting, Information Systems and Improvement Planning criteria's. In summary:

- Council has improved in the general "asset management" practices which improve areas involved with Policy, Strategy, Risk, Asset Management Plan preparation, Service Delivery and Quality Management.
- There are on-going deficiencies with the storage and updating of asset data, and the use of the data for forecast planning for both operational and capital works spends and a lack of models to allow appropriate demand forecasting.
- Little progress has been made on many of the previously identified business improvement items in the 2018 Asset Management Plan.

In addition to the standard Council-wide led assessment, 3-waters carried out a benchmarking against the Water Services Association Australia (WSAA) named the Asset Management Customer Value (AMCV) project in both 2008 and 2016. The benchmarking process accords with ISO 55001 to give a holistic, total lifecycle view of the organisations asset management. The assessment includes 7 functions that including leadership, customer focus and value optimisation as well as the traditional asset management areas.

The 2016 assessment showed that there is correlation in the strengths/deficiencies identified between the AMMA and the AMCV assessments, namely:

- CCC's strengths include Asset Management Governance, equipment selection & acceptance procedures (based on SCIRT processes) and Vendor & contractor selection process and procure.
- CCC's deficiencies include the linkage between Levels of Service, Demand and Price, Asset renewal/replacement/disposal procedures including criticality/risk/condition, staff development and succession planning and customer systems – usability, reporting and integration.

The 3-waters Head of Department determined that the WSAA benchmarking exercise that was scheduled to be carried out in 2020 was not be required to be done.

Further work needs to be carried out to prepare a programme of activities required to close the remaining maturity gaps and address the weaknesses identified during the development of this AMP. The Asset Management Unit have submitted a bid for OPEX expenditure to provide funding for the business improvements as part of the LTP process – see Section 10.5 – *"Resourcing the improvement programme"* for further discussion.

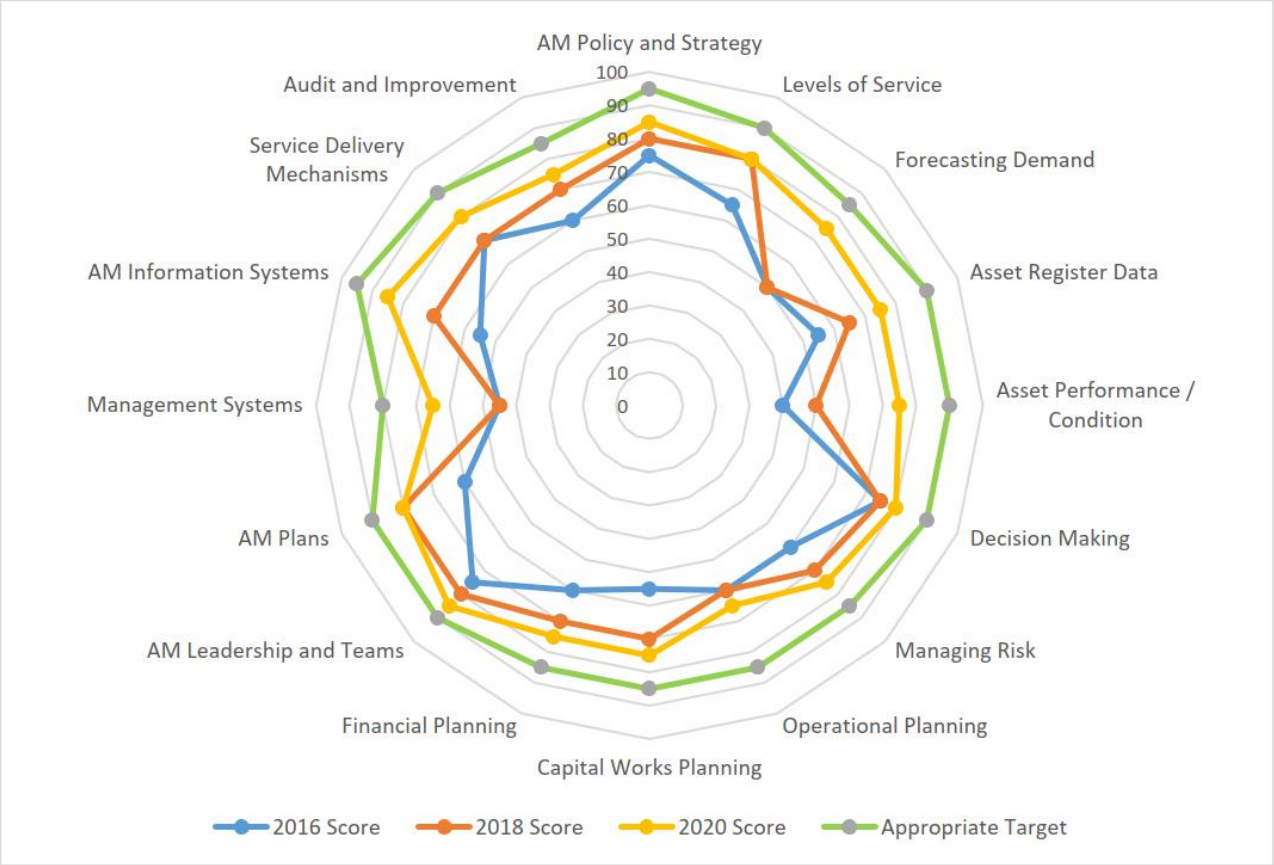


Figure 10-1: 2020 Asset Management Maturity Assessment

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 10.2 provides an update on the status of the improvement programme items as at November 2019.

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

- On-going work to define stormwater facilities and data structure within Councils data structure.
- Changes to the proposed Maintenance Contract to include regular inspections of assets over e.g. a 10-year period and more comprehensive reporting.

Table 10-1: Progress against 2018 Improvement Plan

Task ID	Action/Task	Timeline	Progress and Action
ITEM 1 1	Improve quantity and quality of Banks Peninsula asset data to bring in line with that of the City.	31 December 2022	In progress, 30% complete, carry forward.
ITEM 1 2	Establish clear rules around which asset management information systems are used to store the various types of data and which are the 'master' data systems.	30 June 2019	No progress yet.
ITEM 1 3	Agree and implement a simple process that allows internal staff to update existing asset data or add newly identified existing assets to the asset systems even if full attribute data is not available	30 June 2019	No progress yet.
ITEM 2 1	Develop wider range of formalised methods for obtaining feedback from stakeholders on the levels of service they expect.	31 December 2019	No progress, to be covered by other unit within Council.
ITEM 3 1	Review of current customer feedback to better understand customer expectations (we are currently relying heavily on Resident Satisfaction Survey results.	31 December 2019	No progress yet.
ITEM 3 2	Develop demand monitoring and forecasting systems, which provide details of changes and associated implications at an asset group level.	31 December 2019	No progress yet.
ITEM 3 3	Develop achievable non-asset solutions consisting of a suit of solutions that can realistically be incorporated in to asset management practices.	30 June 2019	No progress yet - could be managed as part of the Integrated Water Strategy.
ITEM 4-1	Update monitoring & hydrometric asset data to incorporate all existing assets and required attribute data	31 December 2019	No progress yet.
ITEM 4 2	Obtain data from NIWA via Water Outlook if the assets are owned by them	28 February 2019	28 February 2019
ITEM 4 3	Add accurate data for existing stop banks to asset systems	30 November 2019	No progress yet.
ITEM 4 4	Develop and implement a planned and targeted CCTV programme for SW pipes	30 June 2020	In progress, 75% complete as part of AAIF tasks
ITEM 4 5	Develop a methodology for assessing condition of field tiles	30 June 2019	No progress yet.
ITEM 4 6	Develop and implement pumping station renewals programme/prioritisation methodology using a risk-based approach	30 June 2020	No progress yet.
ITEM 4 7	Implement regular and planned inspection and condition assessment programme for stop banks and report this to support the relevant performance measure	30 June 2019	30 June 2019
ITEM 4 8	Implement treatment and storage facility condition/performance monitoring programme	30 June 2019	No progress yet.
ITEM 4 9	Link Customer Service Requests to individual assets where possible	30 June 2019	Are linked in SAP

ITEM 4 10	Develop system for identifying pipe capacity issues, which can then be used to inform an improvement programme and allocate sufficient funding.	30 June 2020	In progress, 80% complete as part of the City Wide Catchment Models
ITEM 4 11	Improve quality of waterway structure asset data to allow direct export of all data from SAP for the next valuation	30 June 2019	No progress yet.
ITEM 4 12	Record maintenance requirements against each asset in SAP	31 December 2019	No progress yet, but to be carried out as part of the new Maintenance Contract
ITEM 4.13	Develop maintenance strategies so that longer term impacts can be identified and mitigation measures put in place	30 June 2019	No progress yet, but to be carried out as part of the new Maintenance Contract
ITEM 4 14	Develop and implement a system for ensuring that the future OPEX costs associated with new and upgraded assets are identified at the design stage and that this information is used to inform future OPEX budgets	Ongoing	No progress yet.
ITEM 4 15	Ensure all key data from existing and future O&M manuals is integrated in to the asset systems/contracts and is easily accessible	Integration of existing data by 30 June 2020	No progress yet.
ITEM 4 16	Add pumping station software asset base to asset register and include in future valuations	30 June 2019	No progress yet.
ITEM 4 17	Improve pump station work order data and business information analytics to use historical data for more effective reactive renewal forecasting	30 June 2020	No progress yet.
ITEM 4 18	Add details of basin lining type and plan area to asset register	30 June 2019	No progress yet.
ITEM 4 19	Monitor actual reactive renewals spend to inform future renewal budgets	Ongoing	In progress, 25% complete, on-going
ITEM 5 1	Identify all critical/vulnerable assets	30 Jun 2020	Completed under AAIF project
ITEM 5 2	Incorporate formalised critical facilities dataset from Canterbury Lifeline Group to criticality/vulnerability model	30 June 2019	Completed under AAIF project
ITEM 5 3	Use data from City-wide modelling project to improve criticality/vulnerability model including overland flow paths, flood extents, depths and velocities and network tracing etc.	30 June 2020	No progress yet.
ITEM 5 4	Implement targeted survey of critical pipe invert levels (less than 5% of SW pipes currently have invert levels recorded). Note: this could be co-ordinated with the CCTV programme	30 June 2019	No progress yet.
ITEM 6-1	Create live database of construction and OPEX rates for specific asset types/maintenance tasks to improve confidence in financial forecasts	30 June 2020	In progress, 25% complete, on-going
ITEM 6-2	Improve knowledge of Council's stormwater and land drainage assets with particular focus on asset condition, and implement programmes to maintain up to date records	Implementation of maintenance programme by 30 June 2020	No progress yet, work scheduled to commence June 2020.

10.4 Improvement Plan 2021

The independent asset management maturity assessment process provides a sound basis for prioritising and monitoring improvements to current asset management practices.

Additional improvement items were identified during the maturity assessment and as part of this asset management plan review. Together with the outputs from the 2016 AMMA assessment, a single plan has been prepared which will provide an improvement to both assessment processes. These combined and common improvement items are added to the outstanding items from the 2018 Improvement programme. This will put in place the programme for 2021 through to 2024.

Table 10-2 details those tasks that are intended be addressed over the next three years. These tasks have focus specifically on those areas where the risk is most critical. To facilitate the practical implementation of the improvement programme tasks have been designed to address several issues concurrently and be programmed to ensure a logical progression towards the 3–year target.

Table 10-2: Asset Management Improvement Tasks

Task ID	2018 AMP Plan ID's	Project / Task	AM Maturity Gaps	Priority (H, M, L)	Responsibility	Cost	Resources (teams, $)
LD-01	1-1, 1-2, 1.3, 4-1, 4-2, 4-3, 4-18, 6-2	Field data collection, corporate data storage and update improvements - Establish business rules to improve the ability for staff to collect and update missing or incorrect asset data and to store in a corporate data systems to best suit the business.	Asset Data, Planning, Asset Performance	H	Asset Management Team	$20k to establish rules, and $100k for a data collection programme	IT, 3W AM, AMU, Maintenance Provider
		LD Condition Programme (excl Pipes) - Establish a condition programme across all LD applicable assets - Build programme into maintenance contract and on-board this data into SAP or deliver as a separate contract but via the existing maintenance contractor. LD Condition Programme (Pipes – CCTV) - Implement CCTV programme for condition assessment (initial backlog of 38km to be spread over 10yrs and added to annual approx. 3km required each year to give 6km of annual inspection)		H	Asset Management Team	$100k/yr. for a non-pipe condition programme $125k/yr. for a pipe condition programme	IT, 3W AM, AMU, Maintenance Provider
LD-02	2-1, 3-1	Levels of Service (LoS) Feedback - Better utilise the Resident Satisfaction surveys to satisfy LoS requirements, ensure that the link between LoS and expenditure (CAPEX & OPEX) is clearly identified in a model to allow open dialogue with the community over the cost of LoS expectations	LoS, Decision Making Planning, Service Delivery	H	Asset Management Team	$50k to set up survey model, $20k for comms and public relations and $10k for peer review – total = $80k	3W AM, LD Ops, AMU, Strategy Group…..
LD-03	3-2, 3-3	Demand Projections and Monitoring of SW Quantity and Quality - To better understand the effects on increased demand on the water quality/quantity outcomes of catchments, set up a continuous monitoring project of sites around the city. This can also allow for the monitoring of any source control measures installed. Should be set up to align with the Integrated Water Strategy.	LoS, Planning, Asset Performance, Decision Making, Managing Risk	M	Asset Management Team	Data collection and interrogation approx. $500k/yr.	3W AM, LD Planning, LD Ops, AMU, Strategy Group
LD-04	4-5 to 4-8 inclusive, 4-11, 4-16, 4-17, 5-3, 5-4	Improve Renewals Planning Through Improved Data Management - Provide business rules/requirements for increased amounts of field data collection , improve data condition records and predictive end of life tools for waterway linings, monitoring programmes, data/asset assessment and improved O&M record keeping (including financial recording), into the maintenance contract.	LoS, Planning, Asset Performance, Decision Making, Managing Risk, AM Plans	H	Asset Management Team	$150k for system creation and data collection	3W AM, LD Planning, LD Ops, AMU, IT, Maintenance Provider
LD-05	4-12 to 4-15 inclusive	Improve O&M Integration with Financial Systems and Asset Data Systems - To relate the costs associated with O&M to specific assets (*covered by the setup of the Maintenance Contract)* - the future OPEX is allowed for at the time of capital works planning and that all O&M information is readily available	Operational Planning	H	Asset Management Team	Nil Cost – only Asset Team Staff time	3W AM, LD Ops, AMU, IT, Finance, Maintenance Provider

LD-06	**New Item**	**Place more emphasis on the use of Low Impact Urban Design & Development (LIUDD) in the planning process. Empower Council Planners to become responsible and accountable for promoting the use of LIUD.**	**Not AMMA target**	**H**	**Asset Management Team, Land Drainage Planning Team, Strategy and Transformation Team**	**TBC**	**3W AM, LD Planning, LD Ops, AMU, Strategy Group**
LD-07	New Item	Include the strategies required to meet Councils agreed targets of operational carbon neutrality by 2030 and Christchurch Carbon Neutrality by 2050 as per the Infrastructure Sustainability Council of Australia (ISCA) documentation.	Not AMMA target	H	Asset Management Team, Land Drainage Planning Team, Strategy and Transformation Team	TBC	3W AM, LD Planning, LD Ops, AMU, Strategy Group

10.5 Resourcing the improvement programme

The activity requires resources and budget to deliver the improvement plan tasks. There was insufficient commitment made during the 2018 LTP, 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 Table 10-2 above.

Unfortunately, due the pressures on Council to deliver a zero rates increase coupled with the economic effects of the Covid-19 emergency, there has been no increase provided to the Asset Management Unit's OPEX budget to adequately fund the improvement items in Table 10-2. Therefore, there will need to be a prioritisation exercise undertaken to ensure that the highest priority items are delivered within the existing budget. It is likely that there will be very limited progress on the Improvement Table within the 2021 LTP period.

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.