Land Drainage

Asset Management Plan

Christchurch City Council

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Document Control

Version Control

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Version	Date	Author	Description

Document Acceptance and Release Notice

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1. Introduction to our Asset Portfolio

1.1 Background

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

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.

In delivering this service the Council provides a balanced mix of

- maintenance and renewals to preserve the levels of service;
- capital investment to respond to increasing demands for growth (both greenfield and infill);
- provide for an improvement in biodiversity through waterway improvement works and sediment reduction programmes through hillside planting programmes; and
- improved stormwater discharge quality to existing catchments to address waterway degradation.

Council has a Strategic Framework which details how we will ensure the city develops “A green, liveable city”. 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 follow through into how the business prioritises work streams and are reflected in our levels of service.

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.

1.2 Asset Lifecycle Approach

Council has established a lifecycle management framework, aligned to the *International Infrastructure Management Manual* as illustrated in Figure 1-1.

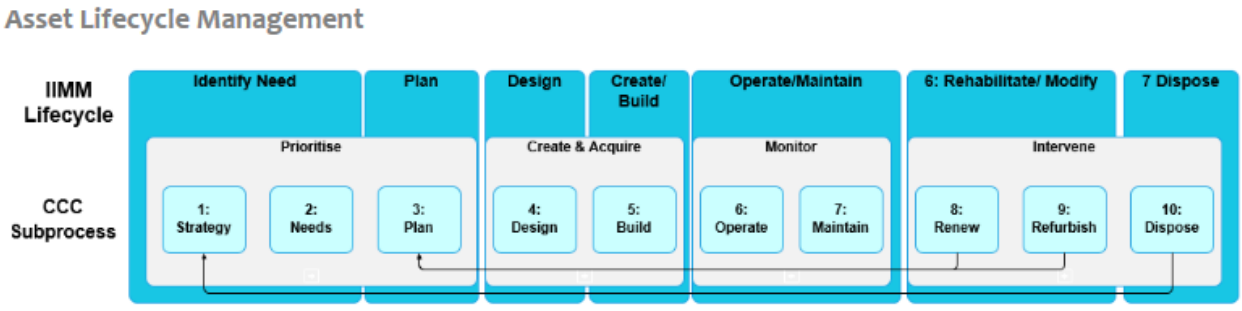

Figure 1-1: Asset Lifecycle Categories

1.3 Goals and objectives of Asset Management

Asset management is a business process which guides the lifecycle management of assets. Lifecycle management includes the planning, acquisition, operation, maintenance, renewal and disposal of assets.

Effective asset management enables the delivery of levels of service in the most cost-effective manner to present and future communities.

The Council's Asset Management Policy (approved by Council's Executive Leadership Team on 26 March 2018) provides the organisation's long-term vision, values and direction for asset management. The policy aligns with the organisation's strategic framework. The policy relates to Council's overarching intentions for asset management and the asset management system and not specifically assets or asset decisions.

The five principles underpinning the policy are:

- Asset management outcomes align with the strategic direction of Council
- Asset management is an organisational wide practice
- Decisions about assets are based on well-managed, quality information
- Asset management maturity is appropriate to the assets, services and risks we manage
- Asset management plans are living documents

The Asset Management policy sets out the assets Council manages in accordance with its asset management principles, and therefore within the asset management system scope.

The Asset Management Policy demonstrates commitment to maintaining an Asset Management System that promotes responsible management of assets to deliver value to customers and support business objectives, in accordance with best practice and alignment across the organisation. This provides a framework for establishing detailed plans and targets that support these objectives, and are measured and monitored to ensure continual performance improvement for Asset Management.

The Asset Management objectives (see Appendix 5.1) enable the management of assets in a manner consistent with the principles of the policy, and the organisation's objectives.

2. Lifecycle Management Plans

2.1 Asset Overview (what assets we have)

The following assets are covered in this AMP

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	1008km of pipe 29,129 nodes
	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 218,803m^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 207,036m 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.	Unconfirmed – provisional estimate of 420 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 72 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	49 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 flap gates (part of outlets)

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

2.2 Location and Value

In the Te Pūrongo-ā-tau Annual Report 2022, Fixed Assets under direct Council Control carried a book value of $14.2 billion. A detailed summary of the assets covered by this AMP is included in Table 2-2 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 2023 Valuation found the total value (optimised replacement cost) of the assets covered by this AMP to be **$2.91 Billion.** Almost 90% of this value is associated with the 1008km of pipes and associated nodes (inlets, outlets, manholes etc.) that make up the reticulation network.

The asset base also includes 49 pump stations, 669 treatment facilities, 219,000m^2 of waterway lining and 12.1km of stop banks.

Table 2-2: Asset Summary table based on 2023 stormwater valuation data

Asset type & valuation data								*Data confidence and completeness From 2023 valuation*			
Activity	Asset Group	Asset Types	Quantity	ORC ($)	ODRC ($)	AD ($)	Proportion of total Asset Value	Quantity	Size	Age	Condition / Performance
Stormwater Drainage	**Reticulation**	Pipe	41,606No. / 1008 km	$2,473,695,407	$2,018,349,598	$22,735,856	85.0%	h	u	u	r
		Pipe Protection including Restraint (thrust Blocks)	2,700 No. / 83.4 km	$12,339,922	$9,112,018	$123,392	0.4%	h	h	h	u
		Access	17,261 No.	$93,984,161	$65,184,786	$854,406	3.2%	h	h	r	u
		Inlet *(excl soakpits)*	4,229 No.	$8,272,957	$6,017,813	$86,618	0.3%	h	h	r	u
		Outlet *(excl soakpits)*	2,726 No.	$1,251,910	$814,153	$26,140	0.0%	h	h	r	u
		Junction	4,913 No.	$4,856,002	$2,952,074	$60,076	0.2%	h	h	r	u
		Restriction *(weir)*	49 No.	$220,648	$200,262	$2,006	0.0%	h	h	h	u
		Flow Control	531 No.	$4,048,343	$3,180,559	$40,483	0.0%	h	h	h	u
		Headwall	1642 No.	$8,217,308	$6,096,479	$74,680	0.3%	h	u	h	u
		Grill	461 No.	$2,241,649	$1,334,789	$43,491	0.0%	h	h	h	u
		Structure	1128 No.	$9,717,750	$6,269,903	$101,351	0.3%	h	u	u	u
	Lined/Unlined Drains	Bank lining	218,803 m2	$139,110,090	$74,878,467	$7,653,258	4.8%	h	u	u	h
		Bed lining	42,836 m2	$13,896,971	$7,919,414	$384,597	0.5%	h	u	u	h
		Earth channels	207,036 m	$9,160,167	$9,160,167	$0	0.3%	h	u	h	h
	Open Waterway Structures (excl lining)	Weirs	208 No.	$1,394,112	$824,671	$18,588	0.0%	h	u	u	u
		Debris Poles	15 No.	$62,690	$38,488	$1,254	0.0%	h	u	u	u
		Debris Racks	44 No.	$170,121	$87,844	$3,402	0.0%	h	r	u	u
		Flumes	13 No.	$17,503	$9,023	$700	0.0%	h	u	u	u
		Fords	3 No.	$37,622	$18,811	$470	0.0%	h	u	u	u
		Valves *(instream valves such as penstocks etc.)*	41 No.	$813,885	$675,571	$13,264	0.0%	h	r	r	u
		Energy Dissipation	96 No.	$713,712	$356,856	$8,480	0.0%	h	u	u	u
	Monitoring & Hydrometric Equipment	Instruments	182 No.	$339,565	$27,608	$9,009	0.0%	h	u	h	u
		Structures	41 No.	$63,679	$23,237	$1,132	0.0%	h	u	h	u
		Piezometers	767 No.	$684,464	$342,232	$13,689	0.0%	h	r	u	u
		Other equipment	89 No.	$125,416	$36,710	$2,511	0.0%	h	u	h	u
Flood Protection & Control Works	**Pump stations**	Building & Structures	49 No.	$7,045,843	$3,480,549	$88,916	0.2%	r	h	r	u
		Electrical	158 No.	$3,328,129	$1,582,311	$81,688	0.1%	h	r	r	u
		Pipework	78 No.	$1,042,659	$590,482	$14,347	0.0%	h	u	r	u
		Instrument & control	142 No.	$915,106	$406,420	$49,008	0.0%	h	u	u	u
		Mechanical	131 No.	$1,447,123	$369,556	$38,034	0.0%	h	h	r	u

		Standby plant	6 No.	$153,201	$16,266	$3,174	0.0%	h	u	h	u
	Flood protection structures	Stop banks	228,438 m2	$8,311,199	$8,311,199	$0	0.3%	u	u	h	h
	Treatment & Storage Facilities*	Earthworks	2,180,818 m2	$86,692,314	$86,692,314	$0	3.0%	h	h	h	u
		Lining	1,090,409 m2	$19,702,799	$12,154,914	$649,358	0.7%	h	h	h	u
				$2,914,125,595	**$2,327,533,833**	**$33,185,041**					

*Note - The 2023 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.

There are also some differences noted in the way that the valuation consultant has grouped some of the asset types between the 2020 and 2023 valuations in particular the pump station asset types. This means that the quantities are not directly comparable between the difference valuations.

2.3 Asset Data Confidence

Table 2.3 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 grading below). Asset data is held in SAP and GIS. The description of the confidence grade is below.

Table 2-3: Data 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.

The Data Confidence rating and descriptions are based on Table 3.5.3 of the "International Infrastructure Management Manual – 2011" which is the grading system used by the consultant who carried out the valuation process.

2.4 Network Age and Lifecycle Stage

There are a number of different asset classes within the Land Drainage portfolio, all of which have different asset life predictions – from 40 years for timber lining, 120 years for a concrete pipe to 25 years for a pump. As an indication of the state of the assets, there are a number of figures below taken from the 2021 Land Drainage Asset Management Plan. While there have been some renewals undertaken since the data in the figures below were extracted from corporate data sources, they information is still generally applicable as the amount of renewed assets have been offset by increased degradation of other asset lengths. The figures show various pieces of asset data to give some context of the asset base condition, age etc.

2.4.1 Piped Reticulation

Storm water reticulation consists of mains, accesses, inlets, outputs, headwalls, valves and fittings. Asset management effort typically focusses on the mains as they form the greatest proportion of reticulation network value.

The Asset Assessment Intervention Framework (AAIF) 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 Internal CCC Document) lists full details on the criteria and the overall AAIF process.

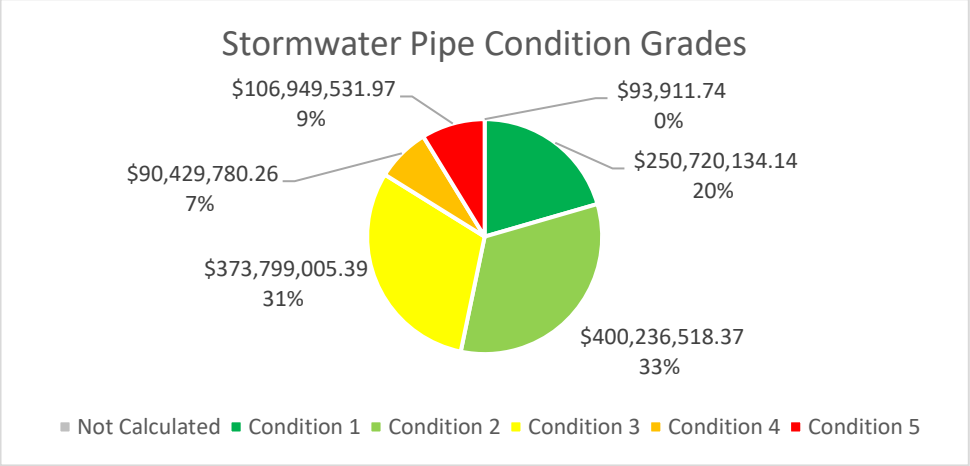

Figure 2-1 – Pipe Condition Based on Value

Note: the value is based on 2018 valuation, but the grades are still reflective of the state of the assets.

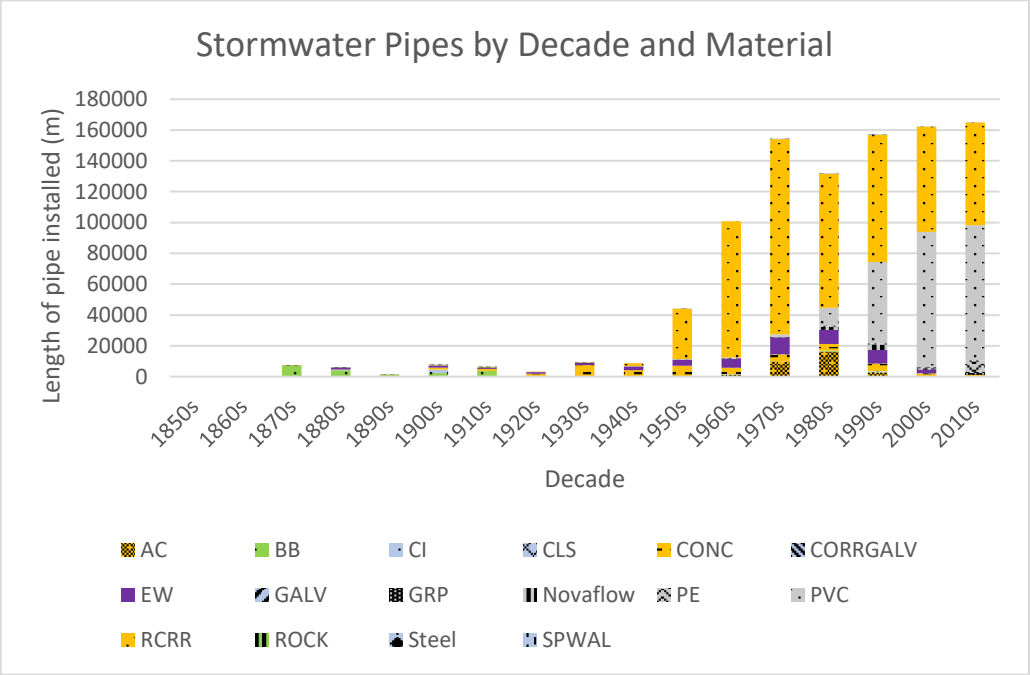

Figure 2-2 – Reticulation Development (including materials used)

2.4.2 Waterway Lining Renewals

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.

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.

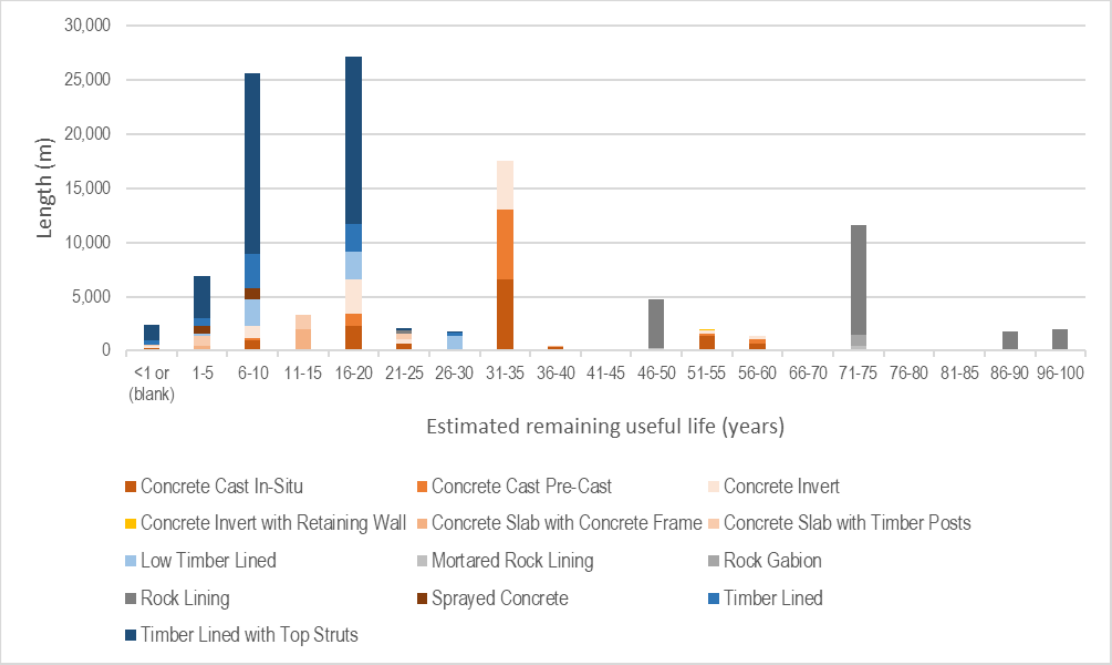

Figure 2.3: Waterway Linings Remaining Useful Age Profile

Note: as this was figure is based on information prepared in 2018, we are now almost into the 6-10 year spike of remaining useful life.

As the above sections only give a snapshot of some of the main land drainage asset classes due to limited space in this AMP template, and there has been insufficient time to carry out a proper asset analysis due to the internal LTP process, the whole of *"Section 8.1 – Lifecycle Renewal Planning – Lifecycle Management Plan"* from the 2021 Asset Management Plan has been included as Appendix 5.2 for context of the asset base.

2.5 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 2.2, there are a number of asset types 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" currently being compiled. The main principles are briefly discussed in Section 2.4.1 – "*Piped Reticulation*" above.

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 4staff (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".* 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 4-2 Asset Management Improvement Table in Section 4.

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 on 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 2-4, 2-5 and 2-6 below.

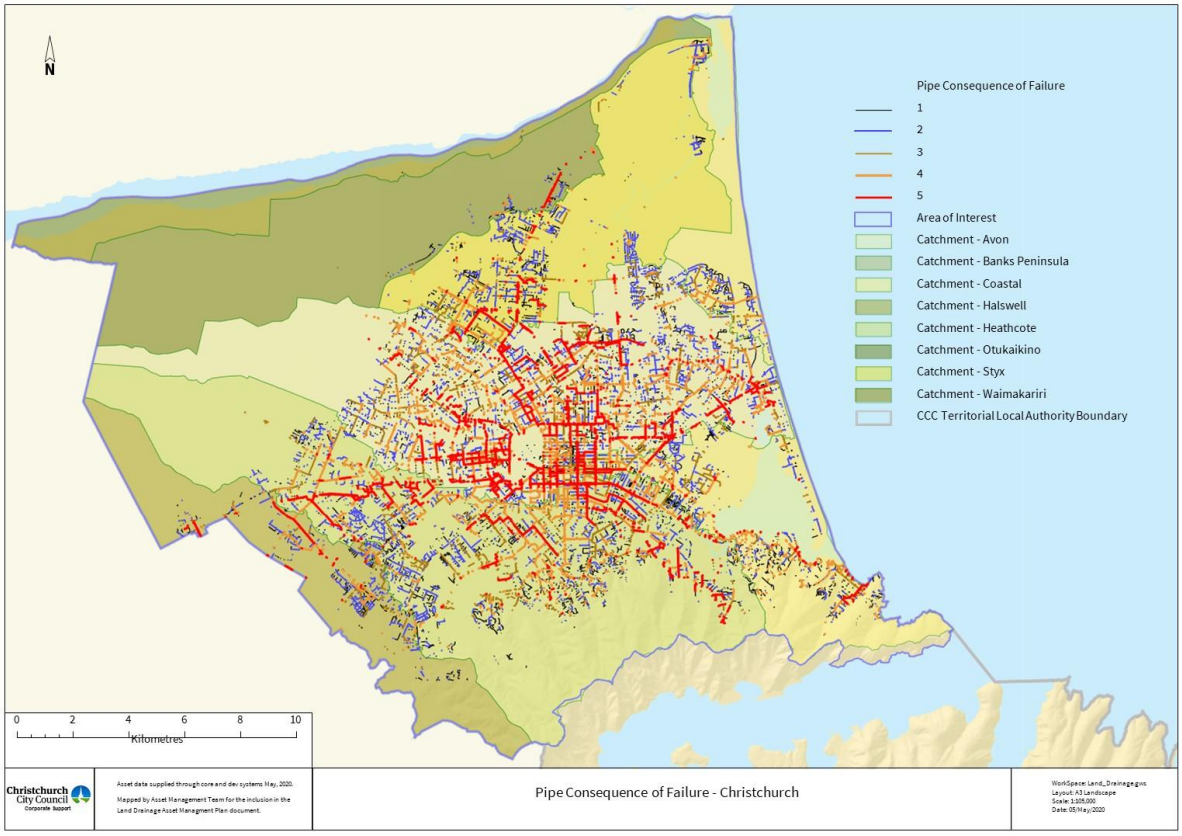

Figure 2-4: Pipe Consequences of Failure – Christchurch City

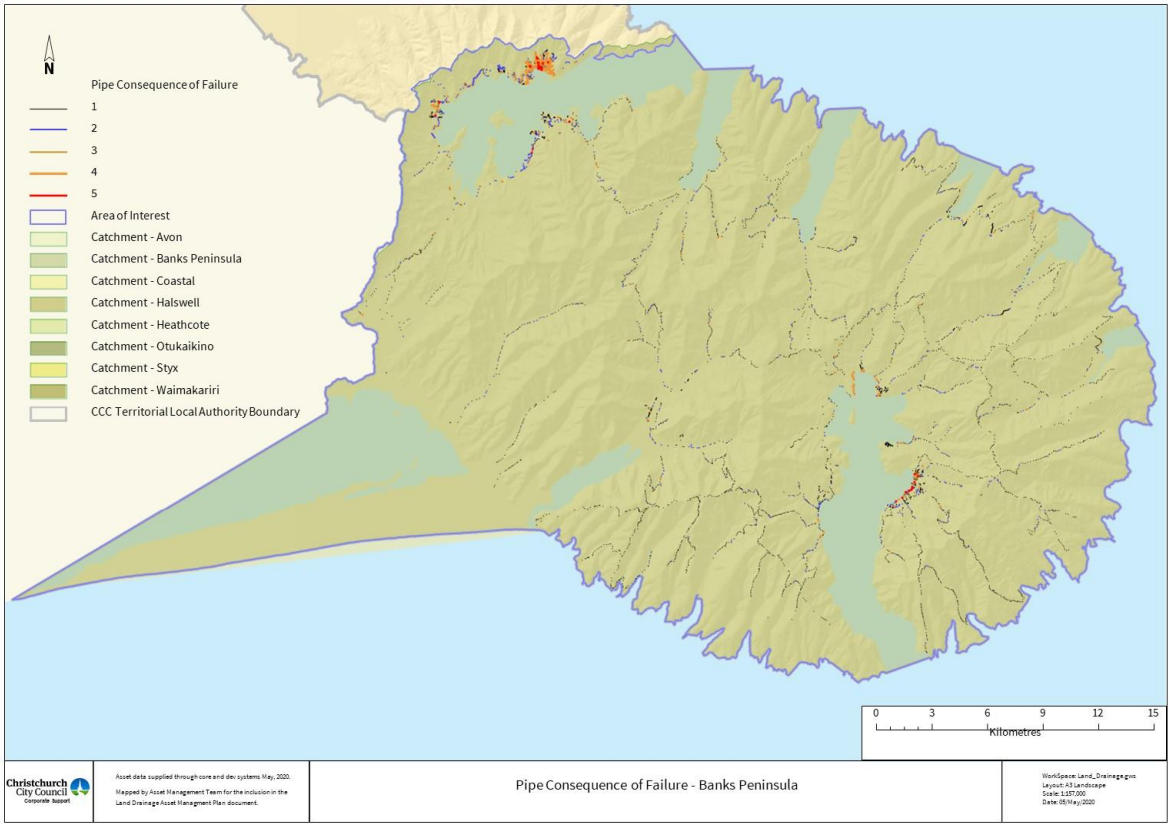

Figure 2-5: Pipe Consequences of Failure – Banks Peninsula

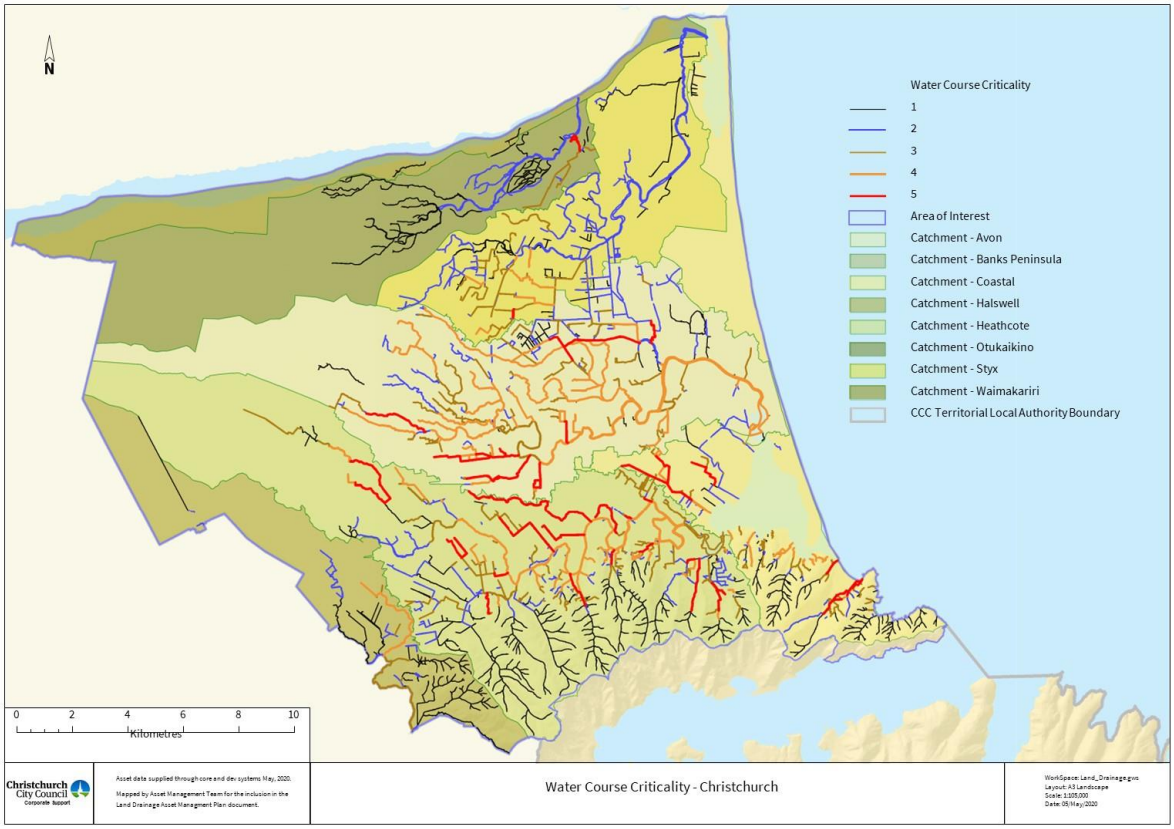

Figure 2-6: Watercourse Criticality – Christchurch City

2.6 Asset Data Confidence

Table 2.6 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 grading below). Asset data is held in SAP and GIS. The description of the confidence grade is below.

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v	Very Uncertain	Data based on unconfirmed verbal reports, weak inspection and analysis processes with the majority of data interpreted or extrapolated.

The Grading and Description are based on Table 3.5.3 of the "International Infrastructure Management Manual – 2011" which is the grading system used by the consultant who carried out the valuation process.

2.7 Asset Data Improvements

- 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.
- Streamline the current asset data structure for waterways and create a method within corporate data for regularly updating condition data.
- 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.

3. Managing Risk

3.1 Managing Risks

Council's approach to managing risk is detailed in its Risk Management Policy

3.1.1 Risk Management plan (risk framework)

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

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.

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

Business Continuity and Emergency Response Planning
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)

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, the 3 Waters Integrated Water Strategy and the Comprehensive Stormwater Network Discharge Consent. These plans outline required stormwater devices, possible treatment and other mitigation methods to meet Council water quality and quantity control for planned urban growth and to improve existing networks.

3.2 Critical Risk Identification and Management

3.2.1 Climate Change Impacts

Potential Vulnerabilities of our Assets and Services

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. These options and the timing of them will be informed by the work being carried out by the Coastal Hazard Adaptation Planning team.

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.

Action to respond to the Climate Impacts to our Assets

To date, the business has progressed with minimal actions to respond to the declared Climate Change Emergency. The main direction of how we manage our assets to respond to climate change will be determined through the Coastal Hazard Adaptation Planning process. To date the effects of climate change haven't affect the activity as for some time the rainfall figures used for drainage design has allowed for an increase due to climate change. This has provided for additional buffer in piped networks and storage/treatment facilities for any recent increases in rain intensity

Additionally, some works were funded in the current LTP for planting up some of the Port Hill catchments to reduce sediment loading in our waterways, assist with stabilising the soils and to reduce the effects of drier periods.

Future options for responding to Climate Impacts as outlined in Sections 2.3 of the Stormwater Drainage Activity Plan and the Flood Protection and Control Works Activity Plan include:

Stormwater Drainage Activity Plan

- Improve water quality through sediment control measures, use of wetlands and nature based design, implementing source control of contaminants and pollutants, retrofit water quality mitigation for existing developed areas
- Encourage communal stormwater management approaches and/or on-site stormwater management at source
- Reduce dependence on piped infrastructure and instead prioritise nature based solutions, water sensitive urban design, and designated overland flow paths
- Improve knowledge of network performance by continuing to use and maintain hydraulic models which consider current and future scenarios to enable informed decision making
- Managing assets collectively to ensure future works maximise collaborative benefits across Council activities. This includes reviewing climate change risks, such as sea level rise extents, and incorporating the results into current and future planning and design works, noting management of climate related risks and reduction in vulnerability will likely include collaboration in multiple Council activity areas.

Flood Protection and Control Works Activity Plan

- Require or incentivise practices such as hydraulic neutrality, minimum floor levels, setbacks from open streams, effects from change in land use in terms of sediment and pollutant loading, and protection of overland flow paths in new developments
- Education surrounding litter, pollutant, and contaminant reduction at source
- Work in collaboration with Environment Canterbury to develop best practices documentation for land development work and environmental management plans
- Improve knowledge of flood management system performance by continuing to use and maintain hydraulic models which consider current and future scenarios to enable informed decision making
- Manage assets collectively to ensure future works maximise collaborative benefits across Council activities. This includes reviewing climate change risks, such as sea level rise extents, and incorporating the results into current and future planning and design works, noting management of climate related risks and reduction in vulnerability will likely include collaboration in multiple Council activity areas such as the coastal hazards adaptation programme.
- When considering upgrading of existing assets to a higher level of service in current and future flood prone areas where required to protect infrastructure or human life, consider the lifespan of the upgraded asset and cost which would pass to future generations. Ensuring costs are more evenly spread may include allowing for the asset to be relocatable or used in a different location to extend the usable life and working jointly with the Coastal Hazards Adaptation Plan principles to manage options.
- Where existing assets no longer provide the intended service targets to existing infrastructure, consider options to adapt to climate change risks and impacts by direct modification of the effected infrastructure to reduce the exposure climate change effects, such as temporary flood barriers or on-site stormwater detention.

Key Sources of Greenhouse Gas Emissions

Key sources of greenhouse gas emissions from this activity includes:

- Construction of new infrastructure
- Decommissioning or renewal of existing infrastructure
- Emissions from pollutants including in-steam chemical processes, sediment accumulation, microbial action and waste disposal
- Electricity usage for activities such as pumping
- Maintenance of infrastructure including travel emissions associated with operation and maintenance activities

Future Strategies for Reducing Emissions

Operational/embedded greenhouse gas emissions

- Reduce the pollutant load by implementing source treatment and catchment management of pollutants to reduce maintenance costs for removal of accumulated sediment
- Include whole-of-life greenhouse gas emissions consideration in planning and design and construction phases
- Reduce our carbon footprint through changes in design, material choice and construction of new assets without compromising asset quality or reliability
- Prioritise nature based solutions and encourage native plantings in infrastructure design

Greenhouse gas emissions by users of the Land Drainage activity

- Consider opportunities for stormwater / rainwater detention storage tanks to limit pressure on downstream network during periods of high flow. Co-benefits also include available water reuse.
- Education in reduction of point source pollutants such as roofing material choices, brake pads, paint, etc
- Encourage reduced impervious area in developments through alternative options such as permeable pavement
- Reduce the need for relocation due to the effects of climate change and flood inundation due to adequate flood protection
- Reduce carbon emissions during and following flood events by providing adequate flood defence. Emissions from adverse flood effects may include:
    - Use of diesel generators to provide temporary power to properties
    - Emergency responses and evacuations
    - Road closures leading to large diversions, increasing petrol use
    - Repairs to or replacement of flood damaged properties, structures, equipment, etc
    - Energy in drying processes (e.g. dehumidifiers, air blowers, etc)
    - Waste generation from flood damaged goods

Issues Affecting Emission and Climate Impacts Decision Making

As previously commented, the activity has not had a lot of strategic policy, direction or impetus to progress with decision making for progressing any emission reduction strategies or addressing climate impacts. While there is some historic records of Council wide emissions, this data has only recorded limited variables (predominately power usage) which is not readily consumable at the various business unit levels. Until very recently, it has been left up to the business to make any improvements, relying on individually motivated staff members to progress work in amongst their "normal day job".

Therefore, the biggest improvement to the ability for the activity to progress and make change would be to provide sufficient funding and staff to carry out the necessary work, ensure that staff in the strategic level are readily available to provide practical and suitable advice and tools, and ensure that suitable policy is available to guide staff.

As a starting point for improvements, some suggestions are:

- *Investigations into the Flooding effects / sea level rise – modelling (pilot project) – further support the Council "Rex" tool (newly developed, not fully functional)*
- *Costing spreadsheet incorporating carbon footprint*
- *Limitations in baseline understanding of emissions, but working on building this*
- *Planning for emergency situation / natural hazard? How to supply water in event of tsunami, flood? Relocatable / transferrable infrastructure? – Business Continuity Plan*
- *Funding – engage in cost versus level of service conversations with community and within Council*
- *Information about level of service requirements or guidance on delivery to areas with associated current and future climate change risk – such as pluvial, alluvial, coastal flooding, sea level rise - Support the Coastal Hazards Adaptation Programme approach through collaboration and community engagement*

Pilot Projects to Build Resilience to Climate Risk

We will be undertaking the following pilot projects in the next three years to further support climate change initiatives. These are:

1. The Ōtākaro Avon River Corridor Regeneration Plan takes steps to build climate resilience and community wellbeing. Some advantages of the project are:
    - Creating a restored native habitat to support a variety of species and enhance water quality through enhanced stormwater treatment
    - Reduce carbon emissions through restoration of native plantings and wetlands
    - Opportunities to increase flood resilience
    - Demonstrate integration of land management, community areas, and management of flood hazards

2. The continuance of the renewals work allows for the following benefits in relation to climate change:

- Opportunity to reduce emissions during construction by selection of lower emission materials (such as in relining of concrete channels with riparian corridors) or design considerations
- Upgrading pipes and designs to better cope with climate change impacts such as allowing for additional capacity to deal to likely increase in flows
- Prioritising nature based solutions and use of native plantings

3. Continued upgrade and maintenance of flood models has the following benefits:
   - Creation and use of a dynamic and comprehensive flood model can be used as the basis for providing forecasting and alerts when predicting effects and likely hazard areas for incoming storm events. Establishment of a model of this detail would enable consideration of flood management procedures such as temporary flood barriers and building design criteria. These types of solutions can enable cost-effective management while minimising the necessity for relocation.
   - Enable a cost-effective way of testing and developing flood management designs which take into account the effects to the whole system and account for future climate change impacts such as sea level rise and increased rainfall.
   - Contribute to the ongoing safety of residents by educating on existing flood risk locations and enabling development of whole of system designs which consider effects upstream and downstream.
   - Are essential for contributing to the ongoing reduction of flood risk to the city by providing information on flood risk, notably when considering new housing areas or facilities or purchase of a property.

3.2.2 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 3-11: 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

3.2.3 Asset 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 3.2 on the following page.

Table 3-2 - Additional Departmental Risk Items

	Risk	Risk Description	Inherent rating	Treatments in place (today)	Residual rating	Proposed additional treatments
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.
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
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
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
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.

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, negatively impacting CCC's reputation, insufficient budgeting for Operation and Maintenance and Capital works.	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 operating levels to confirm the compliance of construction as compared to design.	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 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.
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.
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 maintenance provider will not be able to fully meet the required maintenance of the technology, and that there will	High	Currently Operations and Maintenance has budgeted for maintenance, however it is unclear if these amounts are sufficient. The maintenance of some new technology will be	High	Council ensures all Operation and Maintenance staff are suitably trained, and upskilled to understand new technologies. 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.

		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.		undertaken as part of an agreement with the supplier.		
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.
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	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 the rivers.

		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.				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.
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	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	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.

		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.		parts of the city to monitor changes over time.		
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.
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.
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	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.

		compliance requirements resulting in prosecution.				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.
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, and planned changes to the intensification rules, 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 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.	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 renewals required to replace aged and failing assets. A programme of Capital Works has been proposed for approval in this 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
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

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.
SW17	Dam classified retention basins	Legislation has changed for the definition of what constitutes a Dam, which means that Council may have some treatment facilities that meet the definition. Funding was requested in the previous LTP to commence investigations to ascertain the scale of funding required to meet our obligations to meet legislation, however this wasn't approved. Some OPEX funding has recently been provided, so the initial works can progress, but this is unlikely to be enough in the immediate stages of setting up a framework, policy etc.. Additional funding has been again requested in the LTP. It is essential that this is approved to mitigate the risk of Council being liable 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. A framework and policy need to be set up as per the Dam Safety regulations. 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. 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	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.

		damage and an eventual higher renewal cost.				
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 has occurred with the recently completed Te Kuru facility and Cashmere Valley facilities, which has no OPEX allowance within the FY24 annual plan, and additional FTE for internal staff to manage the treatment facility. This will likely 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 online. This will require a process improvement that involves 3-waters, PMO and finance to prevent this from continually reoccurring. 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.
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.
SW21	Insufficient Investment in Technology - monitoring	There is a risk that Council is not carrying out sufficient monitoring to manage flood events or calibrate and verify flood models and undertake 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.	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, 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.

		weed growth or sediment deposition resulting in underperformance of infrastructure and ineffective use of budget.				
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
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.
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
SW25	Silo Working Departments	There is a risk that different departments in Council carry out works with possible synergies in isolation from each other, or with a timing that affects other renewals. This may result in unnecessary	Medium	While this an on-going issue between Council departments, the silos are slowly becoming reduced due to inter-departmental update meetings occurring i.e. 2 monthly catch up	Medium	Council to fund a project (GIS based) where all future projects 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.

		rework, damage to new assets, and damage to Councils reputation.		meetings between Waterways and Parks		
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.
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.
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. The undelivered works on the Peninsula may expose Council to	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.

		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	Towards the end of the last LTP, Council adopted a new Climate Change Strategy document which provides high level direction for informing how Council will progress to meet is mandated carbon targets. Unfortunately, there was limited workstreams that affect 3-Waters actually started as there was insufficient direction and policy that came from the strategy. The main piece of work was the CHAP programme, however due to the nature of the engagement and the number of communities involved, this hasn't helped 3-waters yet. While there is emphasis on climate resilience in this LTP, there will need to be more effort given to achieve any sincere movement towards neutrality goals.	Very High	Carry out the pilot projects as outlined in the Stormwater Drainage and Flood Protection & Control Structures Activity Plans. Continue to work on the carbon calculation tool for use with capital works. It is assumed that given the emphasis on Climate Resilience in this LTP, that the various OPEX requests for the 3-Waters teams will be provided, otherwise the business may fail to meet the Strategic Priorities and Community Outcomes.

4. Continuous Improvement

4.1 Overview of the Improvement Programme

There has not been investment in either funding or resourcing of asset management improvement within the business units, including working through the improvement items identified in the last 2 AMPs. However, Council has now made a 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.

4.2 Current Asset Management Maturity

An independent assessment of current asset management practice was undertaken in October 2020. Asset Management Maturity Assessments (AMMA) are carried out once every 3 years and will be undertaken again in September 2023.

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

Based on the October 2020 maturity assessment, the activity has been defined as “Intermediate”. However there are some concerns that this assessment may be overestimated, and may go down in subsequent assessments.

A summary of the October 2020 assessment results for this activity and the scores are shown in Figure 10.1. 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 and 2021 Asset Management Plans.

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 3 waters Asset Management team have

submitted a bid for OPEX expenditure to provide funding for the business improvements as part of the LTP process – see table 4.2 - Asset Management Improvement Tasks for further information.

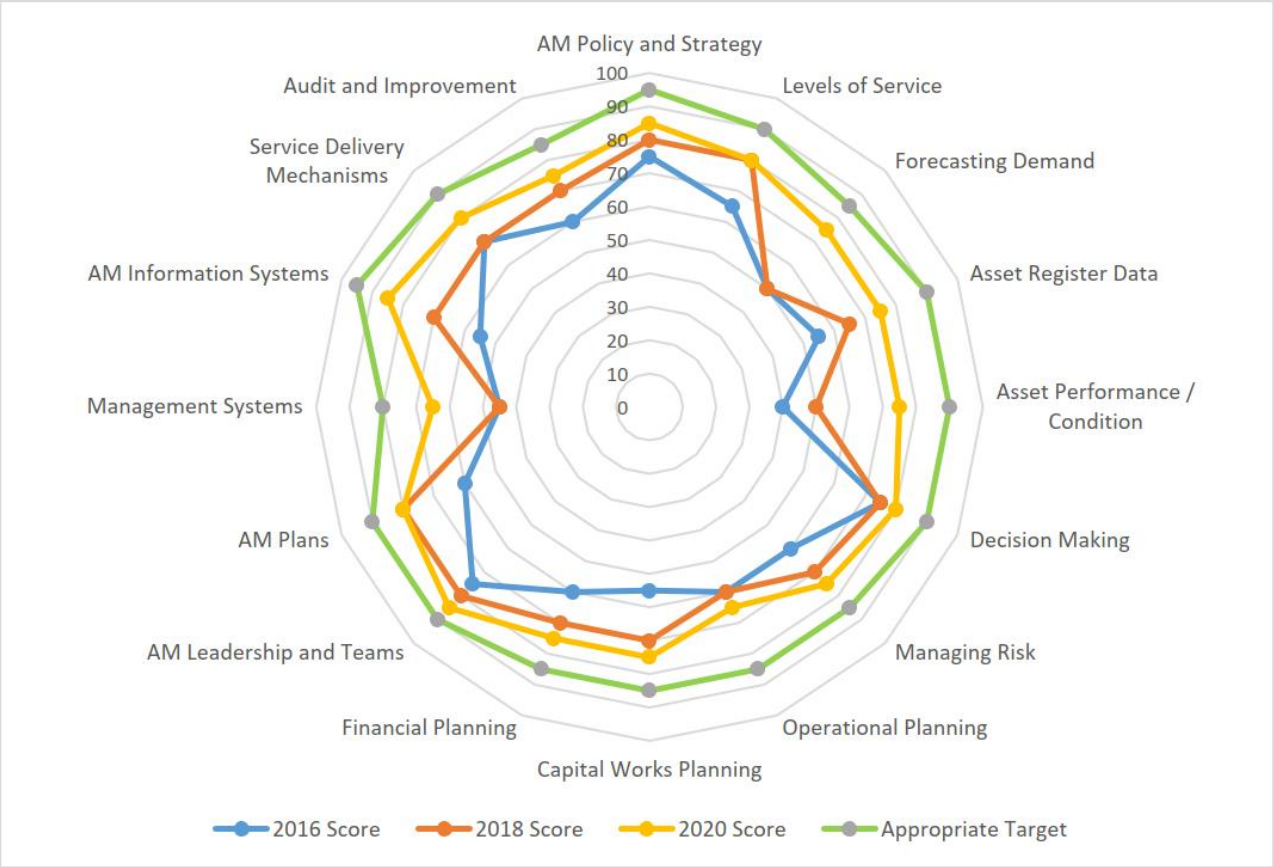


Figure 4-1: October 2020 Asset Management Maturity Assessment for the Land Drainage Activity

4.3 Monitoring and review

The Asset Management Improvement Programme (AMIP) will be reported to the Strategic Asset Management Team (SAM). All improvement items and the improvement programme will be monitored by the SAM team and reported to the Executive Leadership Team as required.

4.4 Review of Progress against Previous Plan

The last improvement plan was developed as part of the 2021 AMP update. The indicative term of the improvement programme was three years. No OPEX funding requested by the 3 Waters Asset Management team for carrying out the land drainage improvement items within the 2021 AMP were approved. Therefore all of the items have been carried through into Table 4-2 within Section 4.5 – Improvement Plan 2024 below.

4.5 Improvement Plan 2024

The independent asset management maturity assessment process provides a sound basis for prioritising and monitoring improvements to current asset management practices. We are currently engaged with the improvement programme horizon with the next maturity assessment scheduled for September 2023. This will put in place the programme for 2023 through to 2026.

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 an improved asset management maturity 3–year target.

It is assumed that suitable funding and resourcing will be provided by the organisation to enable the improvements items to be carried out. Once the degree of funding is understood by asset management staff, a programme road map document can be produced which outlines tasks, timelines, hold points, interdependencies between tasks, resource constraints (either inter or intra unit) and completion dates.

Task ID	Project / Task	AM Maturity Gaps	Priority (H, M, L)	Responsibility	Cost	Resources (teams, $)
LD-01	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	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	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 and Land Drainage Planning Team	Data collection and interrogation approx. $250k/yr.	3W AM, LD Planning, LD Ops, AMU, Strategy Group
LD-04	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	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	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	TBC	3W AM, LD Planning, LD Ops, AMU, Strategy Group

				Transformation Team		
LD-07	Include the aspirational changes to the business as discussed in the Stormwater and Flood Protection & Control Structure Activity Plans to meet Councils agreed targets of operational carbon neutrality by 2030 and Christchurch Carbon Neutrality by 2050.	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

Table 4-2: Asset Management Improvement Tasks

Appendices (Supporting information)

Appendix 5.1 - Asset Management Objectives

Principle	Objective
1. Asset management outcomes align with the strategic direction of Council	1. Linkages between Council's strategic direction and asset management outcomes are clear and understood
	2. All asset based services are linked to the attainment of Community outcomes
	3. A whole of life approach is taken for all asset management initiatives
	4. Asset management planning outputs provide the options and financial forecasts for the first draft of the Long-Term Plan (LTP)
	5. Investment in Infrastructure is optimised across all asset types
	6. Opportunities to increase resilience are considered in all asset management planning
2. Asset management is an organisational wide practice	1. The Strategic Asset Management Team (SAM) provides leadership of asset management practice at Council
	2. Asset management is co-ordinated across the organisation
	3. Core asset management processes are consistent across Council
	4. Asset management practice is compliant and appropriate
	5. Asset Management Teams across all lines of the business are motivated and driven by customer needs
	6. There is an organisational culture of continuous improvement in asset management
3. Decisions about assets are based on well managed, quality information	1. Asset data is available in corporate system for use in all decision making related to Council assets
	2. The performance and condition of assets is monitored and reported
	3. Decision making by asset owners and managers is outcome based and based on reliable asset information
	4. Supporting asset information is readily accessible
	5. Asset data is up to date

	6. Asset management decisions by asset owners and managers are based on evaluation of all viable options to deliver levels of service outcomes
4. Asset management maturity levels are appropriate to the assets, services and risks we manage	1. Identified asset management maturity gaps close over time
	2. The asset management capability of staff resources matches the needs of the organisation
	3. The organisation recognises the importance of AM and adequately resources the AM system
	4. Appropriate levels of asset management maturity are defined and reviewed as business needs change
	5. The level of AM practice is matched to the criticality of the assets
	6. Christchurch City Council gains recognition for its evolving AM practice
5. Asset management plans (AMPs) are living documents	1. AMPs are easy to follow
	2. AMPs are complete and at the agreed level of maturity
	3. AMPs reflect the current level of asset management practice for the asset type
	4. The asset management improvement programme in the plan, contains all actions necessary to close the existing maturity gaps
	5. AMPs contain the 30-year financial forecasts; suitable to develop the first draft of the Long Term Plan and the Infrastructure Strategy
	6. Life cycle strategies are articulated within the asset management plan

Appendix 5.2 – 2021 Asset Management Plan Lifecycle Section

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 Internal CCC Document) 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.

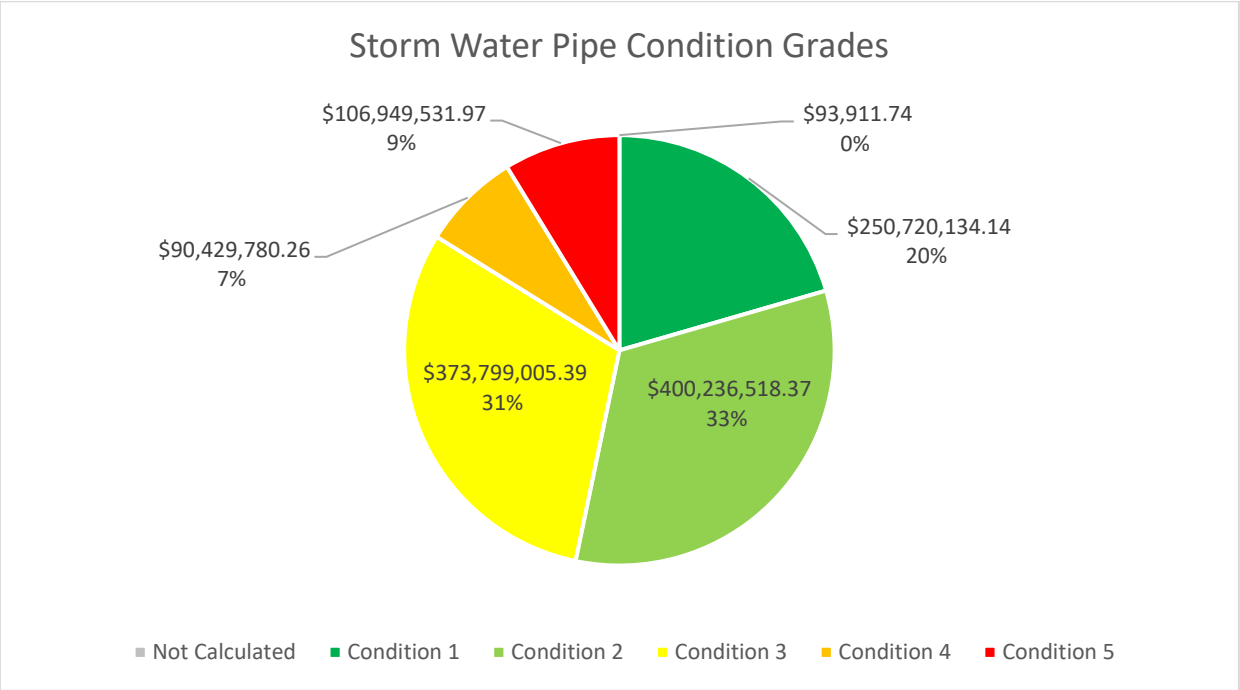


Figure 8-1 – Pipe Condition Based on Value

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.

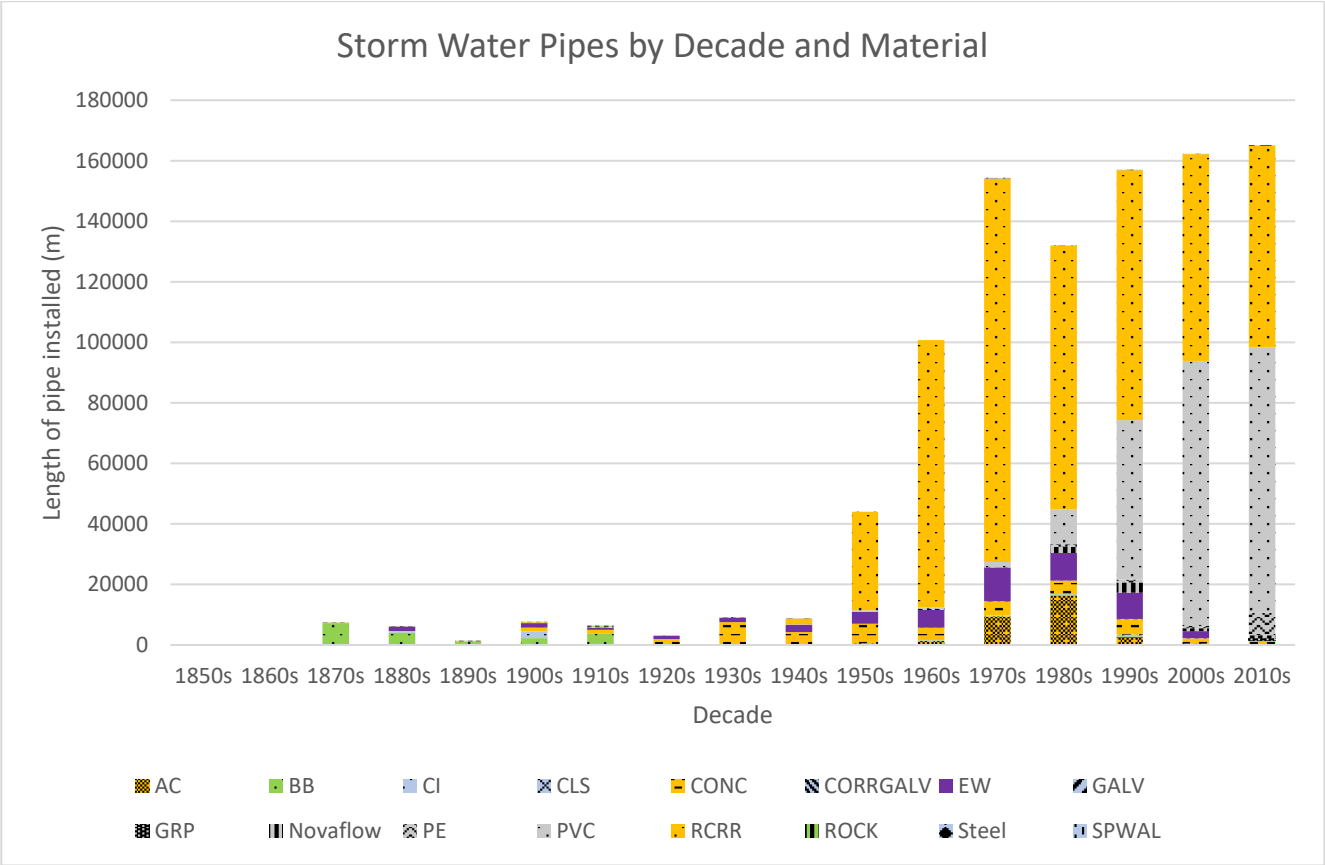


Figure 8-2 – Reticulation Development (including materials used)

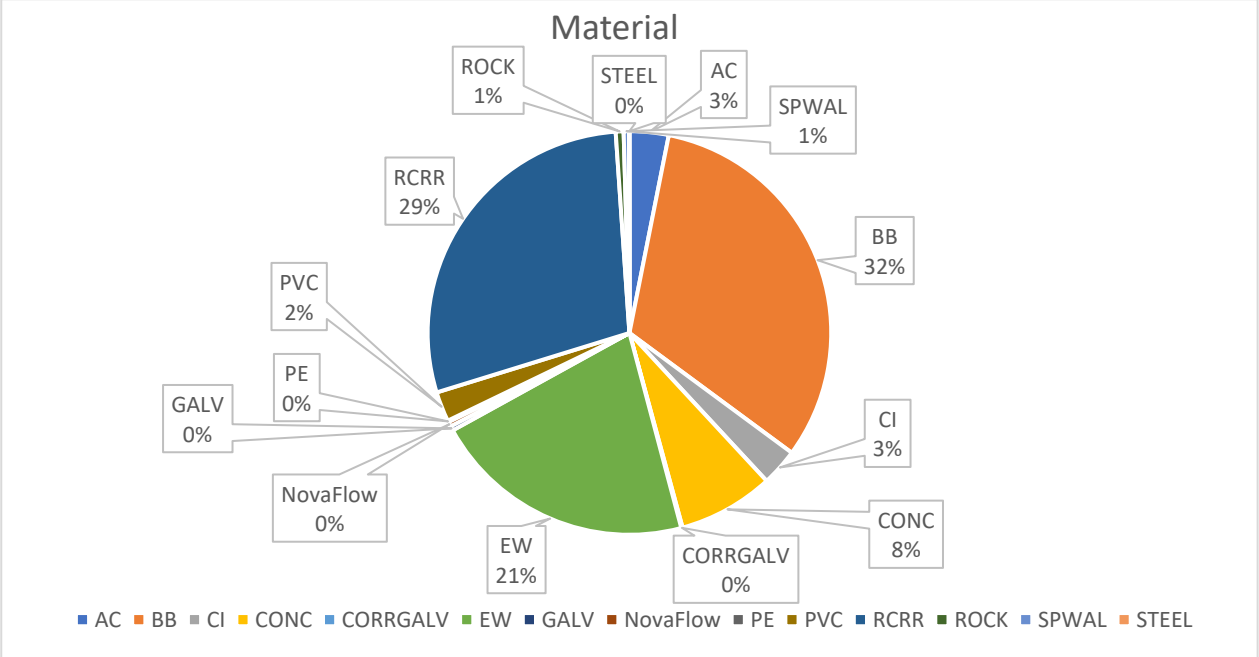


Figure 8-3 – Grade 5 Pipelines by Pipe Material

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

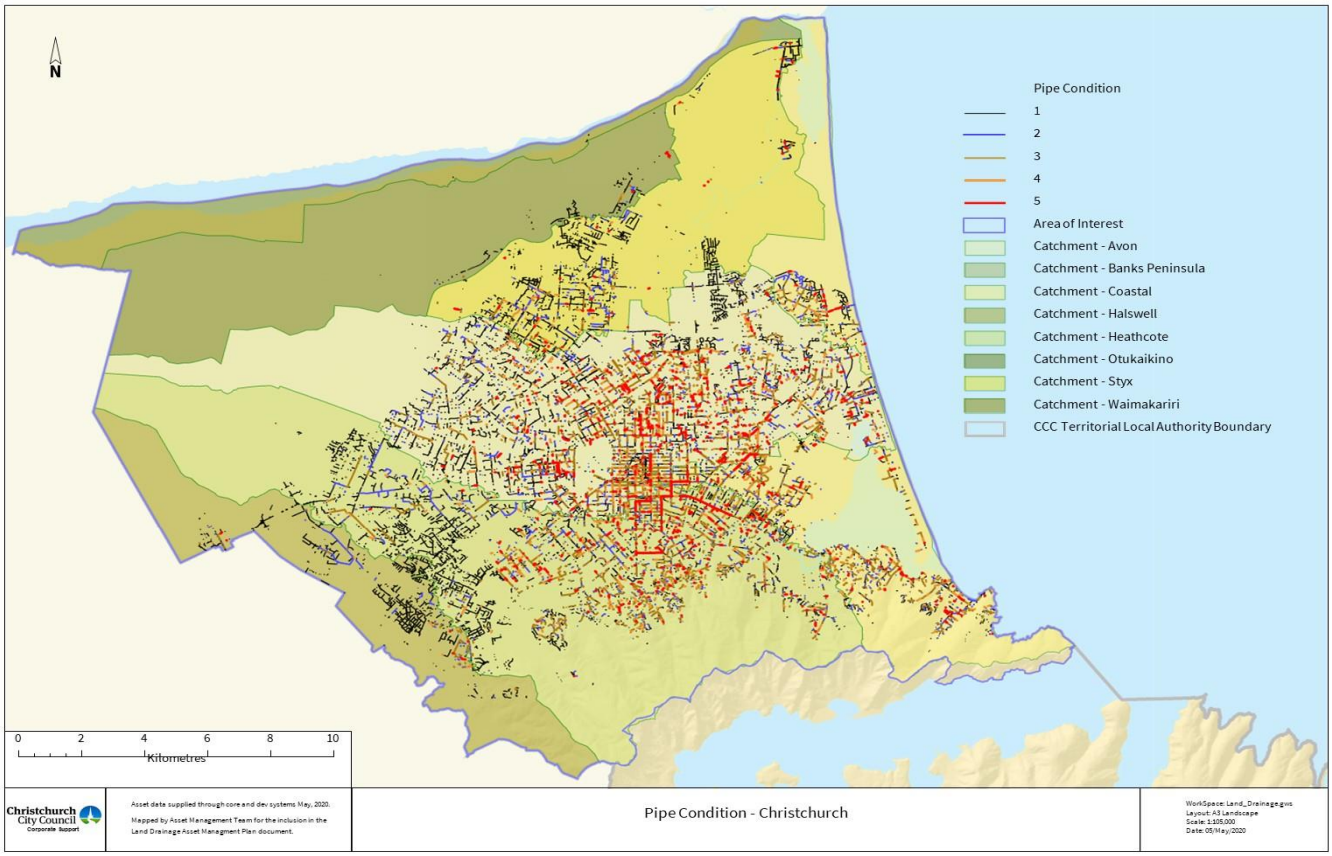


Figure 8-4 – Condition of Pipelines by Grade – Christchurch City

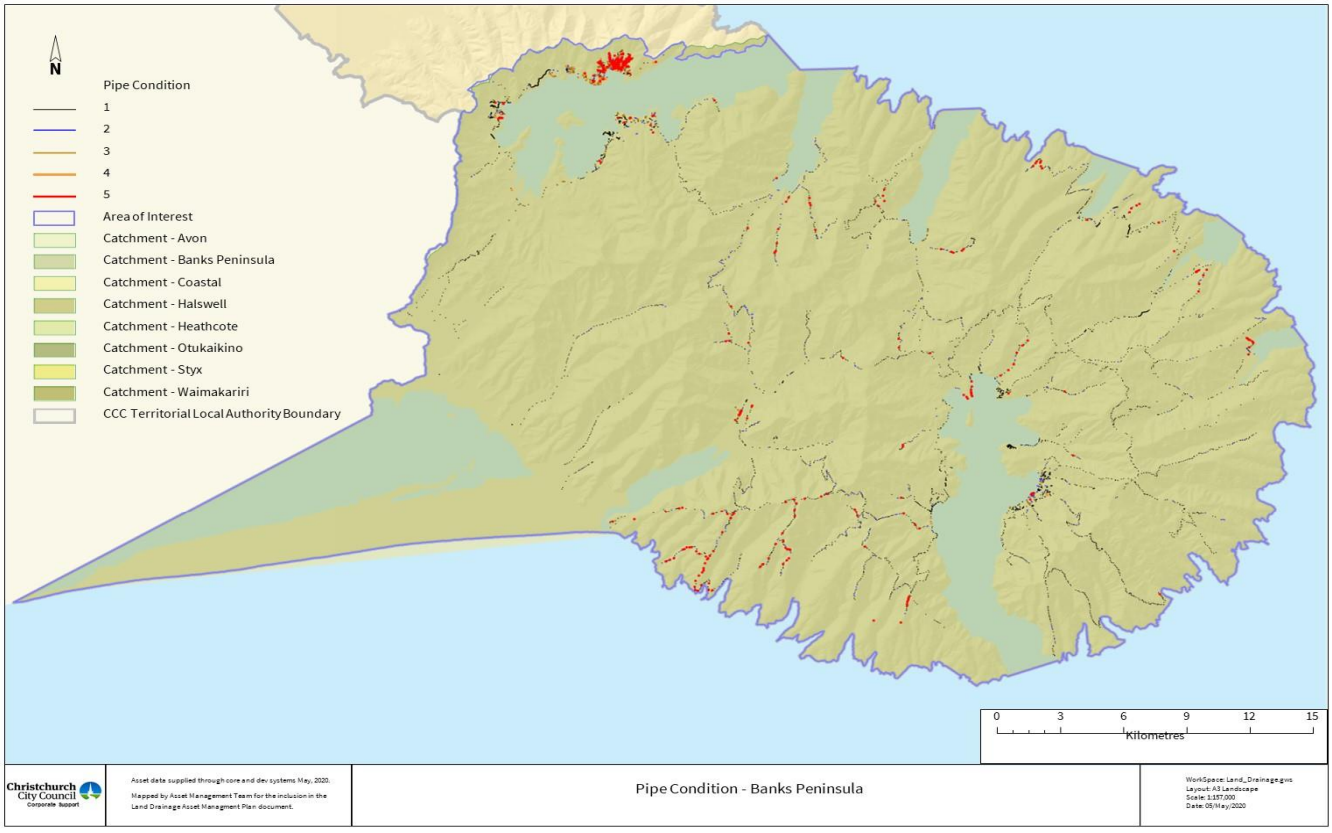


Figure 8-5 – Condition of Pipelines by Grade – Banks Peninsula

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.

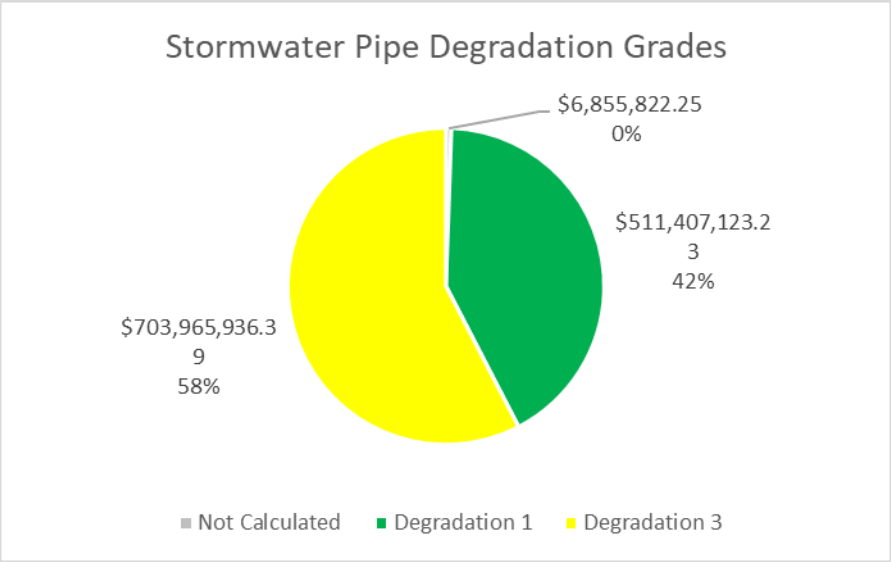


Figure 8-6 – Degradation of Pipelines by Value

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.

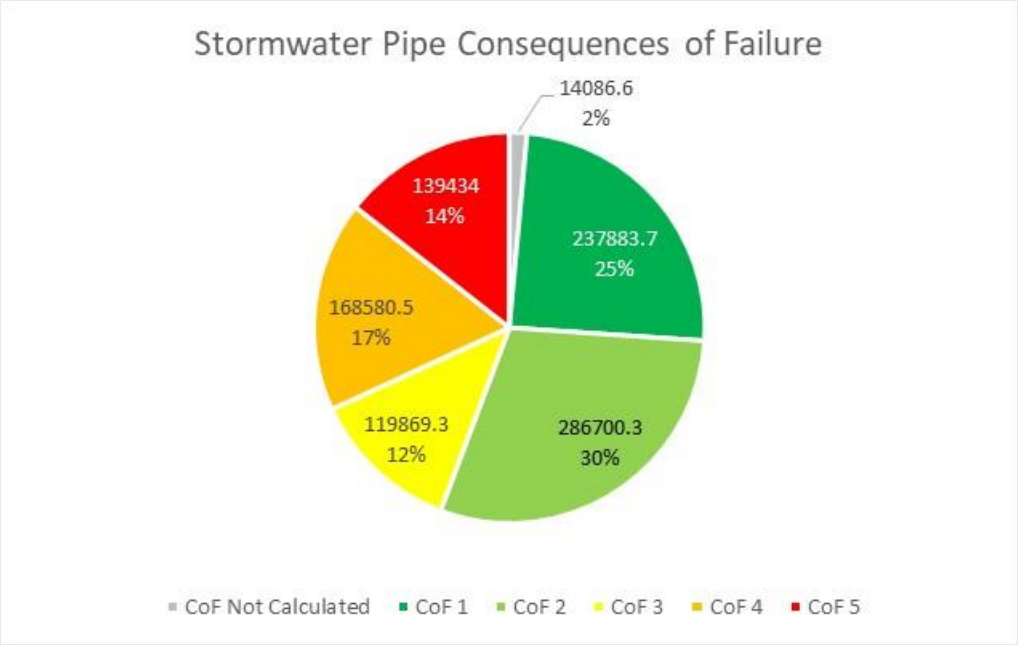


Figure 8-7 – Consequence of Failure Grades by Length

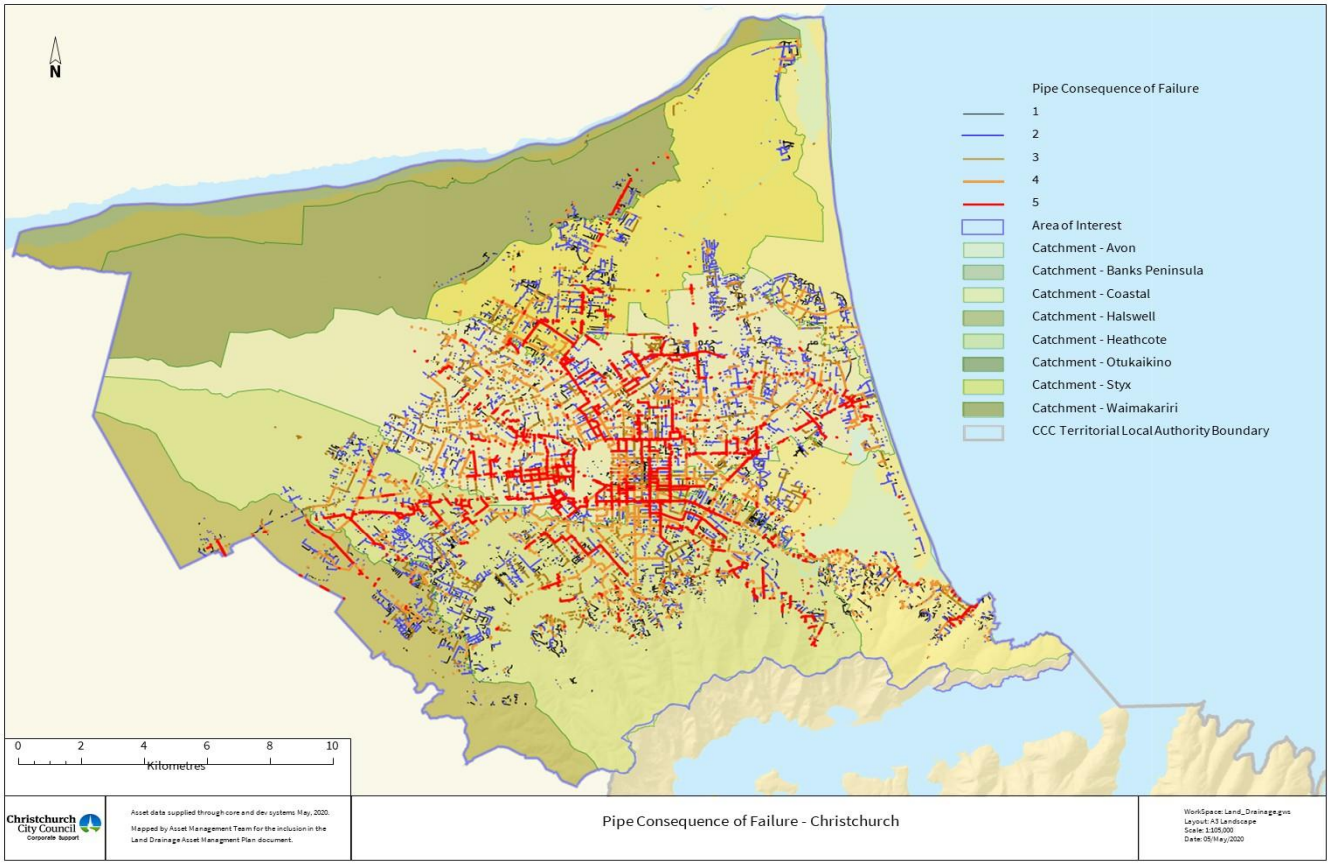


Figure 8-8 – Consequence of Failure Map for Christchurch City

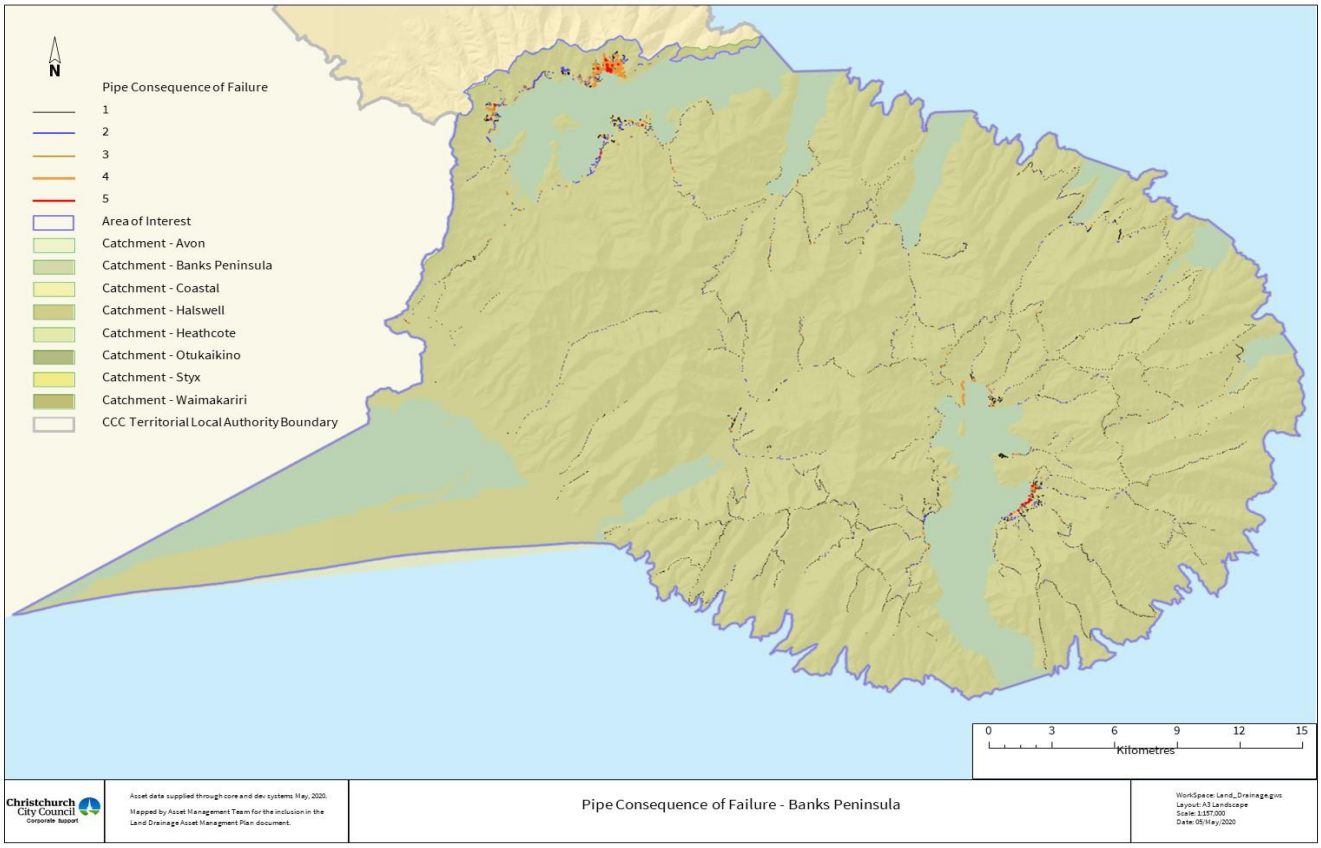


Figure 8-9 – Consequence of Failure Map for Banks Peninsula

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[1] 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.

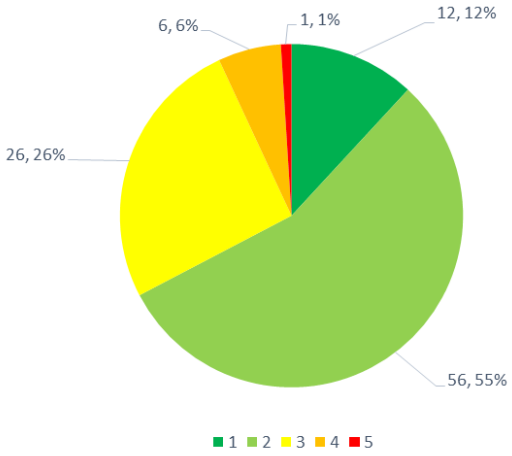
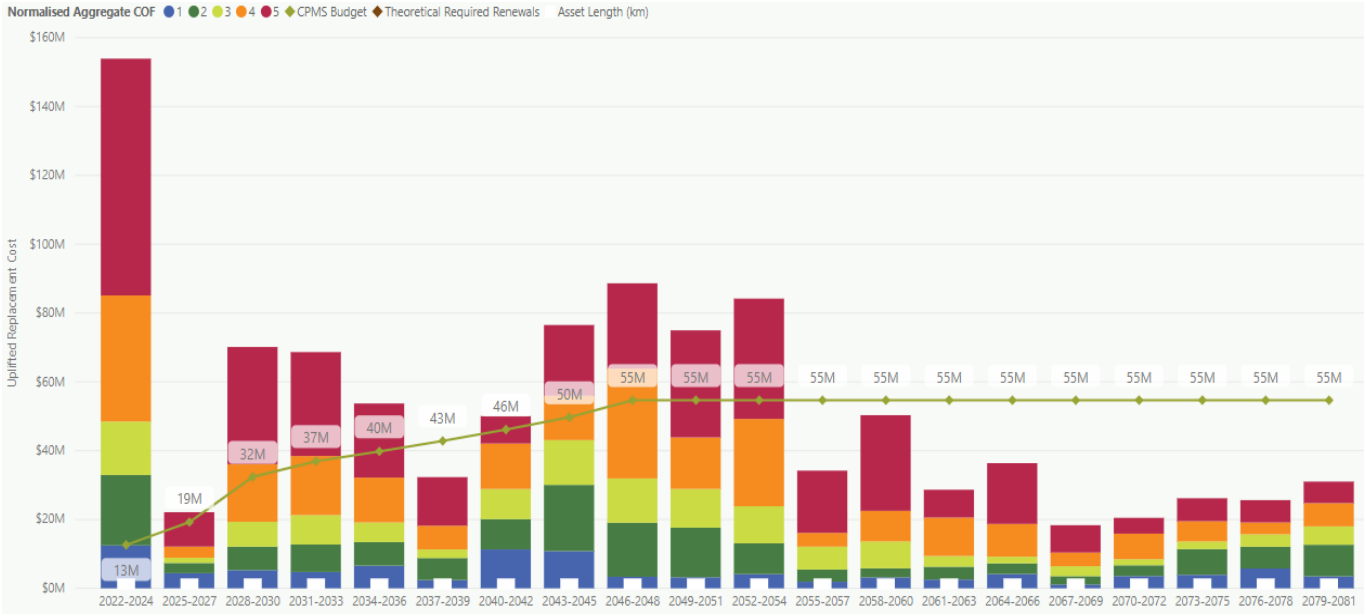


Figure 8-10: Debris & security grill condition grades (refer toTRIM://18/661552 'Pivot for AMP' tab for source data - Internal CCC Document)

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.



[1] Open Channels Condition Assessment Specification Rev 8 TRIM://15/724077 (Internal CCC Document)

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

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).

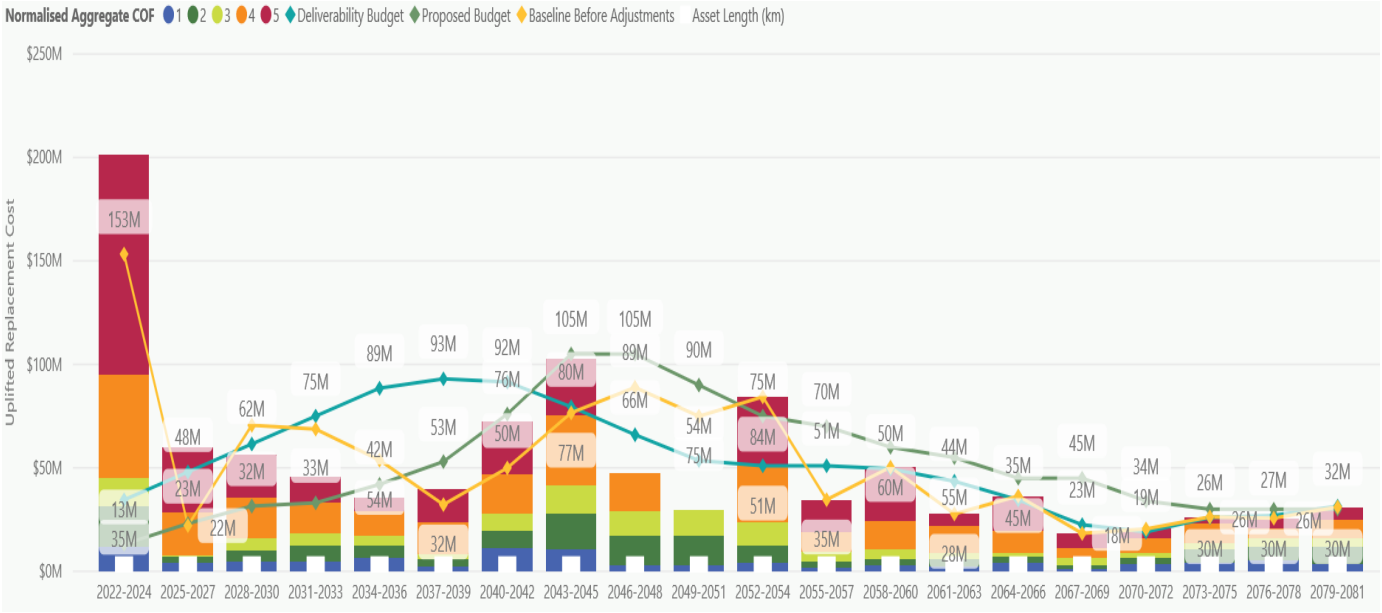


Figure 8-12: Storm Water Main Renewals – Original Recommended Option

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.

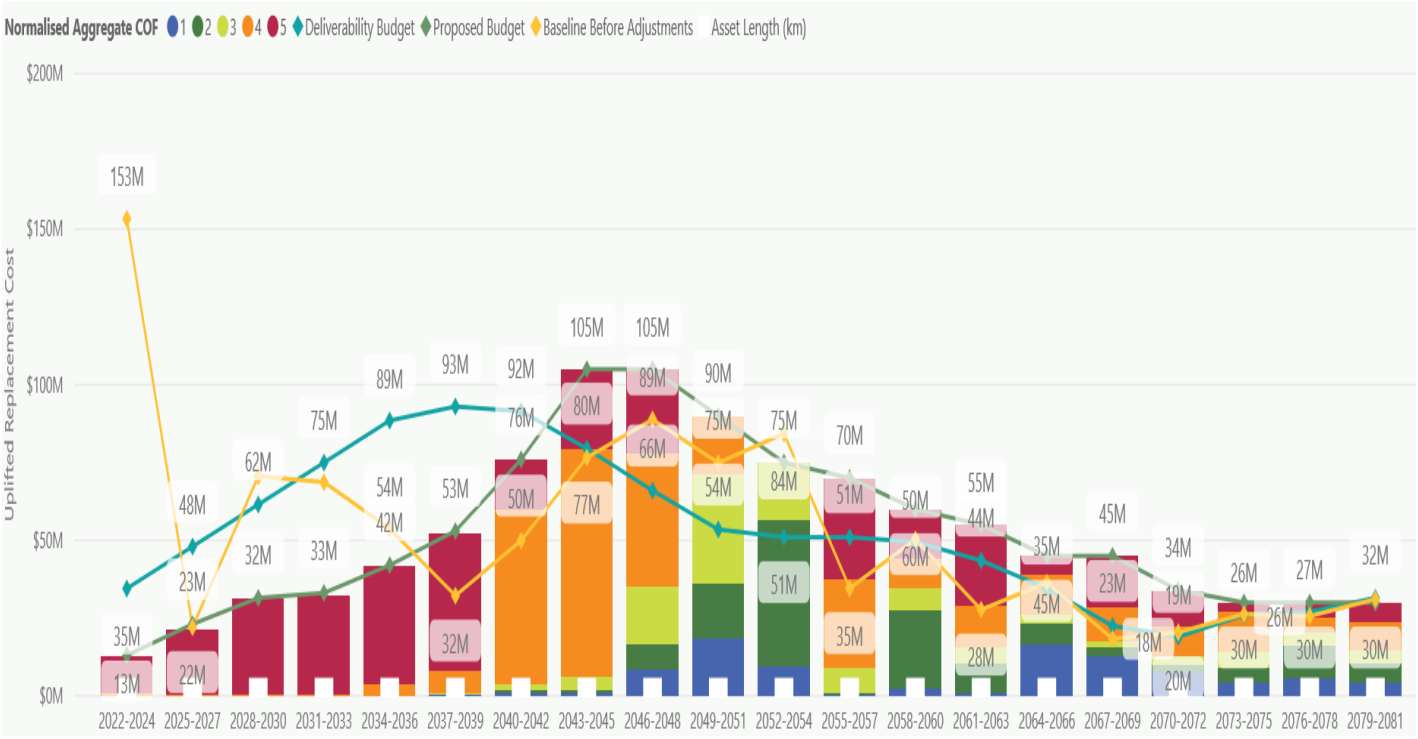


Figure 8-13: Storm Water Main Renewals – Recommended Option with Funding Available

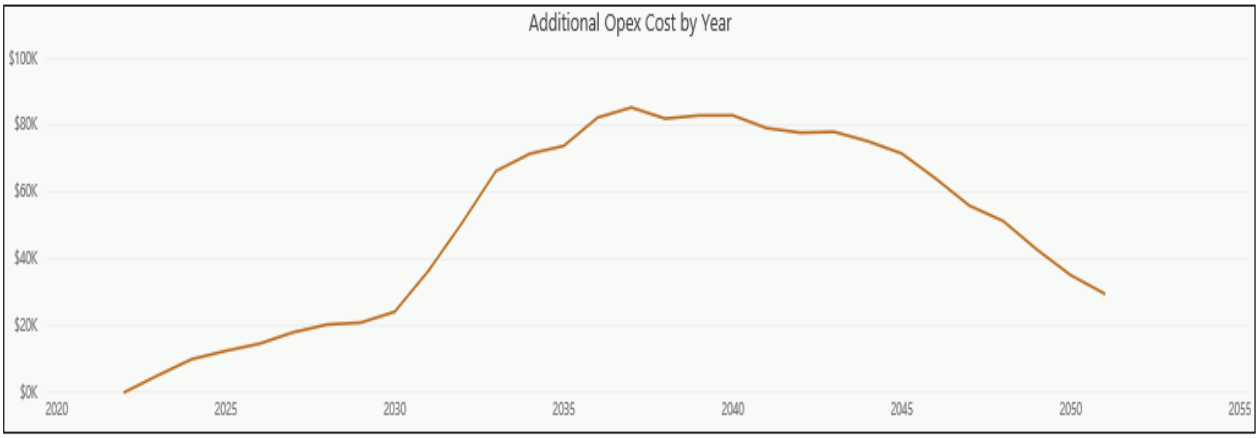


Figure 8-14: Additional Annual OPEX Cost Projection

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 0-1 - 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.

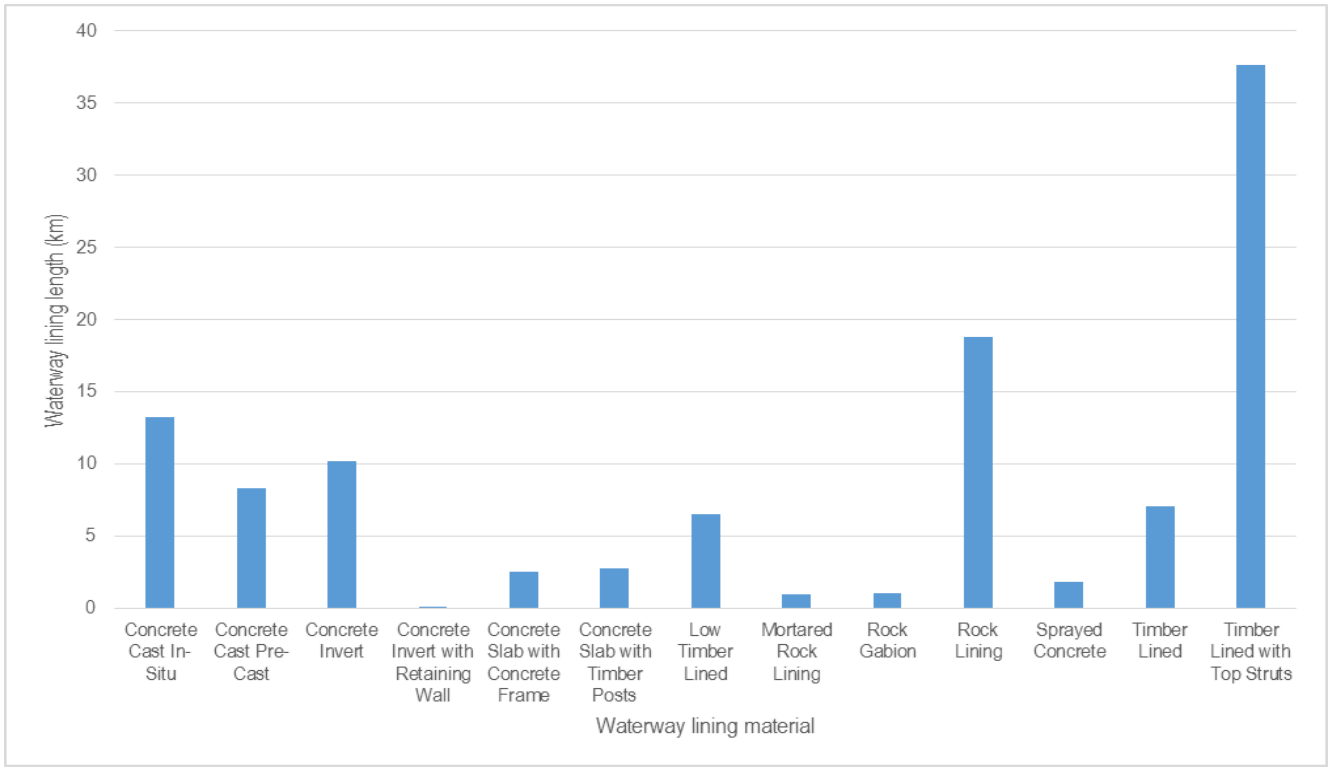


Figure 8-16: Waterway lining length by material/type (refer to TRIM://17/186435 'Type by length' tab for source data - Internal CCC Document) -

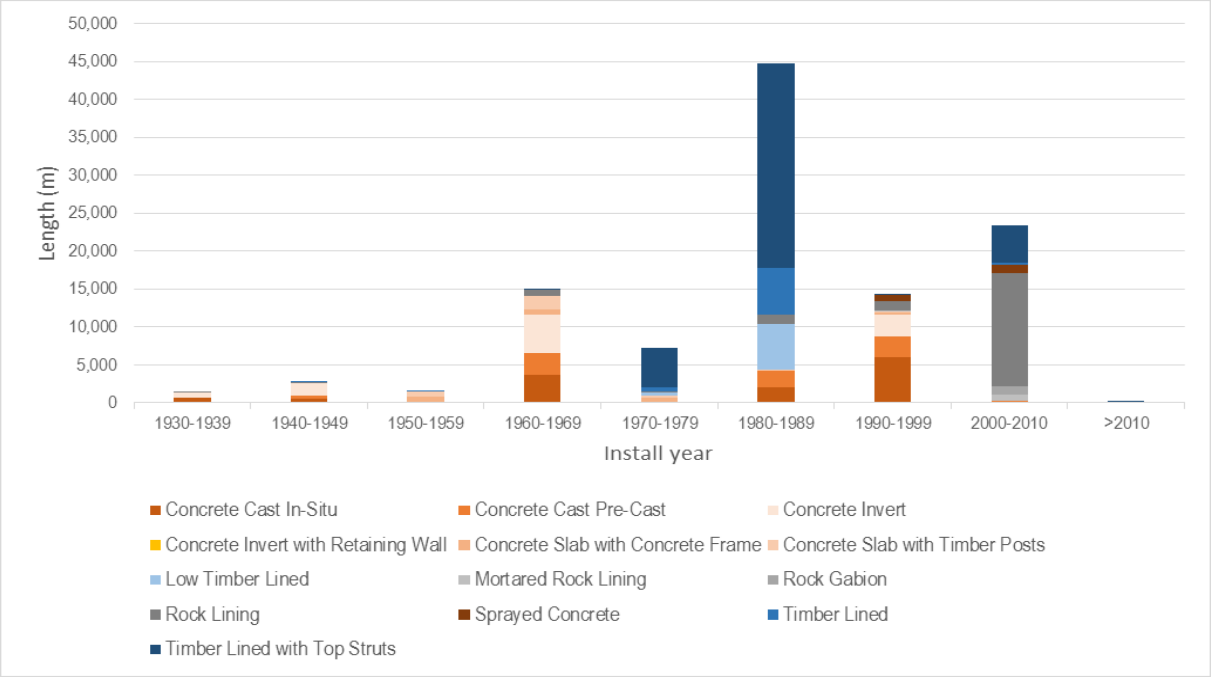


Figure 8-17: Length of lined waterway by type and install year (refer to TRIM://17/186435 'LengthByInstallYr (2)' tab for source data - Internal CCC Document)

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.

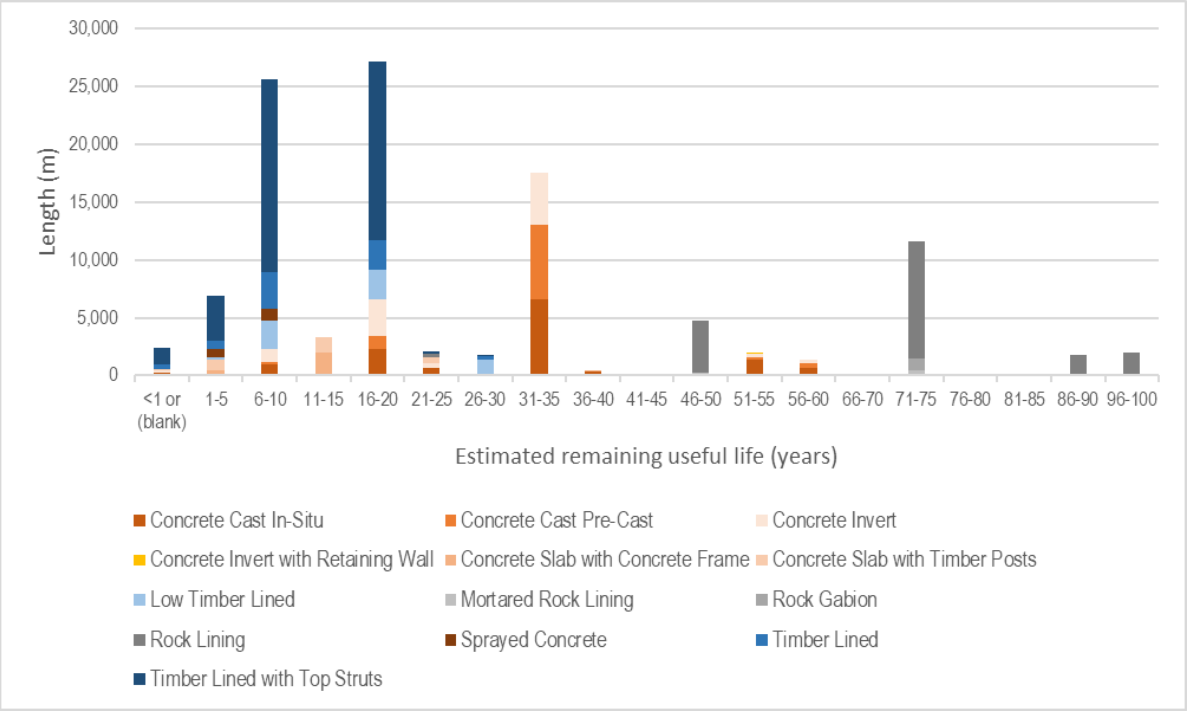


Figure 8.18: Waterway Linings Remaining Useful Age Profile

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.

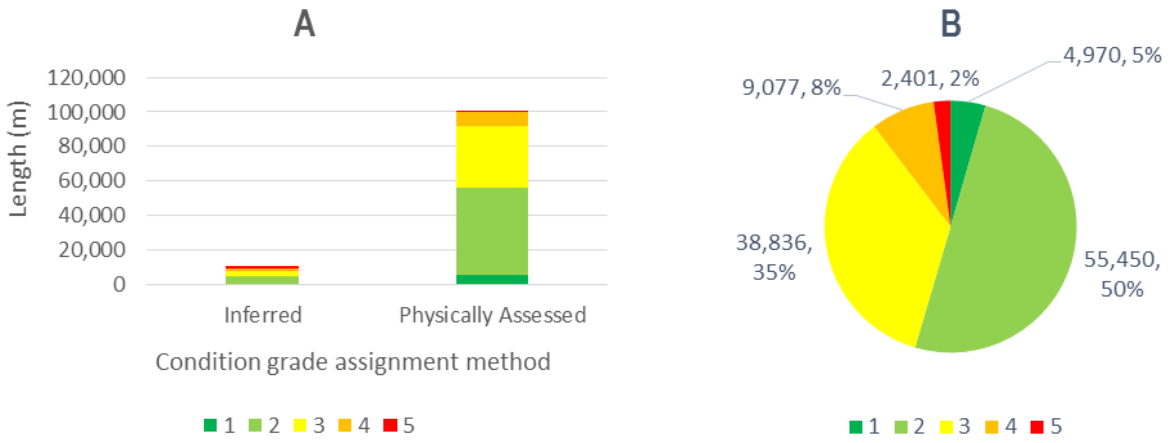


Figure 8-19: Waterway lining (A) physically assessed and inferred average condition grades and (B) overall average condition grade (source TRIM://17/186435 - Internal CCC Document)

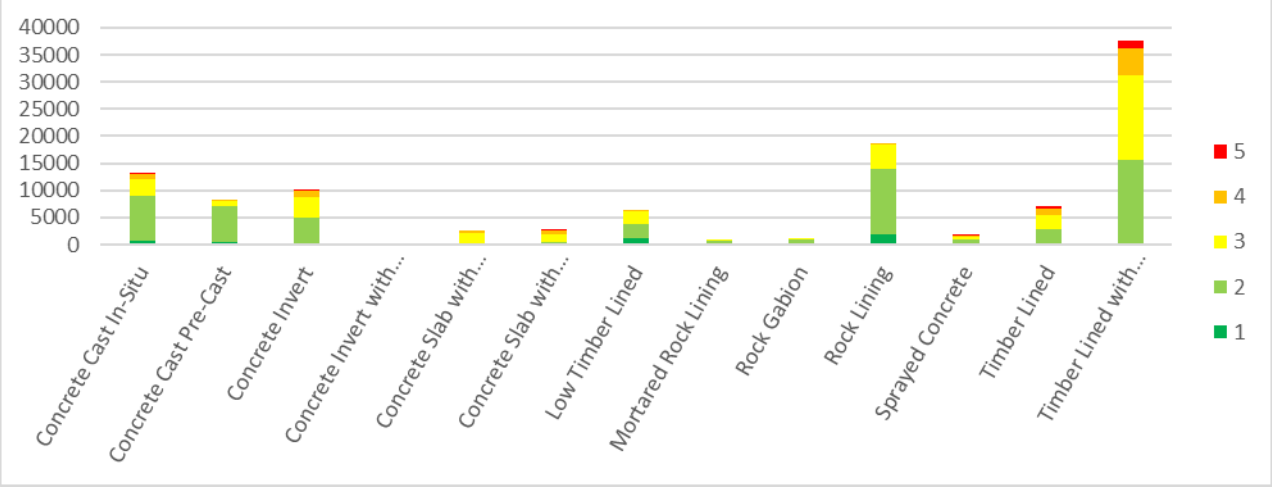


Figure 8-20: Lined drain average condition grade by lining type (source TRIM://17/186435 - Internal CCC Document)

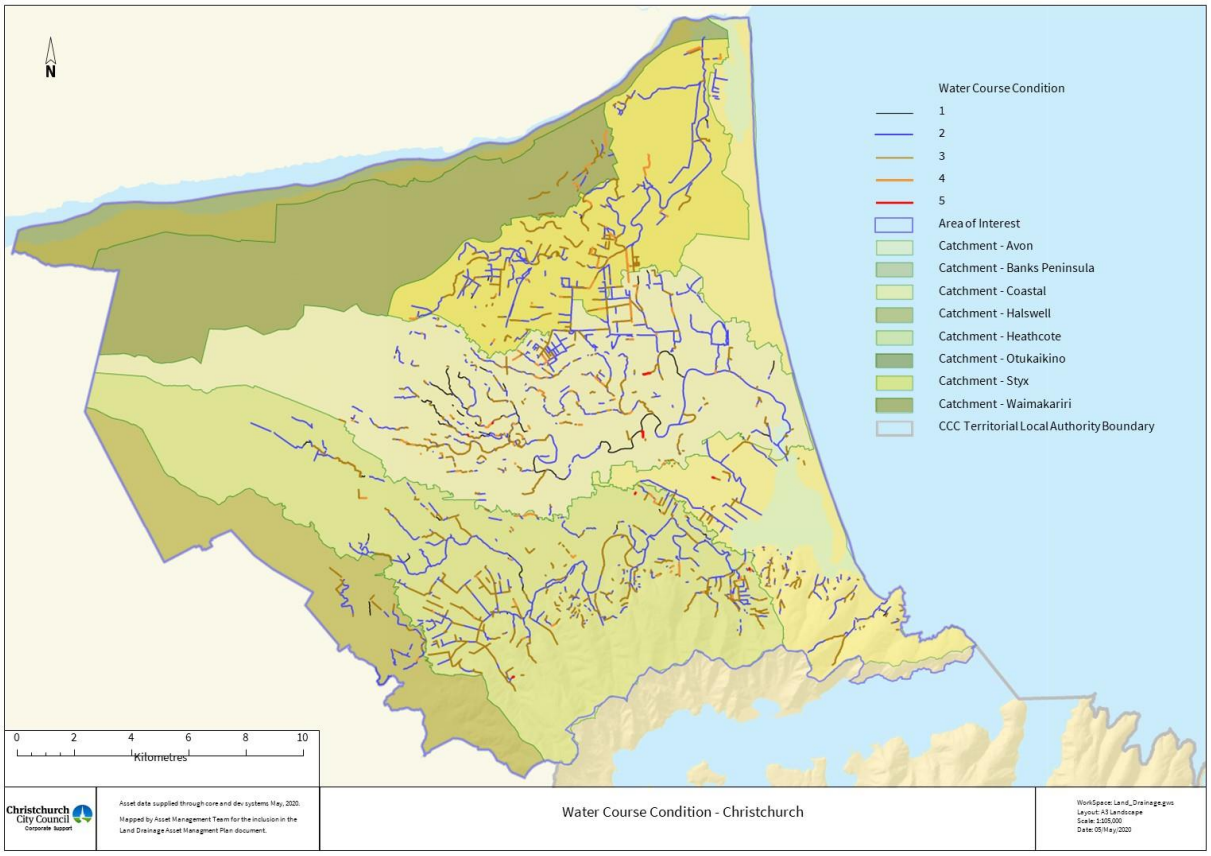


Figure 8-21: Watercourse Condition Grading – Christchurch City

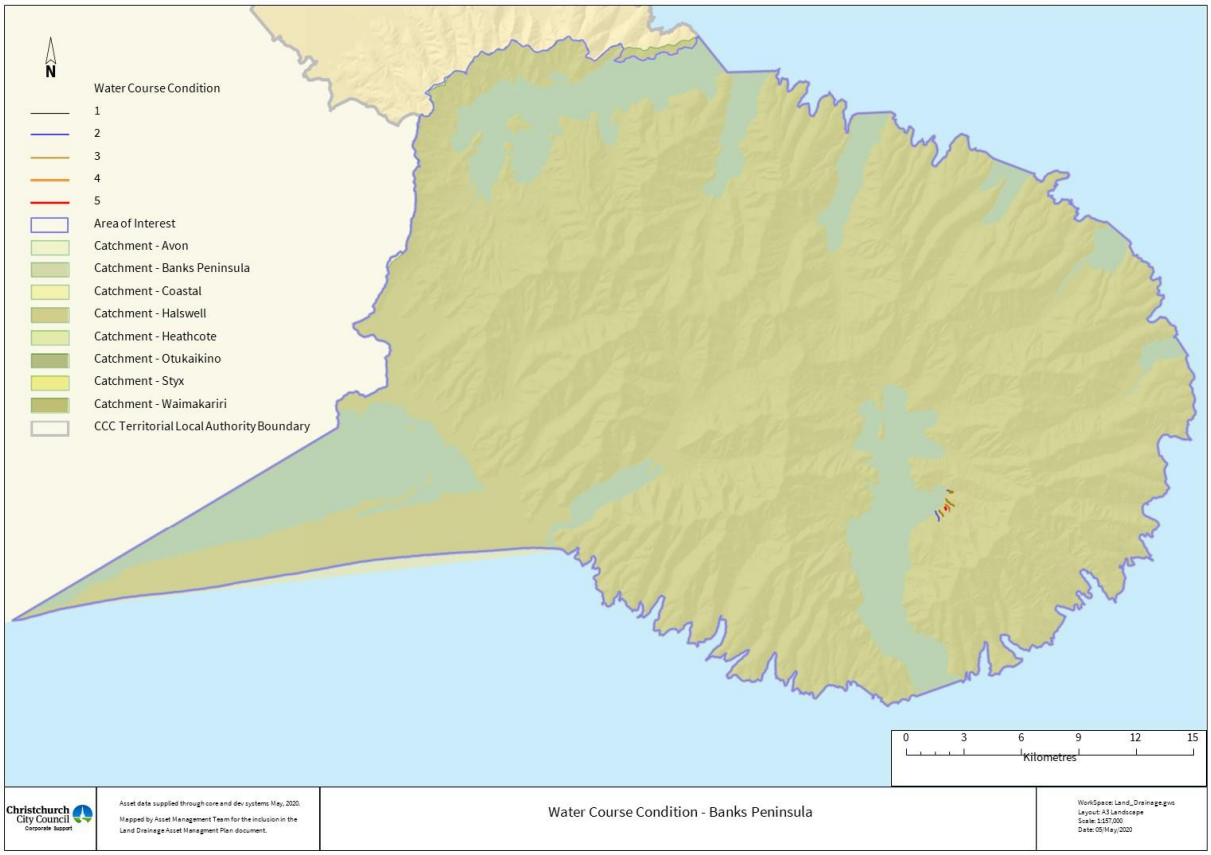


Figure 8-22: Watercourse Condition Grading – Banks Peninsula

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.

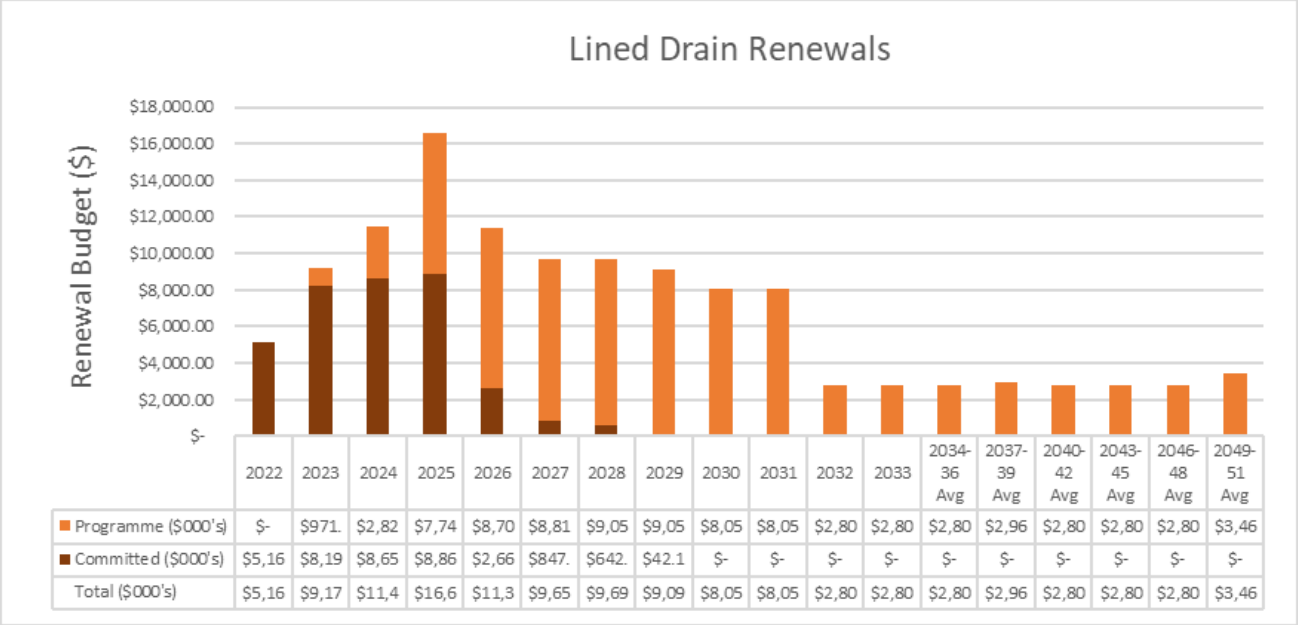
It will not be practical to only renew the sections of lining that are condition grade 4 or 5 as this would leave isolated sections that are in better condition. Renewal lengths scoped for projects will generally be continuous from one point to another to allow the best renewal option to be implemented 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 0-2 - 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[2], 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,

[2] 2018 Land Drainage AMP - Watercourse Classification Data 20171017 TRIM://18/662558 (Internal CCC Document)

Recreation, Heritage and Landscape values). The resulting grades by length are summarised in Table 8.3. Drainage and 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[3] 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[4] and LDRP 98 Tech Summary Document[5].

Table 0-3 - 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

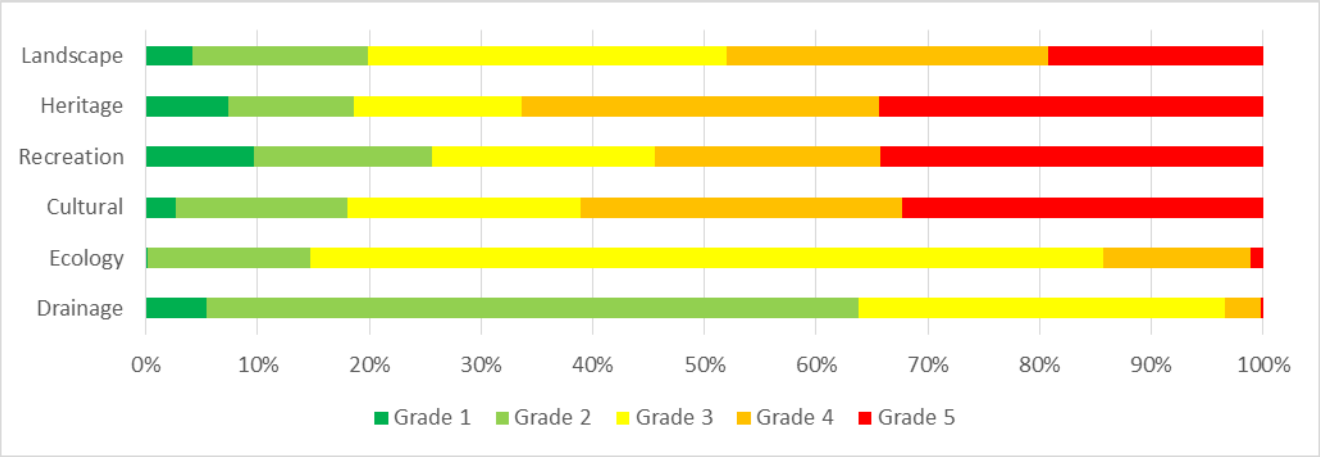


Figure 8.24: Open waterways 6 values average grade proportions

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

[3] Open Channels Condition Assessment Specification Rev 8 TRIM://15/724077 (Internal CCC Document)

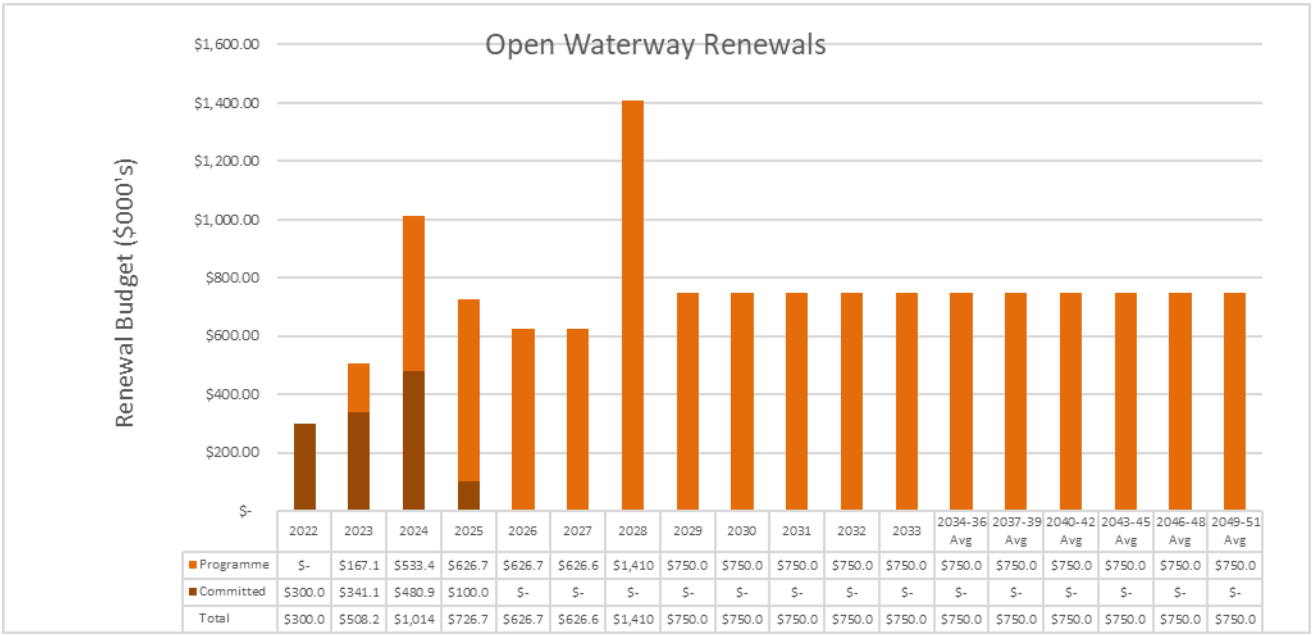
[4] LDRP 98 - Condition Assessment Data Summary Report_FINAL_20170130_City Wide TRIM://16/1441588 (Internal CCC Document)

[5] LDRP 98 - Condition Assessment Technical Summary Report_FINAL_20170209_City Wide TRIM://17/101090 (Internal CCC Document)

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.

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 0-4 - 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.

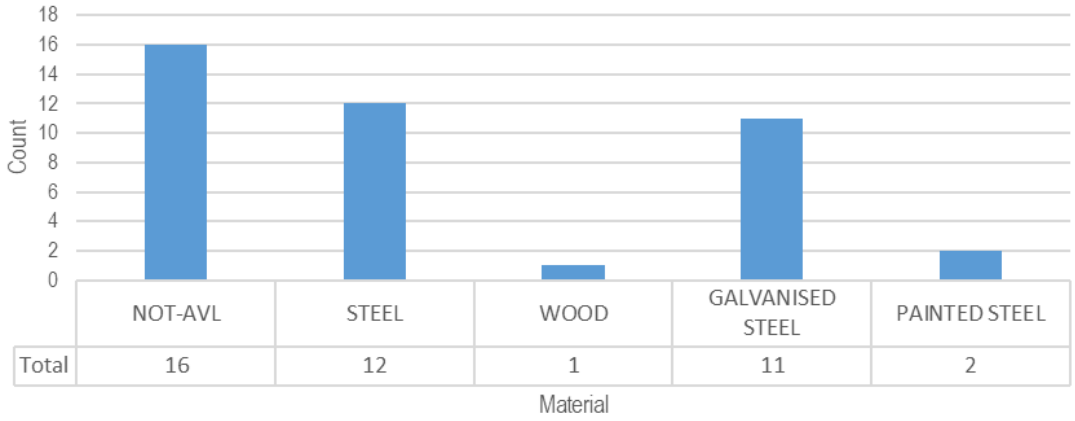


Figure 8-26: Debris rack provisional data summary (refer to TRIM://18/661552 for source data - Internal CCC Document)

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.

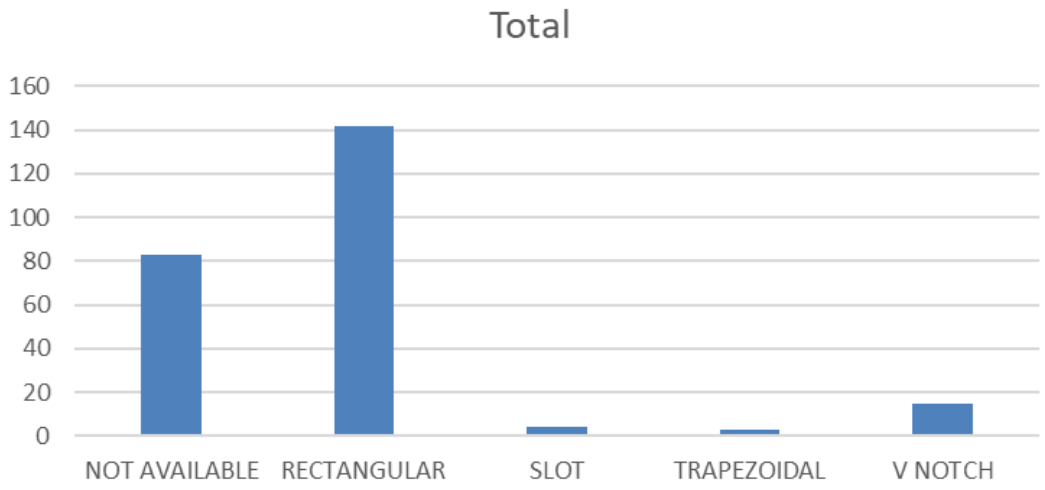


Figure 8-27: Weir provisional data summary (refer to TRIM://18/673311 for source data - Internal CCC Document)

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.

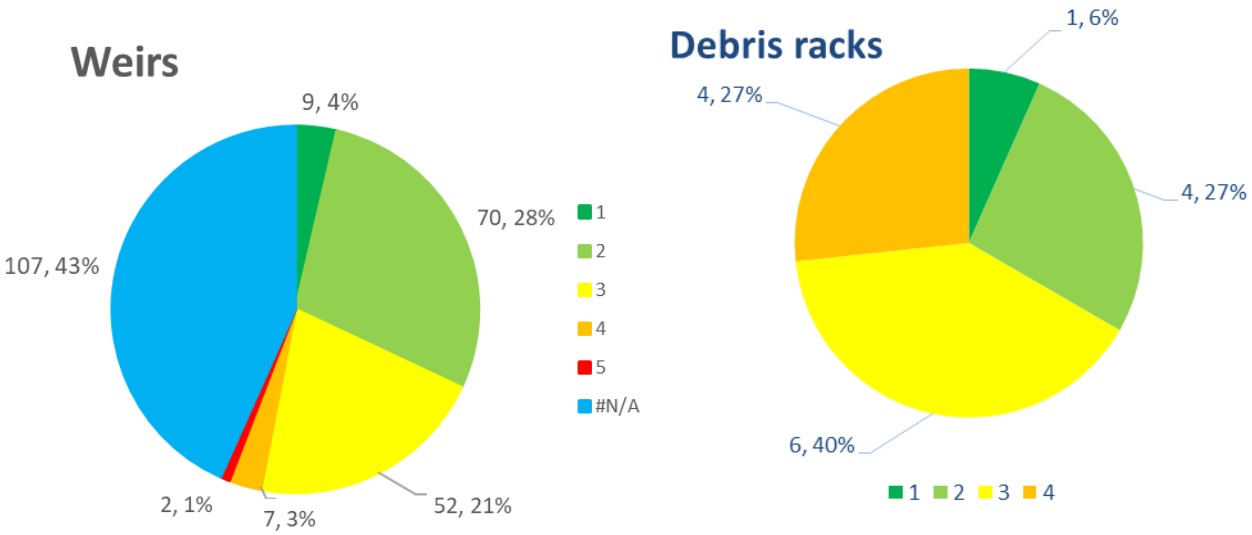


Figure 8-28 - Weir and debris racks physical inspection condition grades (refer to TRIM://18/673311 for Weir and TRIM://18/661522 for Debris Rack source data - Internal CCC Documents)

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.

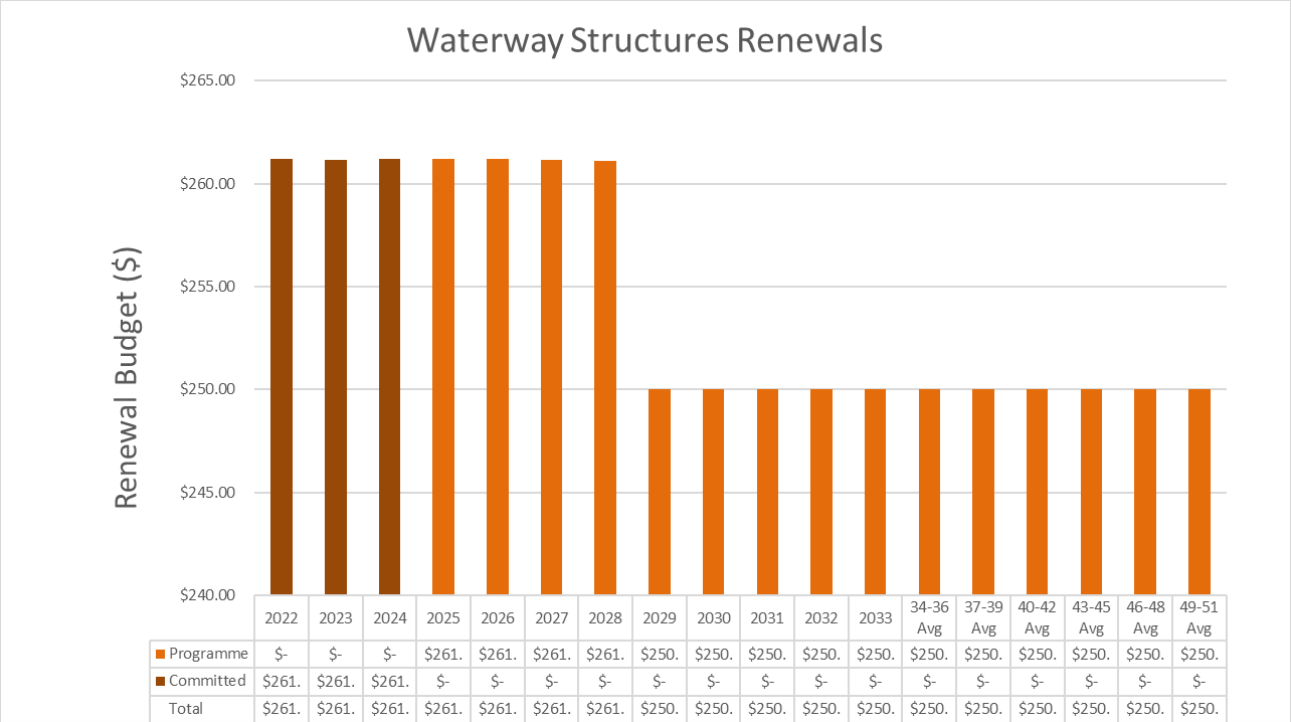


Figure 8-29: Waterway Structure proposed expenditure graph

Table 0-5 - 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.

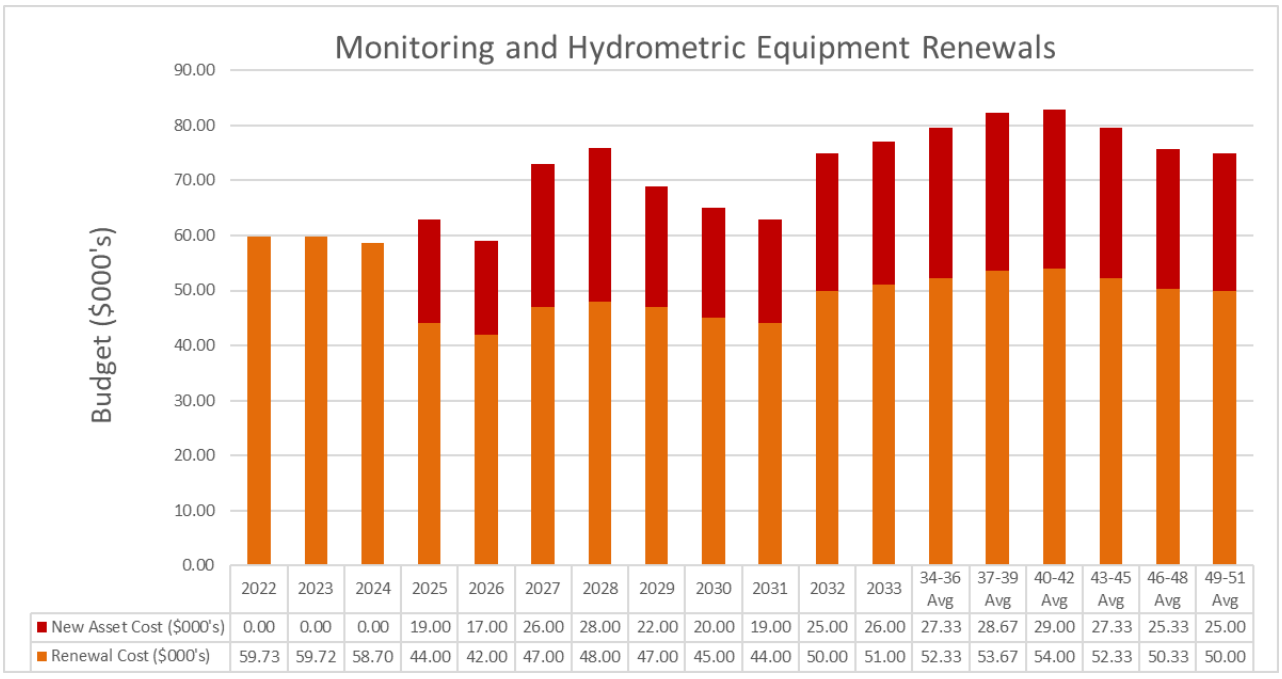
Renewal Plan

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 0-6 - 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 0-7 - 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.

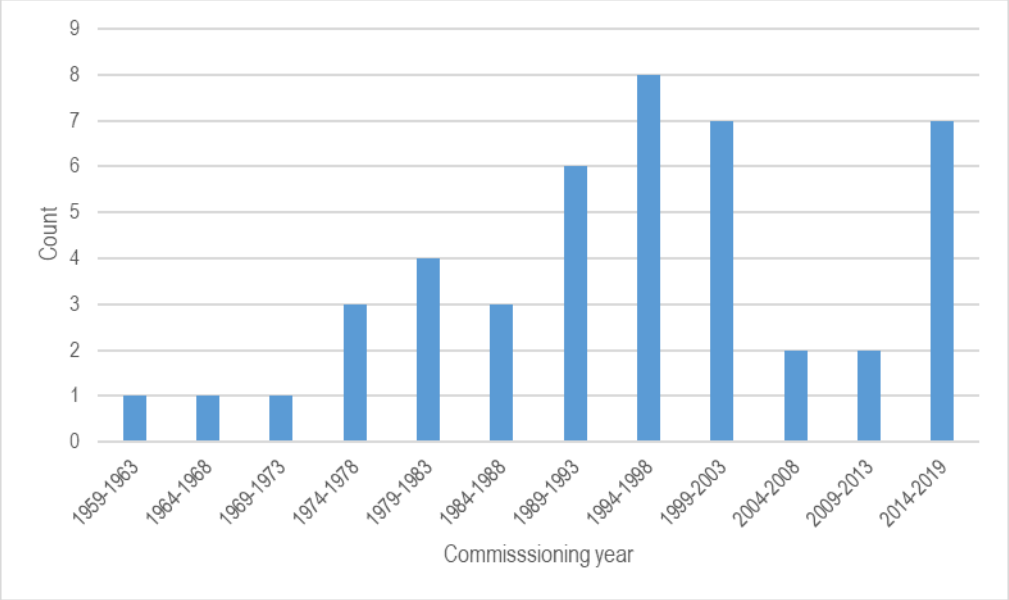


Figure 8-31: Stormwater pump station commissioning years

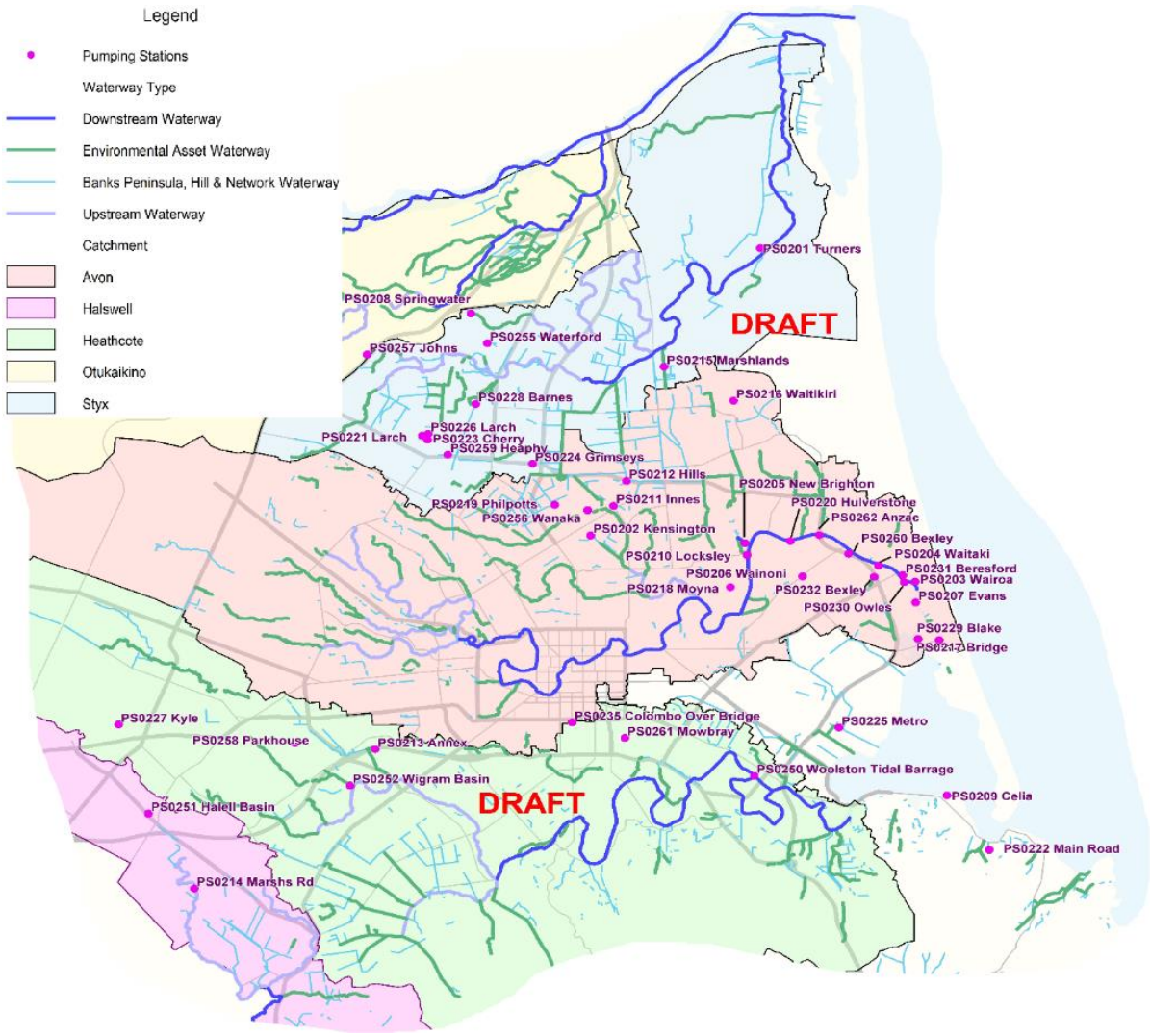


Figure 8-32 Pump station location plan (the 'draft' labels relate to the river catchments)

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 0-8 - 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.

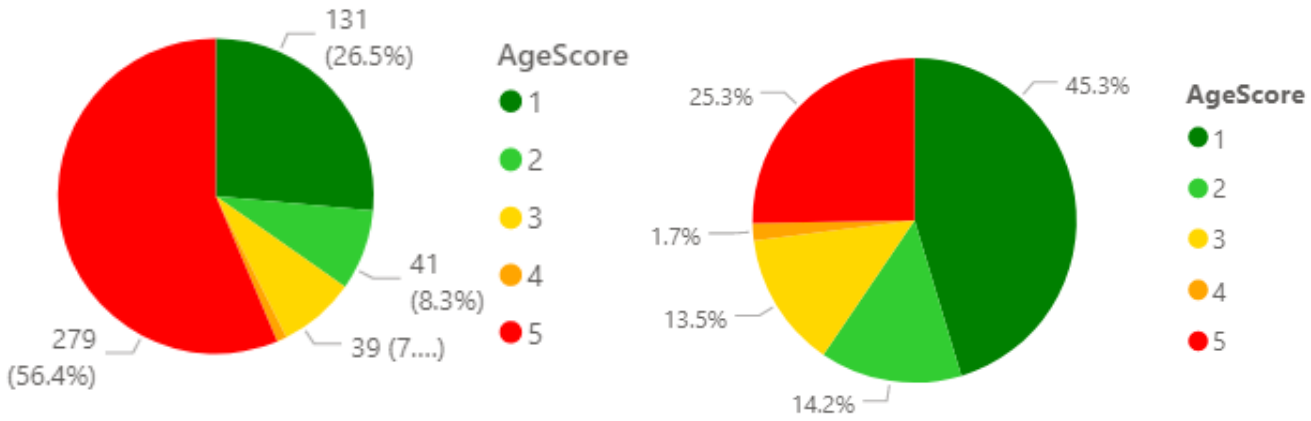


Figure 8–33 - Condition 1-5 by the number of assets (left) and value (right).

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.

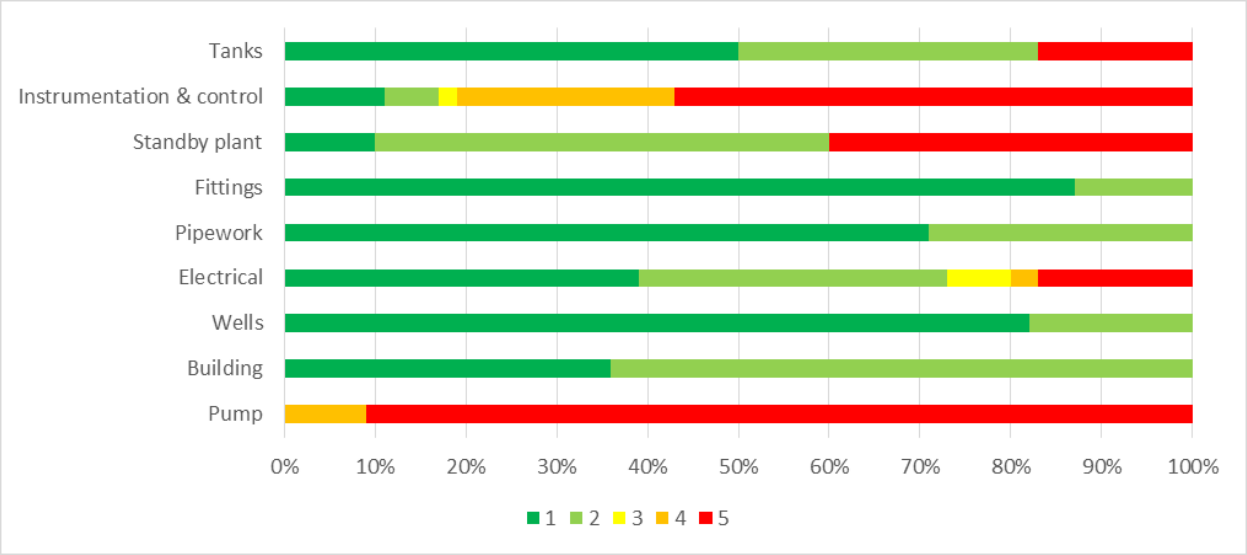


Figure 8-34: Pump station component inferred condition (refer to TRIM://18/715680 for source data - Internal CCC Document)

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.

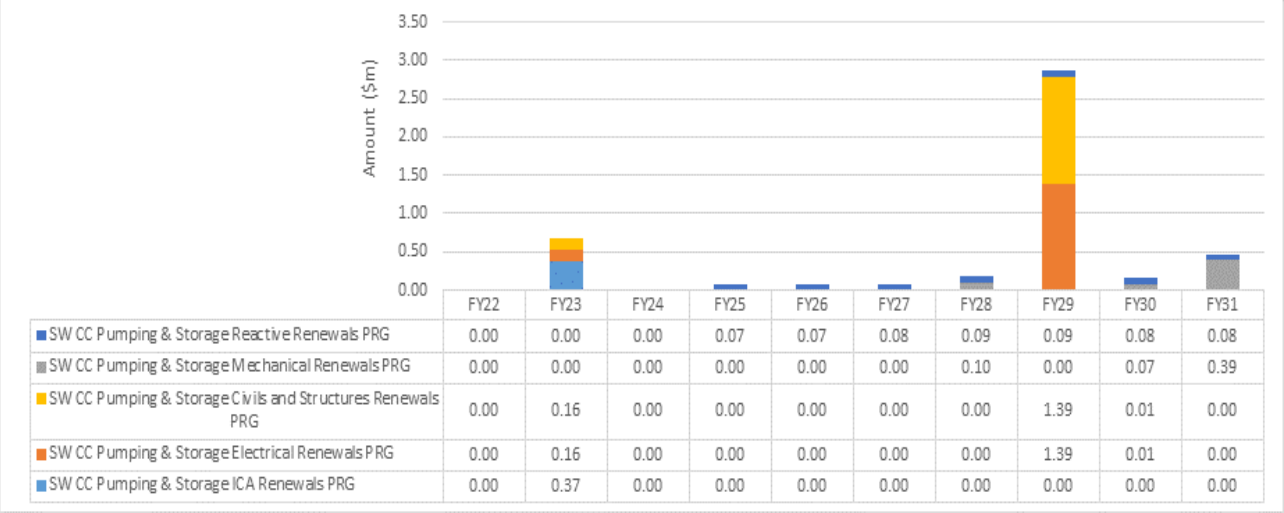
Pumping Reactive Renewals

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 0-9 - 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.

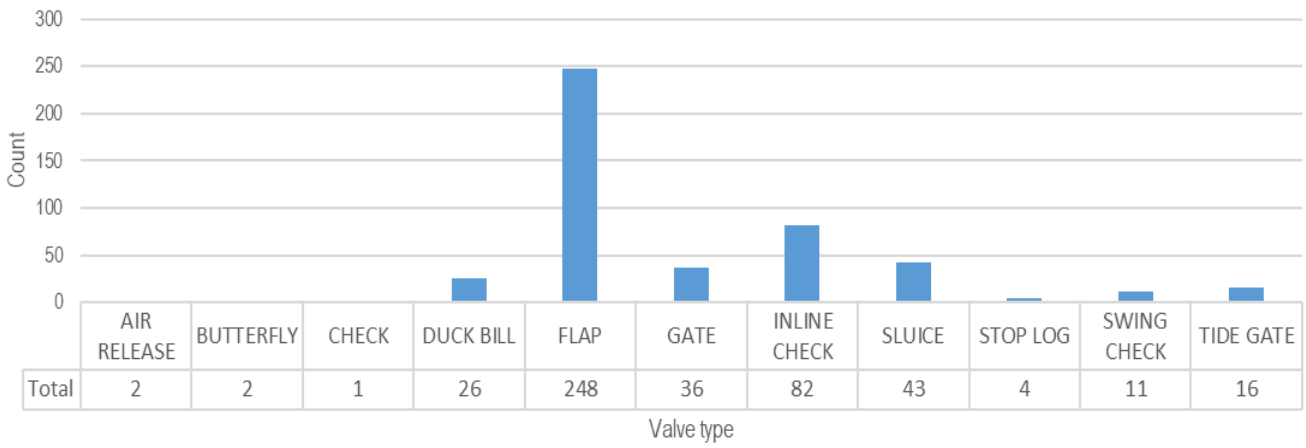


Figure 8-36: Valve data summary (refer to TRIM://18/673503 for source data - Internal CCC Document)

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.

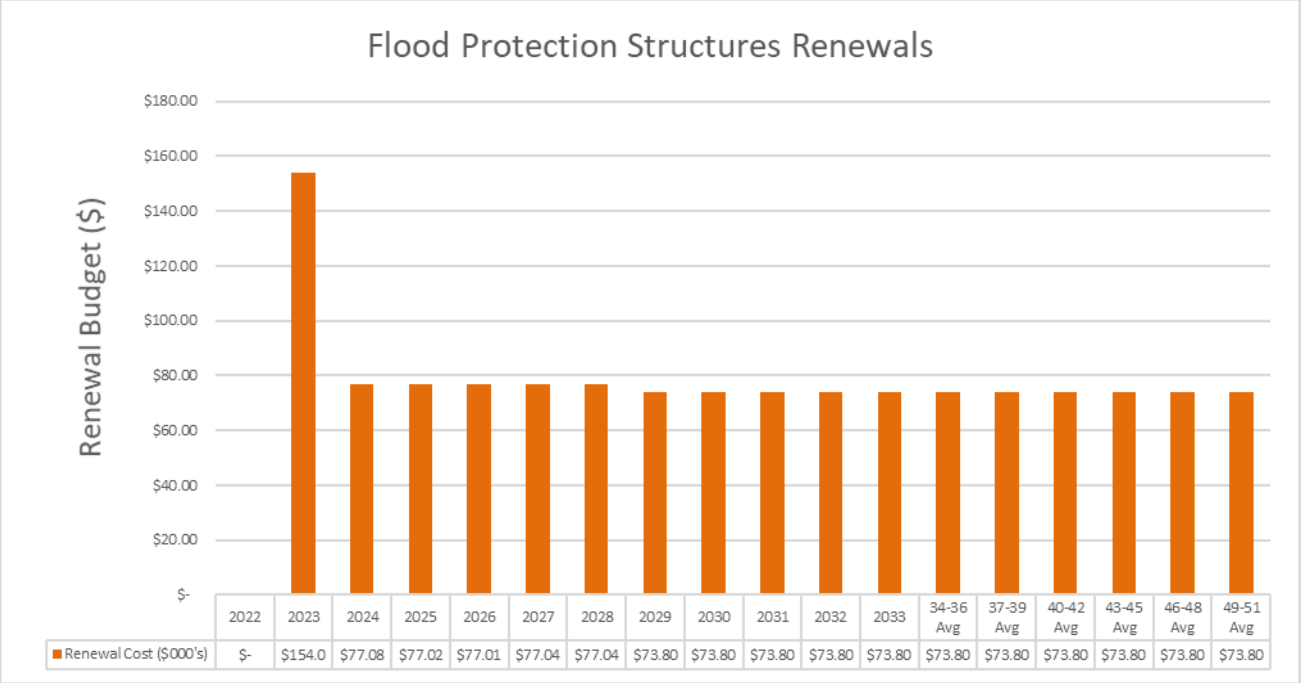


Figure 8-37: Flood Protection Structure recommended expenditure graph

Table 0-10 - 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

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.

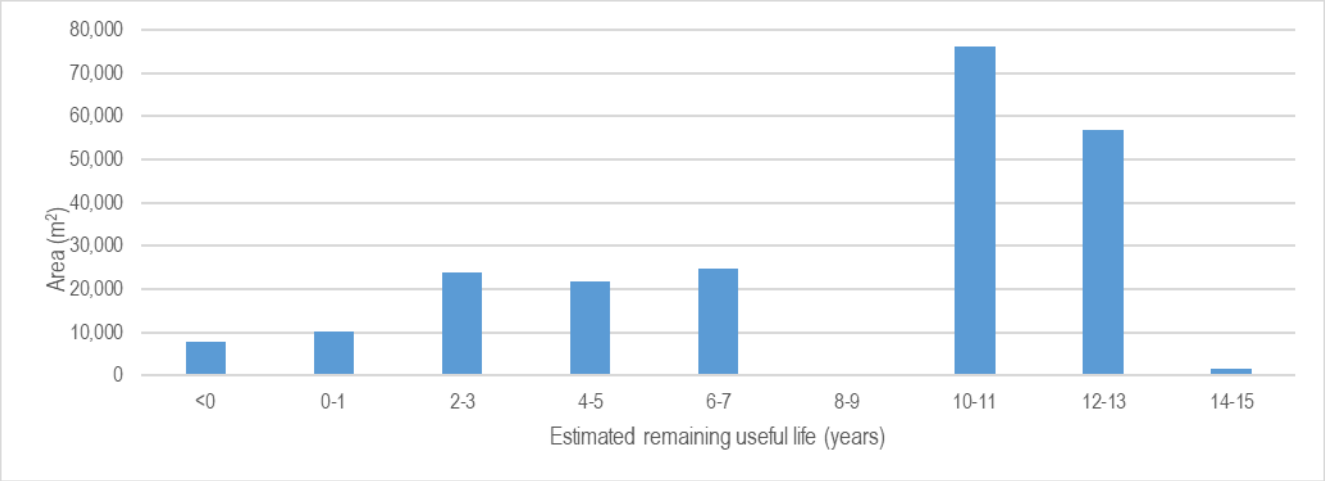


Figure 8.38: Storage and treatment facility lining remaining useful lives

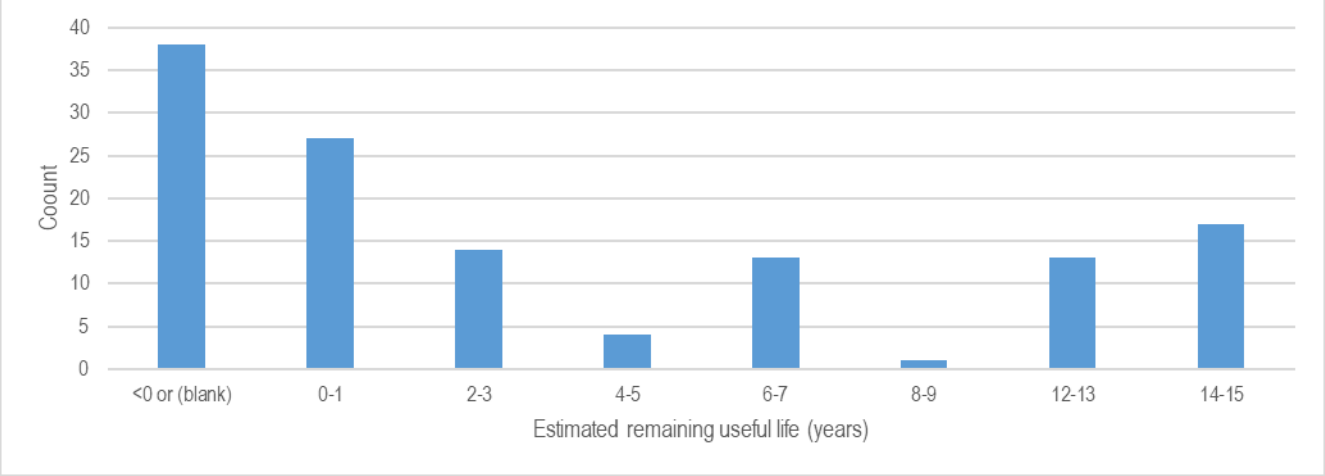


Figure 8.39 Storage and treatment facility soakpit remaining useful lives

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[6]) 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.

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.

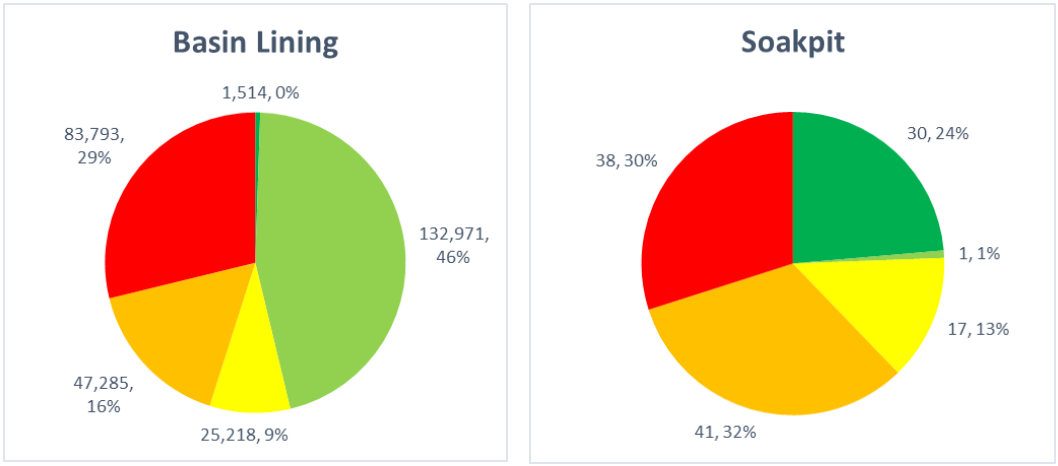


Figure 8-40: Inferred basin lining and soakpit condition grades

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.

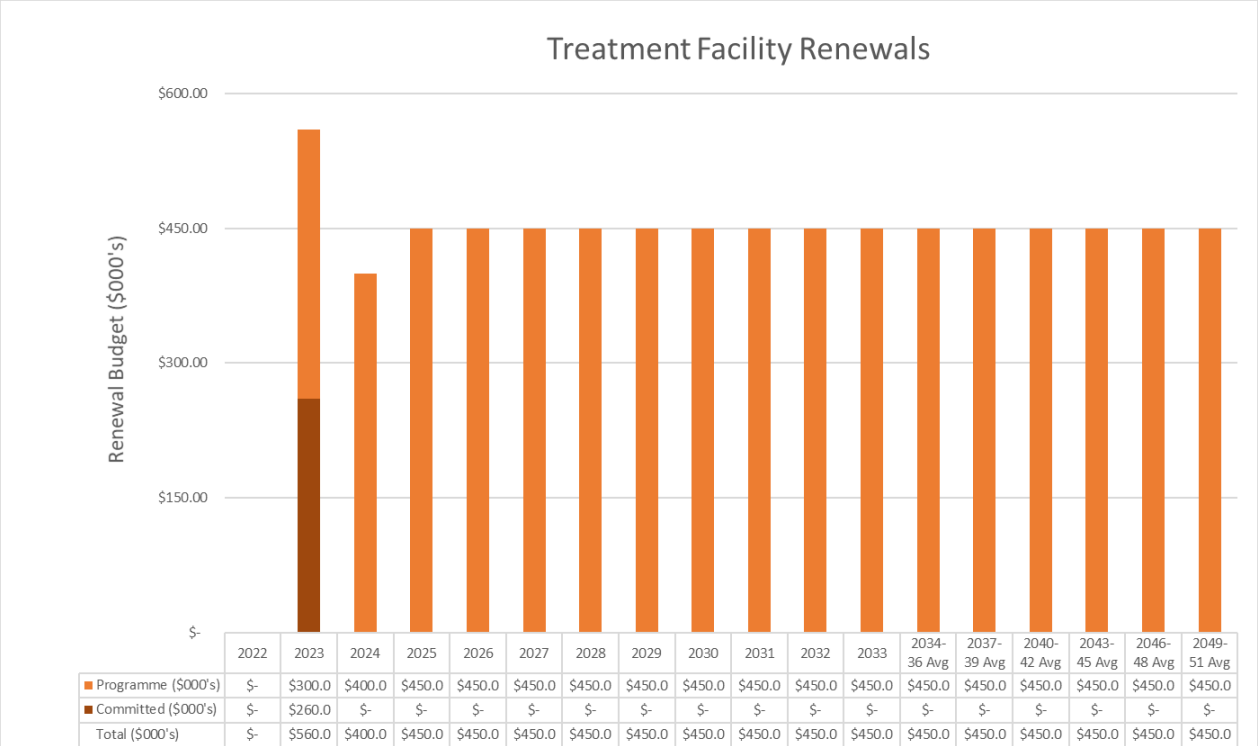
The renewal plan for soak pits, as discussed above, is based on the age of the asset only as no condition information is available.

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.

[6] 2018 Land Drainage AMP – SWBasin Renewals Model TRIM://17/318556 (Internal CCC Document)



	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 0-11 - 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

8.1.8 Reactive Budgets

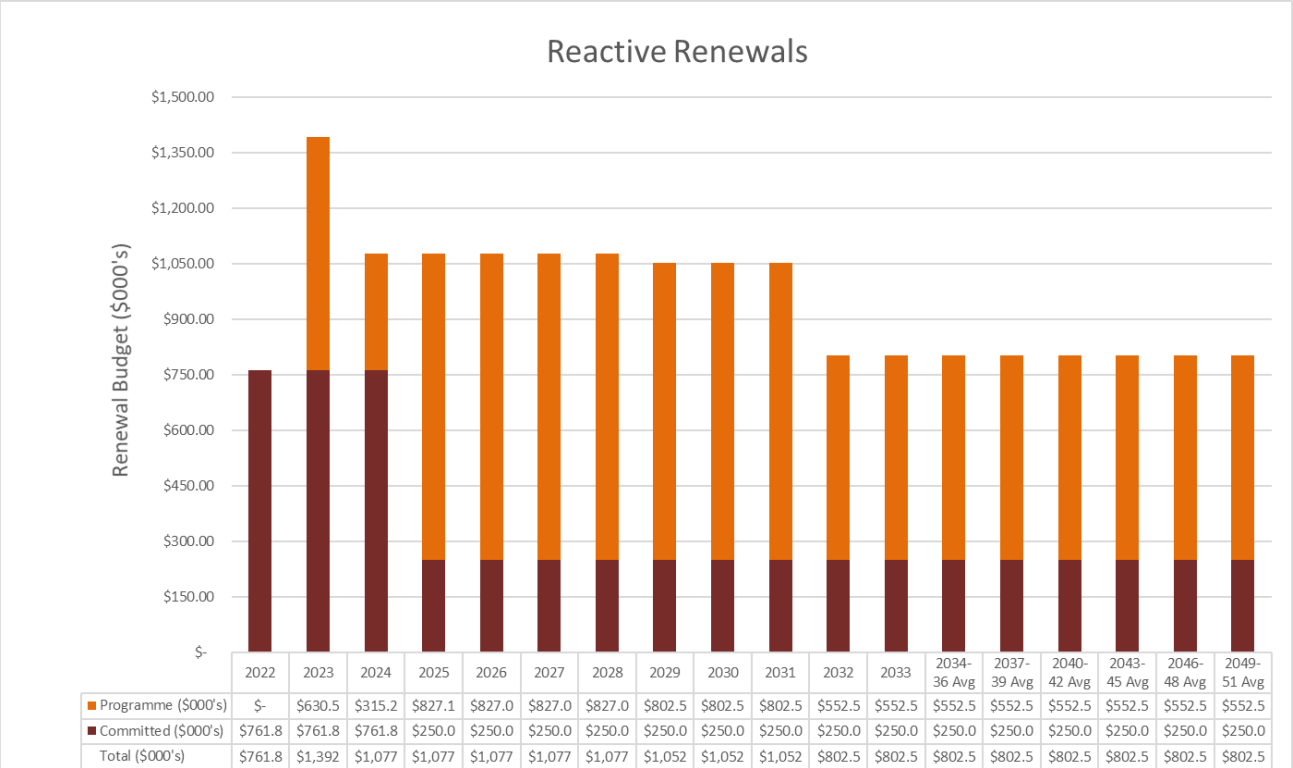
Reactive budgets are required to cover unforeseen failures. In the 2018 AMP, this issue was dealt with by the creation of reactive budgets. The continuation of these budgets is essential to allow for minor reactive works to be carried out, otherwise the works would need to be deferred until they could 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 0-12 - Summary of recommended reactive renewal programmes and costs ($M)

CPMS ID	Programme / project name	Total 3yrs	Total 10yrs	Total 30yrs
	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

Appendix … - Capital Investment Programme 2025-34

PMO to provide this