Christchurch City Council
30 Year Infrastructure Strategy
2018–2048

Christchurch City Council
draft Long Term Plan 2018–2028
Christchurch Ōtautahi

Christchurch City Council

The Infrastructure Strategy is available online:

ccc.govt.nz/assets/Documents/The-Council/Plans-Strategies-Policies-Bylaws/Plans/Long-Term-Plan/draft2018/Infrastructure-Strategy.pdf

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Christchurch City Council

Christchurch City Council
30 Year Infrastructure Strategy

2018 – 2048

Draft 9 February 2018

1.0 EXECUTIVE SUMMARY

The Christchurch City Council's vision is that Christchurch is a city of opportunity for all – open to new ideas, new people and new ways of doing things – a city where anything is possible. The Council has four community outcomes which it seeks to achieve: strong communities, a liveable city, healthy environment and prosperous economy.

Infrastructure provides the foundation for achieving the vision and community outcomes.

The Infrastructure Strategy considers the Council's infrastructure that provide the services of water supply, wastewater, stormwater, transport, parks, facilities, solid waste and information and communication technology. The total optimised replacement value of these assets is $12.5 billion.

This strategy identifies significant issues that will impact on the ability of the Council's infrastructure to support the Council's vision and community outcomes and options to address these issues. The four overarching issues affecting Council's infrastructure are:

1. Asset renewals
2. Climate change
3. Post-earthquake recovery and regeneration
4. Affordability.

Asset renewals

Ageing infrastructure assets and earthquake damage mean that a large amount of asset renewals are needed. Pipes that were laid during early building booms are reaching the end of their effective lives and there is now an imminent tsunami of renewals. The earthquakes shortened the remaining life of many assets. While the Stronger Christchurch Infrastructure Rebuild Team spent $2.22 billion repairing and replacing earthquake damaged infrastructure, a significant amount of damage remains to be repaired. Between $9.3 billion and $11.3 billion is planned to be spent on renewals over the next 30 years, depending on which option is chosen, with $10.5 billion being the most likely option. This expenditure is the biggest component of the Council's planned capital expenditure. It is essential to fulfil one of the two purposes of local government, which is to meet the current and future needs of communities for good-quality local infrastructure and local public services.

Climate change

Based on current information, climate change is expected to affect Christchurch in the following ways:

- Rising sea levels and more frequent storm surges causing more frequent and extensive flooding
- Increased coastal erosion
- Rising groundwater levels at the coast and near rivers
- Fewer rainfall events which may result in rivers with lower flows
- Higher intensity storms which will result in increased flood and landslide risk during those events.

Learning to adapt to a changing environment and make decisions in the face of uncertainty will be important steps in addressing the impacts of climate change. Identifying adaptive pathways, which allow changes to be made in the future as circumstances change, will be key to appropriate infrastructure investment across a range of Council activities.

The Council has begun to plan and respond to the likely effects of climate change. Many asset management programmes now take these effects into account. For example, the future flooding caused by earthquake damage and climate change are taken into account in the design of projects to reduce flooding. However, the Council is yet to develop a strategy about which areas to defend from the effects of climate change and where to retreat from. Therefore, no specific projects to address climate change are included in the Infrastructure Strategy.

Post-earthquake recovery and regeneration

The Council has a greater understanding now of the financial and infrastructure consequences of the earthquakes. There is a significant amount of the Council's infrastructure which is earthquake-damaged and has not been repaired yet. Much of the physical damage is hidden in below-ground infrastructure, or in shortened lifespans of existing assets. The Council knows more now than ever about its underground assets. Although a significant repair and replacement programme has been undertaken by the Stronger Christchurch Infrastructure Rebuild Team, Christchurch still has a long journey ahead to replace the many assets that have suffered partial damage, or assets for which longevity has been compromised. This has added substantially to the asset renewals programme.

The Council is working with other agencies to regenerate key areas of the city. These areas are the Central City (Cathedral Square and surrounds), the Ōtākaro Avon River corridor, New Brighton and Cranford. The Council will be responsible for meeting some of the infrastructure costs for this regeneration and this will place further financial pressure on the Council.

Aside from Cranford, there are no complete regeneration plans or strategies at this time. There is also no clarity about how the costs of implementation will be allocated. While some projects that contribute to regeneration for New Brighton and Cathedral Square are included in the Infrastructure Strategy, the only provision for the Ōtākaro Avon River corridor are stormwater ponds and stopbanks. Early indications are that the eventual call on Council capital funding could be significant. Other areas of Christchurch may also require post-earthquake regeneration projects within the 30 year period of this strategy. The Council will need to make decisions about the funding, timing and scope of regeneration projects, taking into account the all the other work that needs to be undertaken across the city.

Affordability

The Council needs to determine the priority of issues to be addressed and the associated timing and funding for the relevant infrastructure projects. These decisions need to take into account the costs and benefits of those projects over the short, medium and long term. Decisions made now must consider the costs and benefits for future generations as well as the current generation.

The Council is continually balancing the need to re-invest in the city post-earthquake, with the need to reduce costs for ratepayers. In the period since the devastating earthquakes of 2010-2011, the Council has spent approximately $8 billion in capital and operating costs to continue providing services, undertake repairs and improve the city.

By necessity, the additional investment by the Council in recent years has in part been funded through deferring otherwise planned renewals. Compounding this situation, the city is approaching the end-of-life for many infrastructure assets that were built in Christchurch during earlier building booms such as in the 1950s.

Within this context the Council has had to increase rates to service the city – above the rate of inflation – in each year since the earthquakes. All avenues need to be explored to keep rate increases at the minimum possible. This includes exploring alternative ways of funding the work that needs to be done, alongside prioritising capital investment (both in new assets and replacement of assets) and being prudent with day-to-day operational expenditure. This needs to be done while trying to achieve the strategic priorities and community outcomes.

Options to address the issues of asset renewals, climate change, post-earthquake recovery and regeneration, and affordability require challenging prioritisation and trade-offs between proposed infrastructure projects. All costs include inflation, unless stated otherwise.

The three options from which the Council may choose its approach to the management and delivery of infrastructure are:

- **Option 1 - Medium (the most likely option)** – under this option, the focus would be on improving roads, facilities and parks. Water supply and stormwater assets would be maintained in their current condition and wastewater assets would deteriorate. Legal requirements would be met, infrastructure projects to support growth would be provided and commitments would be kept (e.g. cost share agreements and most commitments made by Council through the previous Annual Plan and Long Term Plan). This option's capital expenditure budget is $4,185 million over 10 years and is approximately the total budget in the amended Long Term Plan. Over 30 years $15,205 million in capital expenditure would be spent on infrastructure. Rates increases over the next 10 years would average 4.5%.
- **Option 2 - Low** – a reduced budget compared to Option 1, with reduced renewals and some projects deferred. As well as wastewater, the condition of water supply, stormwater and road assets would deteriorate under this option. This option's capital expenditure budget is $3,253 million over 10 years and $11,148 million over 30 years. Rates increases over the next 10 years would average 3.7%.
- **Option 3 - High** – an increased budget compared to Option 1, with additional projects to restore core infrastructure to a condition which minimises whole-of-life costs. Water and wastewater infrastructure would be provided for medium and long term growth areas. This option's capital expenditure budget is $6,248 million over 10 years and $17,098 million over 30 years. Rates increases over the next 10 years would average 6.3%.

There are difficult trade-offs and risks that need to be made in choosing between the options, such as the impacts on rates and levels of service, and the extent to which community outcomes and strategic priorities are achieved.

The following items have not been included, but could have a significant impact on the capital programme if added:

- Projects to protect infrastructure from the natural hazards arising from climate change (e.g. sea level rise and coastal erosion), noting that climate change is taken into account where possible when designing new projects
- Permanently treating Christchurch's water supply
- Additional contributions to regeneration projects, particularly Ōtākaro-Avon River corridor and Cathedral Square, other than $9 million for Cathedral Square, $118 million for Avon flood plain management and stormwater treatment and $26 million for New Brighton regeneration projects
- Alpine Fault earthquake (AF8) readiness, in addition to the civil defence preparedness already undertaken by the Council
- Variations to cost-share agreements (e.g. Multi Use Arena)
- Changes resulting from Government review of 3 Waters, other legislative changes
- Moving to dispose treated wastewater to land, other than for Duvauchelle.

The Council has developed a Finance Strategy as part of its Long Term Plan. The purpose of the Finance Strategy is to reflect the directions contained in the Long Term Plan and Infrastructure Strategy and to model the financial effects on the Council and the city. The Infrastructure Strategy contains some financial information, but for more detailed information about the financial information underpinning the Long Term Plan, please refer to the Finance Strategy.

The Council's Infrastructure Strategy has been developed based on the best information available to it and the Council has used assumptions based on what it reasonably considers could occur over the next 30 years. The Council will continue to monitor and review the information available to it and will refine and update its Infrastructure Strategy every three years as part of the Long Term Plan process to reflect any significant changes.

The following pages summarise the key projects that are included in each option, the benefits and consequences, and the capital expenditure over 30 years. The projects are colour coded by category (see the table below for the key). The columns on the graphs show the planned capital expenditure, and the line shows the current amended Long Term Plan budget.

Capital prioritisation category key				
Renewals	Contractually committed	Need/demand	Growth – critical	Increased level of service
In construction	Community committed	Level of service recovery	Growth – desirable	
Legal	Internal renewals	Economic benefits	New service	

Option 1- Medium (the most likely option)

What we get – projects already in construction; legal compliance; focus on improving roads, facilities and parks; projects to support short and medium term growth; commitments kept; deteriorating wastewater assets

Key projects and programmes (10 year budgets)

Water supply $495M	Water supply mains renewals $283M	Water supply submains renewals $36M	Water supply headworks well renewals $35M
Wastewater $641M	Wastewater pipe renewals $308M	Lyttelton Harbour wastewater scheme $42M	Akaroa wastewater scheme $35M
Stormwater $678M	Land drainage recovery programme (LDRP) 521 Avon floodplain management $98M	Waterway lining renewals $89M	Styx stormwater management plan $55M
	Stormwater pipe renewals $49M	LDRP 517 Flood Intervention $49M	South west stormwater management plan $24M
	LDRP 528 Eastman Wetlands $21M	LDRP 539 Heathcote low stopbanks $21M	Avon stormwater management plan $19M
Transport $1,049M	Major cycleway routes $206M	Carriageway sealing and surfacing $115M	Kerb and channel renewals $63M
	Footpath renewals $59M	An Accessible City $44M	Road lighting renewals $35M
	Carriageway smoothing $32M	Sumner Road geotechnical risk mitigation $30M	Road pavement renewals $31M
	Northern Arterial extension including Cranford Street upgrade $29M	Central city transport interchange $23M	Pages Road bridge replacement $20M
Facilities $835M	Multi purpose arena $254M	Metro Sports Facility $123M	Social housing renewals and replacements $63 million
	Library resources programme $53M	Recreation and sport buildings and plant renewals $35M	Hornby library, customer services and south west leisure centre $32M
	Recreation and sport mechanical and electrical renewals $25M	Nga Puna Wai sports hub – Stage 1 $24M	Performing arts precinct $22M
Parks and Heritage $267M	Community parks buildings and assets renewals $39M	Community park development programme $26M	Former Municipal Chambers $18M
Information and communication technology $192M	Technology systems renewals and replacements $81M	Business technology solutions $69M	Continuous improvement technology programme $38M
Solid waste $28M	Solid waste new equipment $10M	Solid waste renewals $7M	Waste transfer stations renewals $5M

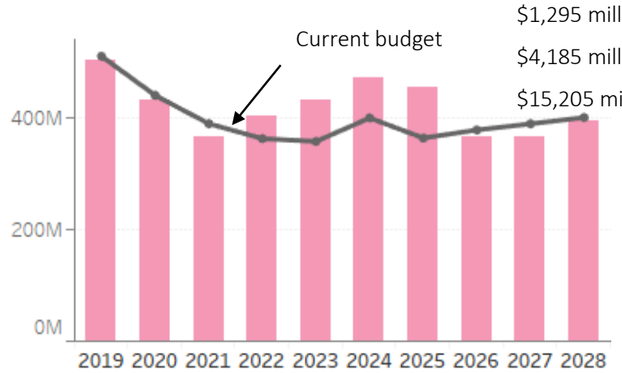
What are the benefits?

- Within the current budget of the amended Long Term Plan for the first three years
- Improved roads, parks and facilities
- Core infrastructure provided to service growth areas; meets the requirements of the National Policy Statement for Urban Development Capacity
- Some reduction in flood risk across the city
- Stormwater discharge quality improves in high priority catchments
- Likely to be able to obtain the global stormwater network discharge consent
- Major cycleway routes completed, some further progress on An Accessible City, some increase in the use of public and active transport
- Road smoothness returned to a level similar to other New Zealand cities over 20 years
- Improved road safety, as known black spots are addressed
- Suburban centre regeneration
- Information and communication technology meets Council and community needs
- Complies with current legislation, health and safety requirements and resource consents
- Legal commitments (e.g. cost share agreements) and political commitments (e.g. through the previous Long Term Plan) are met

What are the consequences?

- Deteriorating wastewater assets
- Increased wastewater overflows in dry weather and wet weather due to blocked pipes and increased groundwater and stormwater entering the wastewater network
- Pre-earthquake flood risk levels not achieved within 30 years, some houses still at an increased risk of flooding

How much does it cost?



Capital cost:

$1,295 million over 3 years

$4,185 million over 10 years

$15,205 million over 30 years

Option 2 - Low

What we get – projects already in construction, legal compliance, reduced asset renewals, projects to support definite growth, commitments kept, some projects delayed

Reduced and deferred projects and programmes, compared with Option 1 Medium (10 year budgets)

Water supply $320M Reduced by $175M	Water supply mains renewals $150M Reduced by $133M	Water supply submain renewals $19M Reduced by $17M	Water supply new pump stations for growth $0 Reduced by $11M
Wastewater $621M Reduced by $19M	Riccarton wastewater interceptor – Upper Riccarton $0 Reduced by $8M	Avonhead Road wastewater main upgrade $0 Reduced by $5M	Belfast pump station 62 capacity upgrade $0 Reduced by $3M
Stormwater $420M Reduced by $257M	Waterway lining renewals $36M Reduced by $53M	Stormwater pipe renewals $34M Reduced by $15M	Land drainage recovery programme (LDRP) 521 Avon floodplain management $17M Reduced by $81M
	LDRP 517 flood intervention $15M Reduced by $34M	Avon stormwater management plan $0 Reduced by $19M	Heathcote stormwater management plan $0 Reduced by $14M
	Addington Brook and Riccarton Drain Filtration Devices $0 Reduced by $13M	Waterways and wetlands land purchases $0 Reduced by $7M	Open waterway renewals systems – utility drain improvements $0 Reduced by $7M
Transport $709M Reduced by $339M	Major cycleway routes $93M Reduced by $113M	Kerb and channel renewals $56M Reduced by $7M	Suburban master plan projects $14M Reduced by $1M and delayed by up 1 – 5 years
	Asphalt surfacing $7M Reduced by $8M	An Accessible City $2M Reduced by $43M	Road lighting renewals $0 Reduced by $35M
	Carriageway smoothing $0 Reduced by $32M	Route improvement Northcote Road $0 Reduced by $13M	Lincoln Road passenger transport improvements $0 Reduced by $10M
	Coastal pathway $0 Reduced by $6M	Core passenger transport route and facilities: South-West (Wigram and Halswell) $0 Reduced by $5M	Local Cycleway: Northern Arterial Link Belfast to Waimakariri $0 Reduced by $5M
Facilities $808M Reduced by $27M	South library and service centre earthquake repairs $0 Reduced by $10M	Art collection acquisitions $0M Reduced by $4M	Smart cities innovation $0 Reduced by $3M

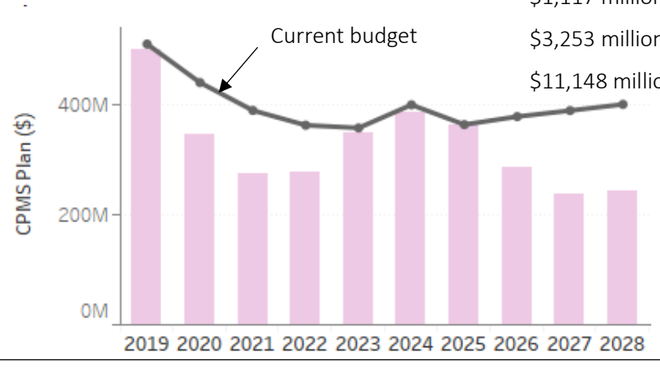
What are the benefits compared to Option 1 - Medium?

- Lowest capital cost in the short term

What are the consequences compared to Option 1 - Medium?

- Increase in public health risk from contaminated water supply due to increases in burst water mains
- No services provided for medium and long term growth areas, does not meet the legal requirements of the National Policy Statement for Urban Development Capacity
- Highly unlikely to be able to obtain global stormwater discharge consent
- Greater risk of increased flooding of houses and businesses due to increased failures of stormwater pipes and waterway blockages
- Increased asset failures due to insufficient renewals
- Increased operating costs
- Increased capital expenditure in future years due to deferred renewals
- Reduced levels of service in some areas
- Minimal progress on some strategic priorities and community outcomes
- Resident satisfaction declines
- Greater risk of increased flooding of houses and businesses due to burst water mains
- No reduction in flood risk for Avon River and Wairarapa Stream catchments
- Deteriorating waterways and water quality
- Increased threat to Council services from cyber security and technology failure, limited improvement in technology resilience
- Roughness of road network gets worse
- No improvement in road safety Increased traffic congestion
- Use of active transport increases more slowly

How much does it cost?



Capital cost:

$1,117 million over 3 years

$3,253 million over 10 years

$11,148 million over 30 years

Parks and Heritage $184M Reduced by $83M	Community parks development programme $0 Reduced by $26M	Regional parks development programme $0 Reduced by $15M	Lyttelton marina environs development $0 Reduced by $10M
Information and communication technology $173M Reduced by $19M	Technology systems renewals and replacements $78M Reduced by $3M	Business technology solutions $57M Reduced by $12M	Continuous improvement technology programme $34M Reduced by $4M
Solid waste $17M Reduced by $11M	Solid waste new equipment $0 Reduced by $10M		

Note: projects which have not changed compared to Option 1 Medium are not shown, only projects which have changed are shown

Option 3 - High

What we get – restore asset condition to minimise whole-of-life costs, projects to support medium and long term growth, projects with economic benefits, increased levels of service and new services

Key projects and programmes in addition to Option 1 - Medium (10 year budgets)

Water supply $779M Increased by $283M	Water supply mains renewals $496M Increased by $213M	Water supply reticulation submain renewals $60M Increased by $24M	City water supply re-zoning $23M Increased by $23M
Wastewater $1,230M Increased by $589M	Wastewater pipe renewals $729M Increased by $421M	Wastewater overflow reduction programme $84M Increased by $74M	Belfast northern wastewater pump station $33M Increased by $33M
	Akaroa wastewater land based reuse and disposal $13M Increased by $13M	Wainui wastewater scheme $11M Increased by $11M	Christchurch wastewater treatment plant channel improvements $9M Increased by $9M
Stormwater $1,200M Increased by $522M	LDRP 521 Avon Floodplain Management Implementation $231M Increased by $133M	Stormwater reticulation renewals $191M Increased by $142M	Styx stormwater management plan $121M Increased by $66M
	Avon stormwater management plan $66M Increased by $46M	South west stormwater management plan $57M Increased by $31M	Heathcote stormwater management plan $27M Increased by $13M
Transport $1,563M Increased by $514M	An Accessible City projects $118M Increased by $73M	Carriageway Sealing and Surfacing Programme $115M Increased by $115M	Road safety improvements $92M Increased by $67M
	Intersection improvements $76M Increased by $52M	Foothpath renewals $70M Increased by $11M	Route improvements $54M Increased by $31M
	Suburban master plans $32M Increased by $17M	Local cycle network $30M Increased by $25M	Road pavement renewals and replacements $28M Increased by $28M
Facilities $936M Increased by $101M	Belfast library and service centre $18M Increased by $18M	Linwood library rebuild $13M Increased by $13M	Nga Puna Wai sports hub – Stage 2 $10M Increased by $10M
Parks and Heritage $320M Increased by $53M	Land acquisition for new parks $16M Increased by $16M	Marine facility development $11M Increased by $11M	Residential red zone new park development $9M Increased by $9M

What are the benefits compared to Option 1 - Medium?

- Assets renewed at optimal time to minimise whole of life cost
- Current levels of service retained and improved in some areas
- Increased likelihood of global stormwater consent being obtained
- Recovery to pre-earthquake flood levels achieved over 30 years, fewer houses at risk of flooding
- Operational cost savings
- Wastewater overflows reduce
- Improved waterways and surface water quality
- Road roughness returns to a level comparable to other New Zealand metropolitan centres in 10 years
- An Accessible City completed
- Increased use of active and public transport
- Reduced traffic congestion
- Services for currently unserviced areas (e.g. Wainui wastewater)
- Community outcomes and strategic priorities achieved
- Resident satisfaction improves

What are the consequences compared to Option 1 - Medium?

- Higher capital cost
- Rates rises may be unaffordable for some people

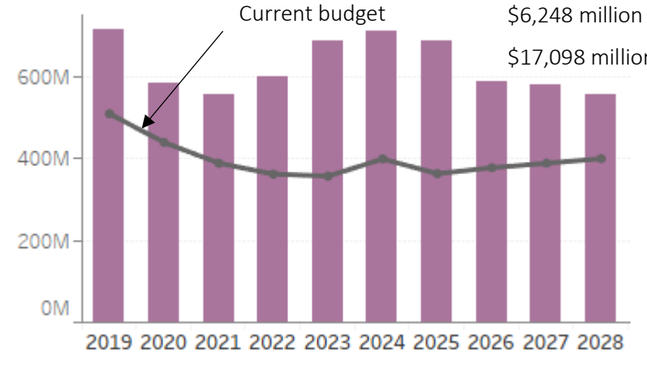
How much does it cost?

Capital cost:

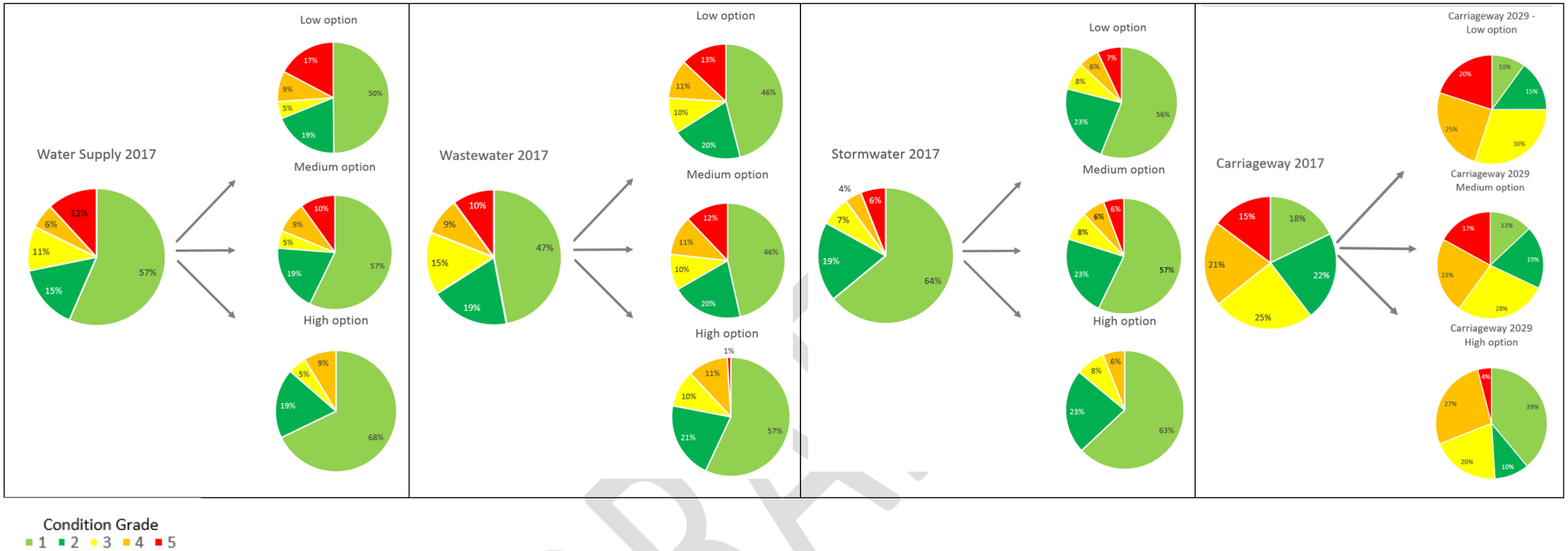
$1,849 million over 3 years

$6,248 million over 10 years

$17,098 million over 30 years



Assessed current pipe and road condition grades and predicted condition grades after 10 years for low, medium and high options



For water supply, wastewater and stormwater pipes: 1 – as new, 5 – expected to fail in 1-2 years. For carriageway: 1 – excellent, 2 – good, 3 – average, 4 – poor, 5 – very poor.

Contents

2.0 INTRODUCTION

2.1 Strategy layout

Strategy Section		Local Government Act 2002, Section 101B
1	Executive Summary	-
2	Identifies the purpose of the Infrastructure Strategy and the infrastructure assets included in this strategy	2(a) and 6
3	Discusses the overarching significant issues that will impact on infrastructure	3 (b) to 3(e)
4	Identifies significant issues for specific infrastructure types, the options for addressing these issues, the implications and costs of those options, and when Council will need to make a decision on which option to pursue	2(a), 2(b); 3(a) to (e) and 4(a) to (c)
5	Describes three options for the capital programme: Option 1 - Medium, Option 2 - Low and Option 3 - High, and the benefits and consequences of these options	-
6	Describes how the Council plans to respond to changing demand for services	3(d)
7	Describes how the Council provides for the resilience of infrastructure by identifying and managing risks relating to natural hazards	3(e)
8	Describes the Council's asset management systems and processes and changes to levels of service if Option 2 – Low or Option 3 – High was adopted	3(c)
9	Provides the financial estimates for capital and operational expenditure over the next 30 years, and records the significant assumptions, risks and mitigation	4(a)
Appendix 1	Describes the district and illustrates the linkage between strategic documents	2(a)
Appendix 2	Describes the core infrastructure and its condition	2, 4(c) and (d)
Appendix 3	Describes how projects and programmes have been prioritised	-

2.2 Purpose

The Infrastructure Strategy explains how the Council will deliver infrastructure to support core services to meet the needs of current and future generations. It aims to achieve a balanced investment programme within the Council's tight financial constraints.

The strategy covers a period of 30 years from 2018 to 2048. It provides an overview of the major issues and trends forecast to have an impact on Council infrastructure over this period, how the Council proposes to respond to these, and the risks and costs associated with investment in infrastructure over that time. It looks at choices available and describes how the Council could provide good quality, cost-effective infrastructure.

The investment the Council makes in providing, managing and maintaining infrastructure on behalf of the residents of Christchurch is significant. The Council will deliver between $8.0 billion and $12.5 billion in capital projects over the next 30 years, depending on which option is chosen, with the mostly likely option being $10.6 billion.

The strategy describes the Council's intended direction in providing infrastructure for Christchurch communities in ways that provide value to residents. This high level direction has formed the basis of infrastructure planning decisions included in the Long Term Plan 2018-28. In doing this, it links with the Council's Finance Strategy to provide an integrated approach to providing value for money services for Christchurch.

Section 101B of the Local Government Act 2002 requires each local authority to prepare an Infrastructure Strategy as part of its Long Term Plan. The scope of this Infrastructure Strategy is to outline the most likely option for managing the following infrastructure assets:

- Water supply - water extraction, treatment and distribution
- Wastewater - wastewater collection, treatment and discharge
- Stormwater and flood protection - stormwater collection, treatment and discharge, flood protection works
- Transport - arterial, collector and local roads, kerbs and gutters, bridges, footpaths, cycleways, bus priority lanes, bus stops, street lights
- Facilities - Christchurch Art Gallery, Akaroa Museum, libraries, recreation and leisure centres, outdoor aquatic centres, paddling pools, stadia, camp grounds, golf course, community halls and facilities, volunteer libraries, early learning centres, social housing
- Parks - community parks, regional parks, Botanic Gardens, Hagley Park, cemeteries, foreshore, heritage
- Solid waste - Kate Valley landfill, transfer stations, composting facility, recycling facility
- Information and communication technology - information, software, integration services, equipment, servers, storage, network and telecommunications.

The Local Government Act requires that water supply, wastewater, stormwater, flood protection and control works, and roads and footpaths are included in the Infrastructure Strategy. In addition, the Council has chosen to also include non-mandatory infrastructure (facilities, parks, solid waste and information and communication technology (ICT)) so that the majority of the capital programme is captured. However, the asset management for the non-mandatory infrastructure is not as advanced as for the mandatory infrastructure, so the information provided for these assets is not as comprehensive and is not intended to meet every requirement of Section 101B of the Local Government Act.

Figure 2.1 shows how the Infrastructure Strategy links to other documents. Please see Appendix 1 for a more detailed description of each of these documents.

For a description of the assets and their current condition, please see Appendix 2. For a detailed description of how the Council plans to manage these assets, please refer to the Service Plans.

All costs include inflation, unless otherwise stated.

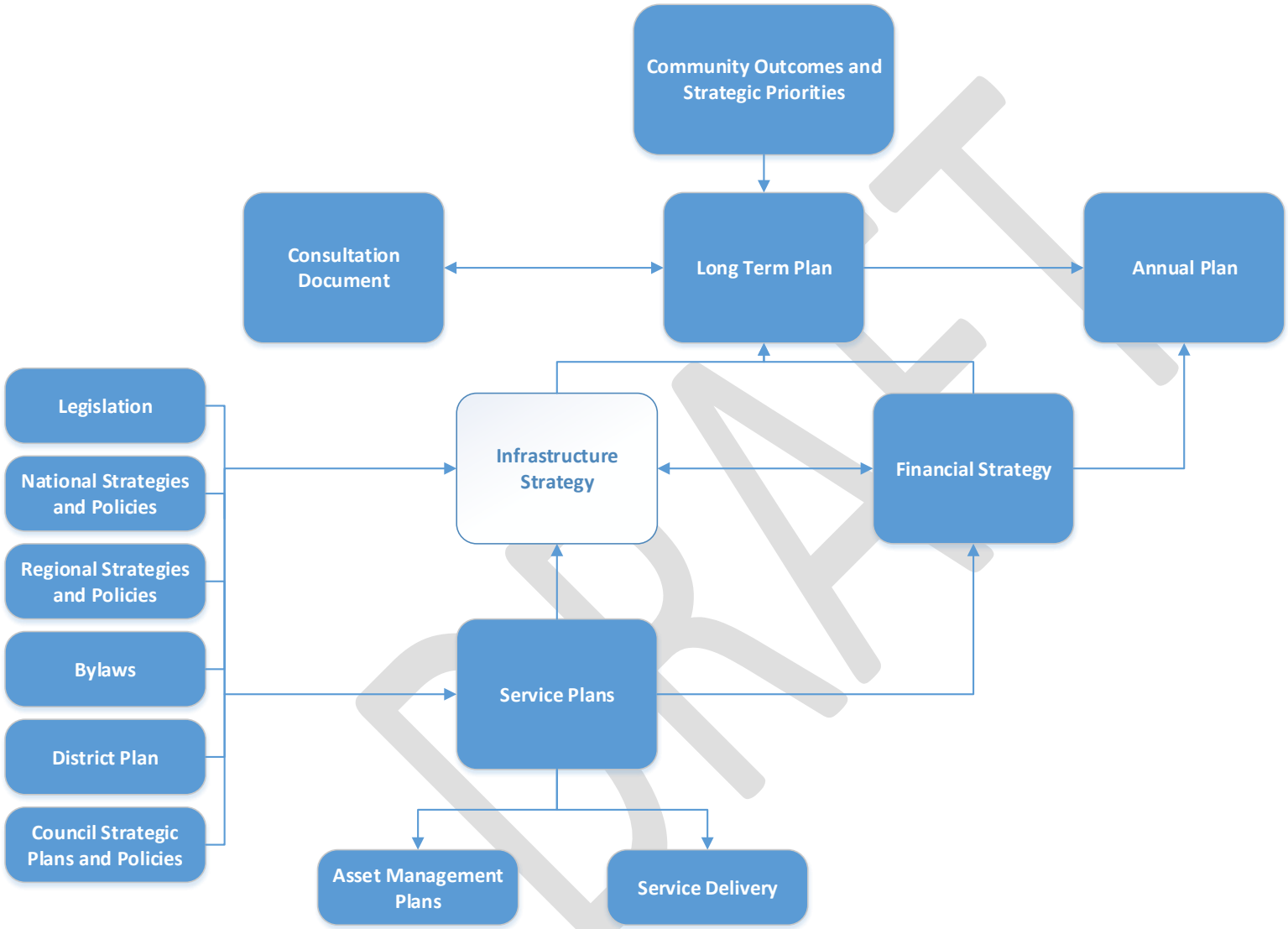

Community Outcomes and Strategic Priorities
Consultation Document
Long Term Plan
Annual Plan
Legislation
National Strategies and Policies
Regional Strategies and Policies
Bylaws
District Plan
Council Strategic Plans and Policies
Infrastructure Strategy
Financial Strategy
Service Plans
Asset Management Plans
Service Delivery

Figure 2.1: How the Infrastructure Strategy links with other documents

2.3 Context

Christchurch is the second largest city in New Zealand and home to 387,200 people. Christchurch's population is projected to grow by 21% to 467,000 people by 2048, making it one of the top five growth areas in New Zealand. With the largest port and largest international airport in the South Island, Christchurch is the gateway for visitors and goods to and from the South Island.

Banks Peninsula makes up 70% of the land area of the Christchurch district. Christchurch is in a seismically active area with the Alpine Fault 100 kilometres to the west and many other faults nearby. The recovery from the effects of the earthquakes in 2010 and 2011 is well underway, but there is more work to be done to complete the regeneration of the city. As a coastal city, it is also exposed to risks from climate change and sea level rise, particularly in the east.

Please refer to Appendix 1 for a more detailed description of the district and its population, economy, environment and history.

2.4 Strategic framework

The Council has developed a strategic framework to guide its planning, decision-making and service delivery. The framework has four levels – vision, community outcomes, strategic priorities and targeted key strategies and plans. This has been used as the strategic basis for this Infrastructure Strategy and for planning and decision making related to the Long Term Plan 2018-28.

Council vision – Christchurch is a city of opportunity for all – open to new ideas, new people and new ways of doing things – a city where anything is possible.

Community outcomes – state how the Council wants the city to be. The Council has 17 outcomes in four strategic themes – strong communities, a liveable city, healthy environment and prosperous economy. Under the prosperous economy theme, one outcome is "modern and robust city infrastructure and community facilities". The Infrastructure Strategy is the key document for achieving this outcome.

Strategic priorities – these concern areas where the Council wants to see a change in approach or increase in focus over the coming three years and beyond. The six strategic priorities are:

- Enabling active citizenship and connected communities
- Maximising opportunities to develop a vibrant, prosperous and sustainable 21st century city
- Climate change leadership
- Informed and proactive approaches to natural hazard risks
- Increasing active, public and shared transport opportunities and use
- Safe and sustainable water supply and improved waterways.

The Infrastructure Strategy has a strong role to play in meeting these strategic priorities.

Targeted Plans and Strategies – the Council has adopted a range of activity or outcome focused plans and strategies that provide the detailed link between the high level community outcomes and strategic priorities and the work programmes the Council undertakes to deliver on these. The Infrastructure Strategy is a targeted strategy.

2.5 Review of service delivery

As required by Section 17A of the Local Government Act, the Council has undertaken a review of the cost-effectiveness of current arrangements for meeting the needs of communities within its district for good-quality local infrastructure, local public services, and performance of regulatory functions. The outcome of this review is that the Council is satisfied that the current delivery mechanism is the most cost effective for ratepayers.

3.0 OVERARCHING SIGNIFICANT ISSUES

The Council's responsibility for building, operating and maintaining infrastructure is increasingly difficult due to four overarching significant issues:

1. Asset renewals
2. Climate change
3. Post-earthquake recovery and regeneration
4. Affordability.

3.1 Asset renewals

Ageing infrastructure assets and earthquake damage mean that a large amount of asset renewals are needed. While the Stronger Christchurch Infrastructure Rebuild Team (SCIRT) spent $2.22 billion repairing and replacing earthquake damaged infrastructure, a significant amount of damage was not repaired and the remaining life of many assets was shortened. SCIRT undertook extensive condition assessments of our horizontal infrastructure, and in combination with condition assessments completed recently by the Council, the Council now has much better information about the condition of its horizontal assets than ever before[1]. Unfortunately this has revealed that the asset condition is worse than was assumed for the previous Infrastructure Strategy and Long Term Plan.

Infrastructure that was built during early building booms is reaching the end of its effective life and there is now an imminent tsunami of renewals. This requires expenditure at a time when the Council is in a financially constrained environment and when there are competing demands to address other significant issues such as post-earthquake regeneration. The Council needs to make significant decisions about when to undertake asset renewals and how to fund these without placing undue financial burden on future generations.

Implementing a well-planned and timely programme of renewals avoids the creation of a future renewal programme that would be so large that it would be unmanageable in terms of funding and resourcing. Renewal programmes in the technology environment operate with significantly shorter lifecycles than horizontal infrastructure and facilities, driven by the pace of innovation and application of technologies.

Asset renewals are the biggest component of Council's planned capital expenditure, with between $9.3 billion and $11.3 billion planned to be spent on renewals over the next 30 years, depending on which option is chosen, with $10.5 billion being the most likely option.

Asset renewals are essential in fulfilling the one of the two purposes of local government, which is to meet the current and future needs of communities for good-quality local infrastructure and local public services (s10, Local Government Act 2002).

3.1.1 Water supply renewals

Pipes that were laid during early building booms are reaching the end of their effective lives, particularly asbestos cement and early cast iron pipes. Increased pipe renewals are expected for the next 42 years. Approximately 150 km of water main renewals have been deferred past their expected design life. While the overall condition of these mains is adequate, performance deficiencies are anticipated. Some pipes cannot provide peak flows leading to pressure drops in peak times or an inability to provide sufficient water for firefighting. Leaks from the water network are likely to increase due to increased pipe failures in the ageing network. Leakage and pipe bursts not only increases water demand and pumping costs but can cause damage to roads and other assets.

Renewal provides an opportunity to review the demand in an area and install the correctly sized infrastructure to meet demand. Installing correctly sized infrastructure optimises the network and avoids additional costs from undersized assets or overinvestment. A city-wide water supply network model is being created and this will be used to make sure pipe sizes are adequate.

Asset condition data is based on asset age, material and expected useful life. Pipe samples are collected from throughout the reticulation network and detailed condition assessments are undertaken. Where a condition assessment has been completed confidence in the asset condition data held is very high; however as the total number of samples is small confidence in overall network condition data is moderate to high. Figure 3.1 shows the total length of water supply mains for each condition grade, with condition grade 1 being as new and condition grade 5 being very poor.

Condition assessment results are used to refine expected useful lives for other pipes of the same material and similar age, and the remaining life of water main pipes is shown in Figure 3.2.

Recent advances in technology mean that pipe condition assessments using drones in pipes is now possible and this is something the Council will explore to improve confidence in water supply condition data.

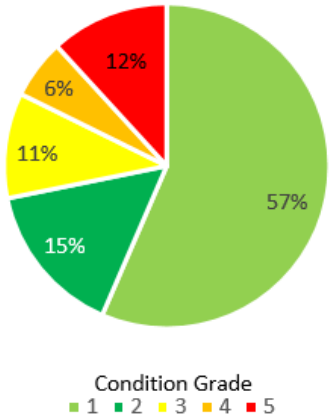


Figure 3.1: Assessed condition of water supply mains

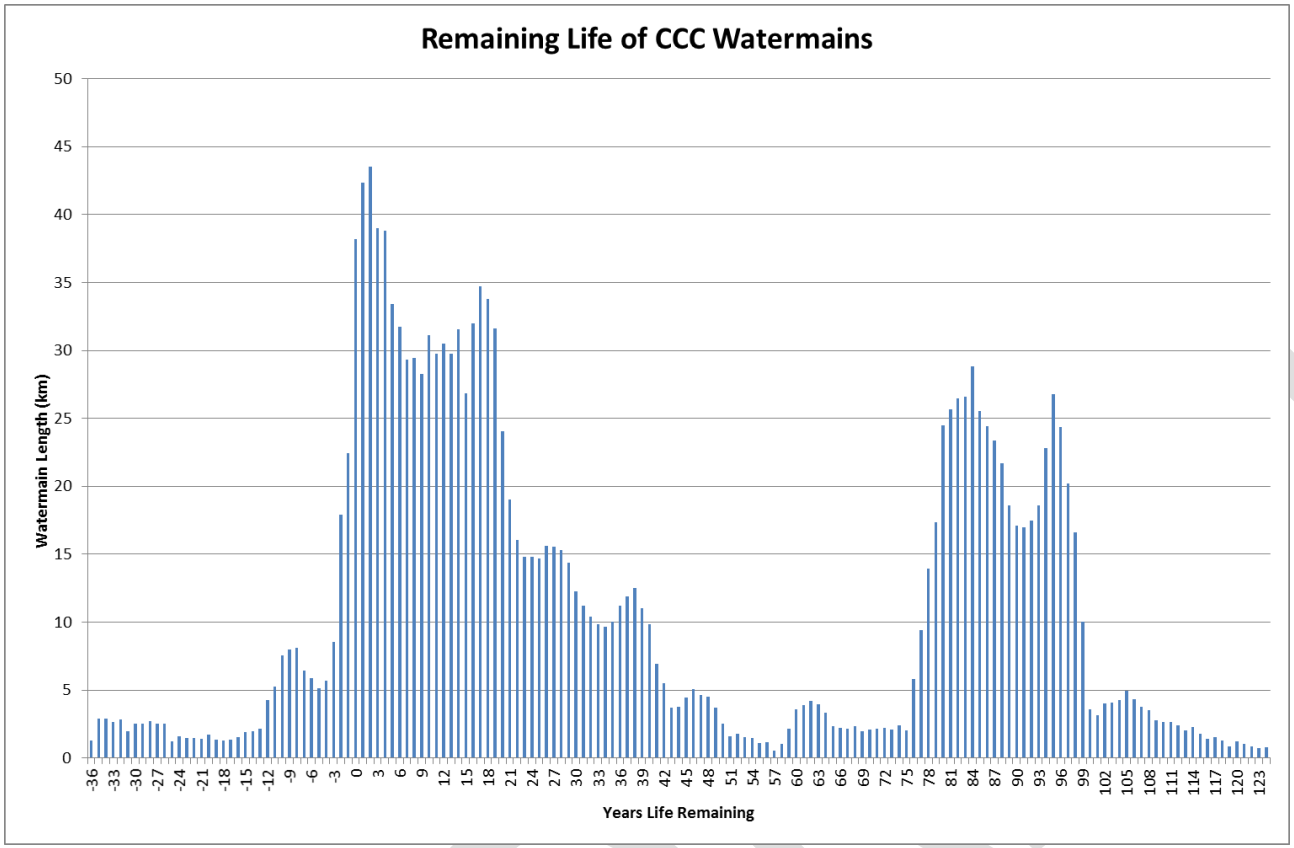


Figure 3.2: Assessed remaining life of water mains

3.1.2 Wastewater renewals

Materials used for wastewater pipes have changed over time, with early pipes made from earthenware, a mix of earthenware and concrete between the wars, a mix of reinforced concrete and asbestos cement post-World War II, and plastic more recently. As different pipe types have different effective lives, pipes from a number of periods are now reaching or past the end of their effective lives. Age combined with reduced life due to earthquake damage has increased the length of pipes in very poor condition (condition 5), with 10% of pipes in this category and needing replacement.

Pipes in very poor condition allow groundwater and stormwater to leak into the wastewater network increasing the flow that must be pumped and treated. When flows increase above the capacity of pump stations wet weather overflows occur.

Figure 3.3 shows the percentage of wastewater mains for each condition grade by value, with condition grade 1 being as new and condition grade 5 being very poor. 55% of wastewater pipes have been inspected to give accurate condition grades. For the remaining 45% of wastewater pipes the condition grade has been estimated based on pipe age and material. Improvements in Council asset management processes mean renewals programmes are now based on pipe condition rather than pipe material and age.

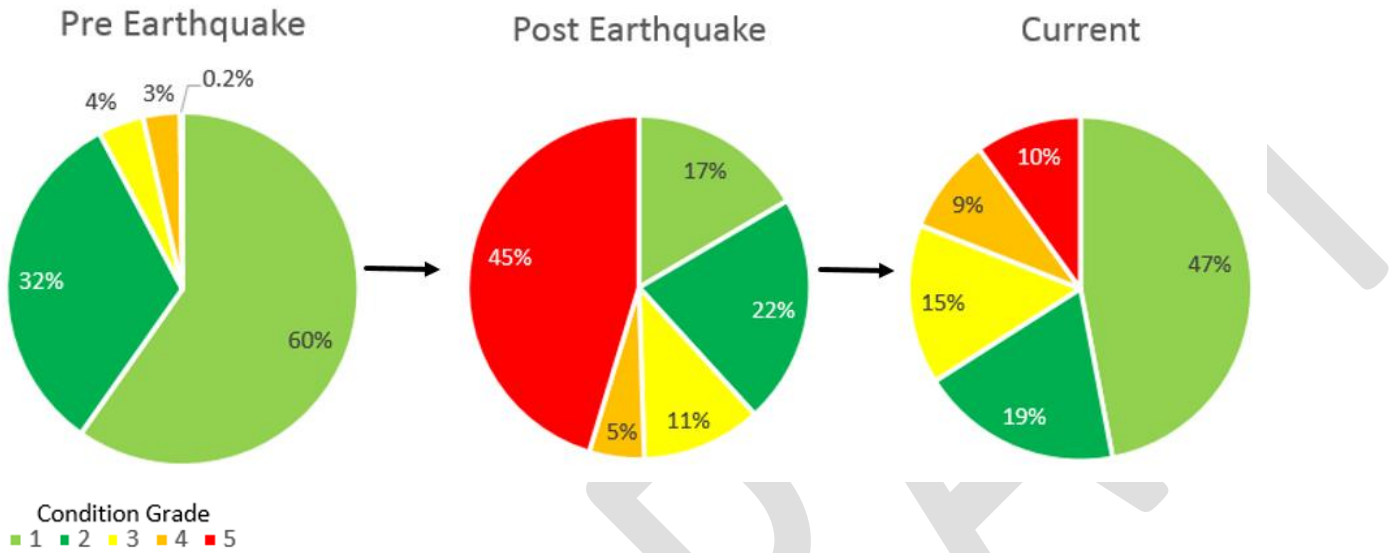


Figure 3.3: Assessed condition of wastewater mains (percentage by value), before and after the earthquakes and current

By applying these asset management processes a remaining life profile has been calculated and is shown in Figure 3.4. This shows significant lengths of wastewater pipes are reaching the end of their useful life over the coming 18 years. The two peaks in this time period correspond with condition 4 (poor) and condition 5 (very poor) pipes. 93% of condition results for pipes in these two peaks are based on physical inspections giving a high level of confidence in the years of life remaining.

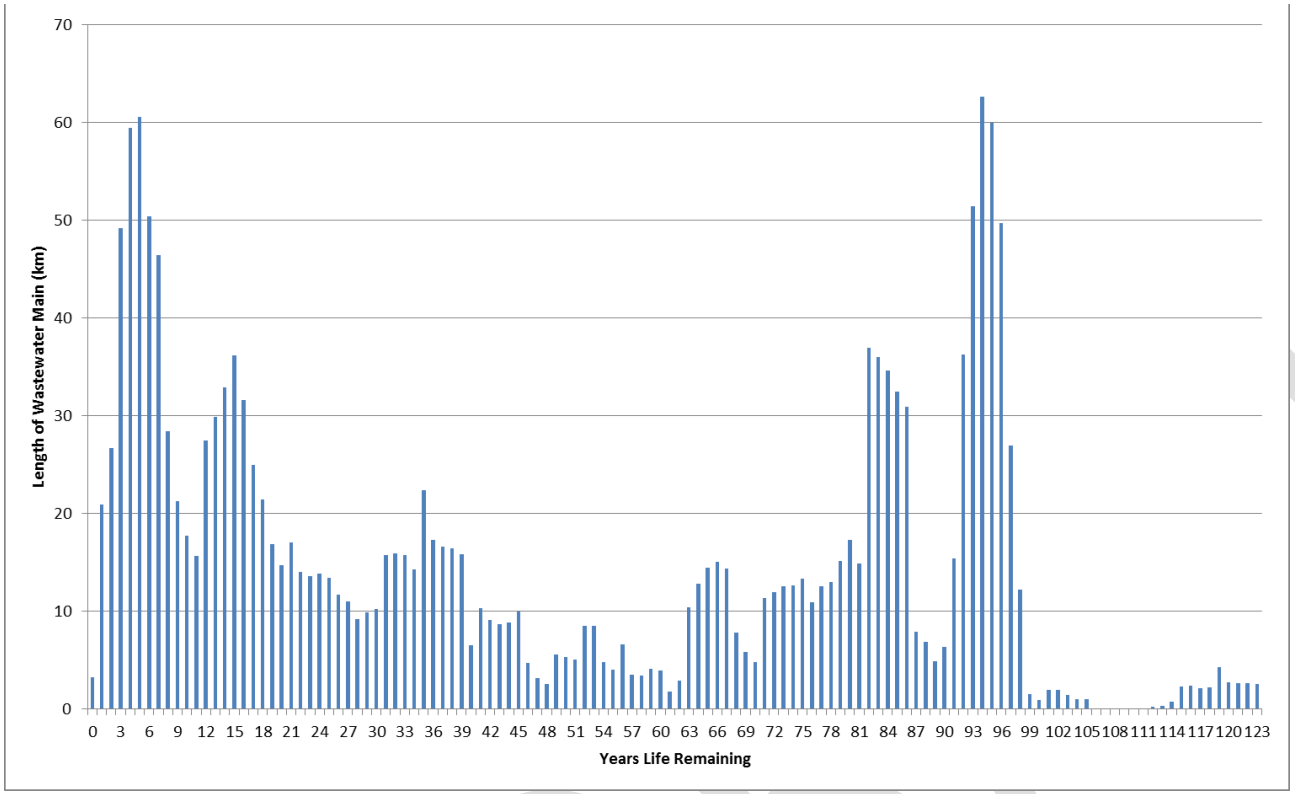


Figure 3.4: Assessed remaining life of wastewater mains

3.1.3 Stormwater renewals

Pipes installed before the mid-1900s, including large brick barrels, are reaching the end of their useful lives and the need for renewal has been accelerated by the earthquakes. Much of the waterway lining installed in the 1970s and 1980s is reaching the end of its useful life, triggering the need for extensive investment in lining renewal, or naturalisation of lined channels.

Stormwater pipe materials and approaches to lining waterways have changed over time. Early pipes were typically made from brick and earthenware, a mix of earthenware and concrete between the wars, a mix of reinforced concrete and asbestos cement post-World War II, and plastic more recently. As different pipe types have different effective lives, pipes from a number of periods are now reaching or past the end of their effective lives. Age combined with reduced life due to earthquake damage, has increased the number of pipes in very poor condition (i.e. pipe condition grade 5).

Historically, linings were installed to waterways to contain the flow within a confined path, achieve maximum capacity with minimal land-take and to stabilise banks. Lining was largely undertaken prior to the Council adopting a six values approach to waterway management in the 1990s, where the six values are drainage, ecology,

landscape, recreation, heritage and culture. Therefore, when linings now come up for renewal the preference is to naturalise the waterway by removing the lining to improve other values. This often has a higher capital cost than like-for-like replacement, but the whole of life costs are generally lower as there is no need to renew again in 40 – 60 years. This approach is more likely to result in healthy waterways in the city and provide a wider range of benefits to the community.

Pipes and waterway linings in very poor condition allow groundwater and surrounding ground material to be washed in to the pipe or waterway, or conversely allows leakage or uncontrolled outflow. Such uncontrolled flows can lead to erosion and instability of the surrounding ground, with more rapid deterioration of the pipe or waterway and potential structural failure. Pipes and waterway linings can collapse suddenly and without warning, and cause damage to roads and other infrastructure as well flooding due to blockage and uncontrolled surface flows.

Figure 3.5 shows the percentage of stormwater pipe and waterway lining for each condition grade, with condition grade 1 being as new and condition grade 5 being very poor. 42% of stormwater pipes and 90% of waterway linings have been inspected to give an accurate condition grade. For the remaining pipes and linings, the condition grade has been estimated based on age and material. Currently 6% of stormwater pipes and 2% of lined drains are in poor or very poor condition. These need replacing in the next 1-10 years to avoid failure of the assets, which could cause flooding, damage to other infrastructure, utilities and private property and degraded surface water quality. Improvements in Council asset management processes mean renewals programmes are now more commonly based on asset condition rather than material type and age.

Flood protection pump stations and control structures have been maintained reactively on an “as needed” basis and many of their components are now at end of life or require major overhaul or upgrade. As a result, an increase in renewals is required. In addition, damage from the earthquakes has reduced the expected life of assets. Failures due to inadequate renewals increase the risk of flooding with associated widespread disruption and health and safety risks.

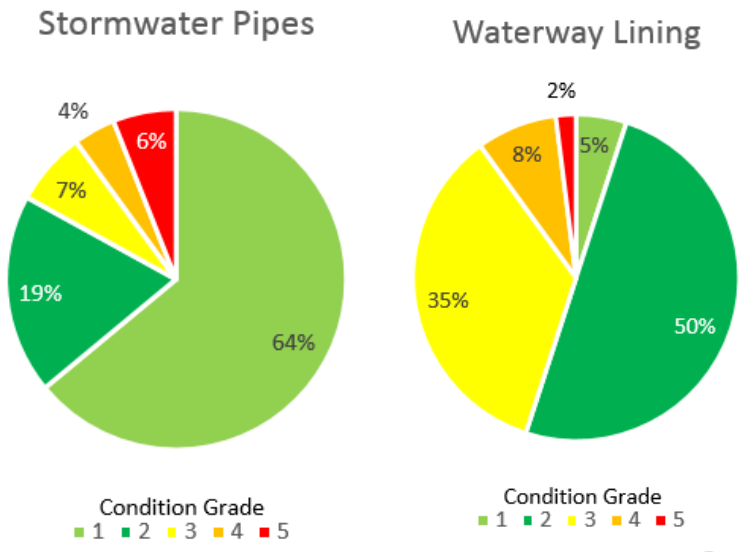


Figure 3.5: Assessed condition of stormwater pipes and waterway linings (percentage by value)

A remaining life profile has been calculated using condition data for stormwater pipes and is shown in Figure 3.6. This shows a significant peak in stormwater pipes reaching the end of their useful life over the coming 12 years. This peak corresponds with condition 4 (poor) and condition 5 (very poor) pipes.

A remaining life profile has also been calculated for waterway linings and is shown in Figure 3.7. This shows a significant peak in the waterway linings reaching the end of their useful lives over the next eight years. This peak corresponds with condition 3 (moderate), 4 (poor) and 5 (very poor) waterway lining.

Over 90% of condition results for pipes and linings in these peaks are based on physical inspections giving a high level of confidence in the years of life remaining.

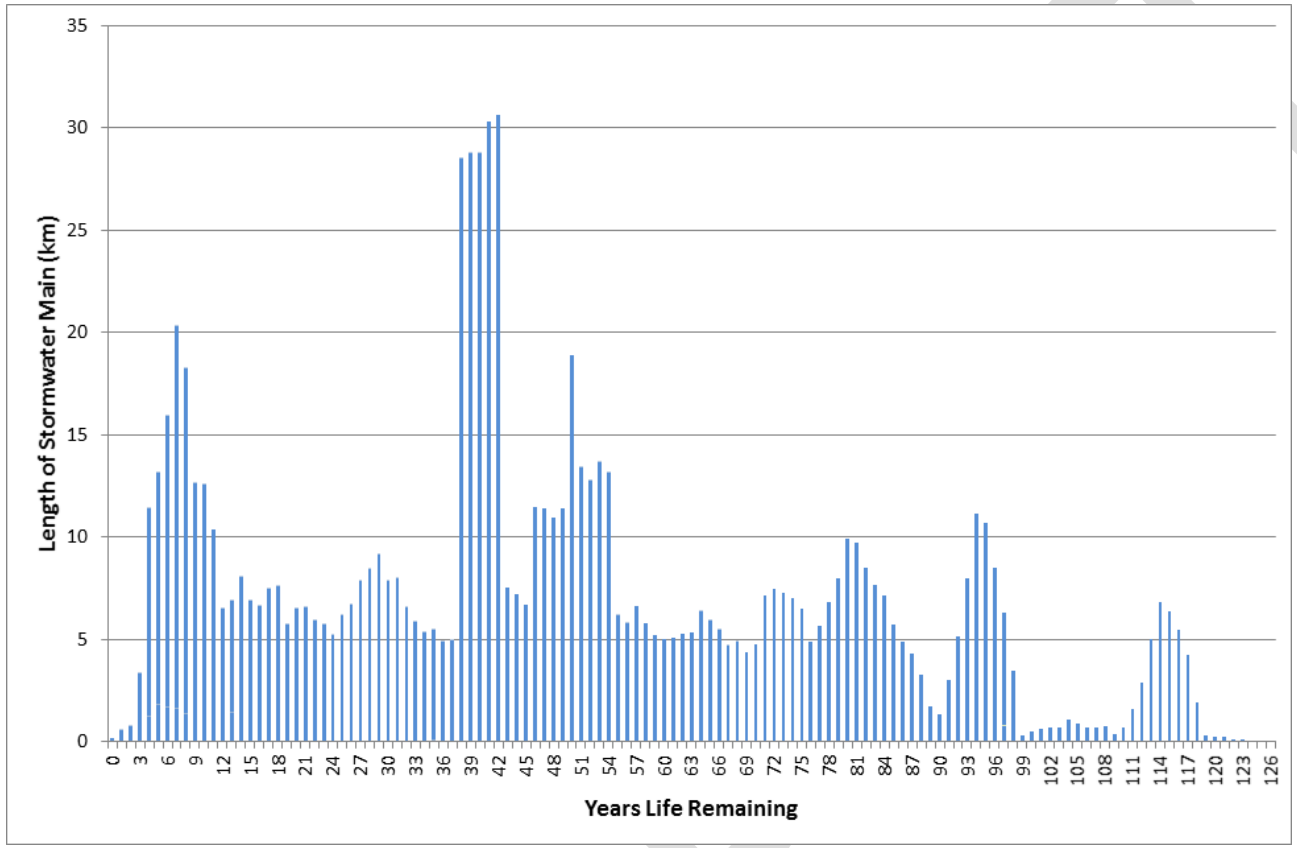


Figure 3.6: Assessed remaining life of stormwater pipes

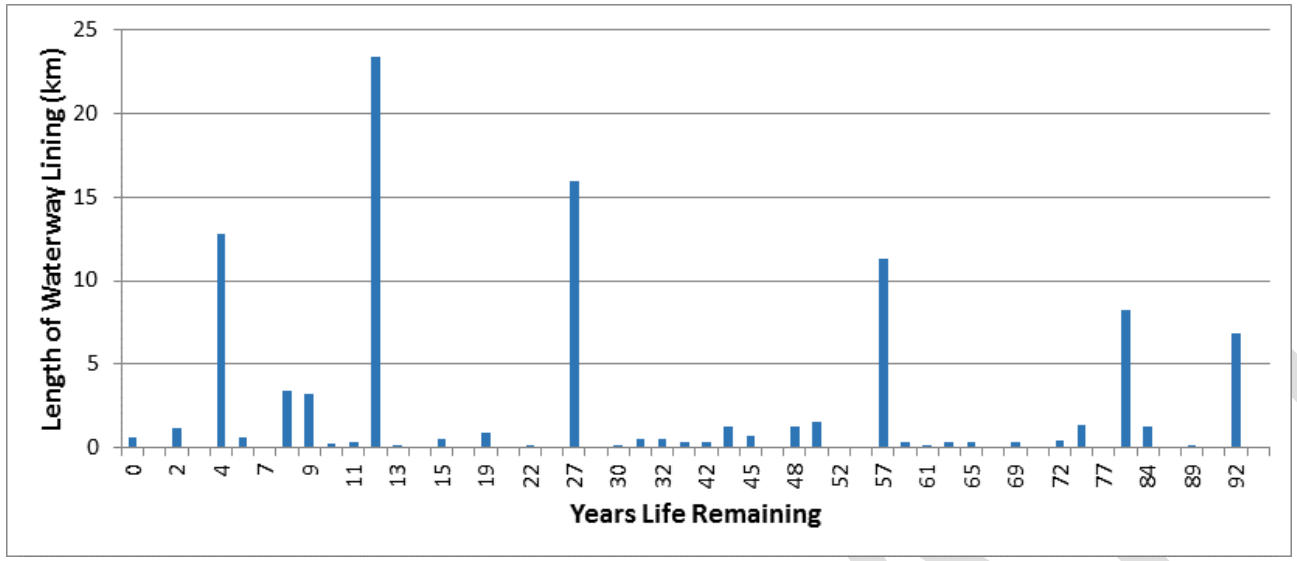


Figure 3.7: Assessed remaining life of waterway linings

3.1.4 Transport

SCIRT completed its repair programme to address the significant earthquake damage to the road network in June 2017. However, there remain issues with maintaining the condition of the network with an increased number of roads requiring maintenance, renewal and replacement. If this is not planned for, asset condition and quality will continue to be below the New Zealand average with customer safety and comfort compromised, as shown in Figures 3.8 and 3.9. It can be seen that the average road roughness is higher than for other New Zealand cities, and the percentage of roads that are smooth is lower than for other cities. Figure 3.10 shows the percentage of roads in each condition grade.

In addition, there are still remaining pipe reticulation issues that affect the road; these include trench reinstatements and raised manholes which both create very rough roads. In many areas the kerb and channel does not drain properly due to ground movement. Continued local subsidence and deformation of road surfaces due to infiltration into unrepaired pipes also remains an issue.

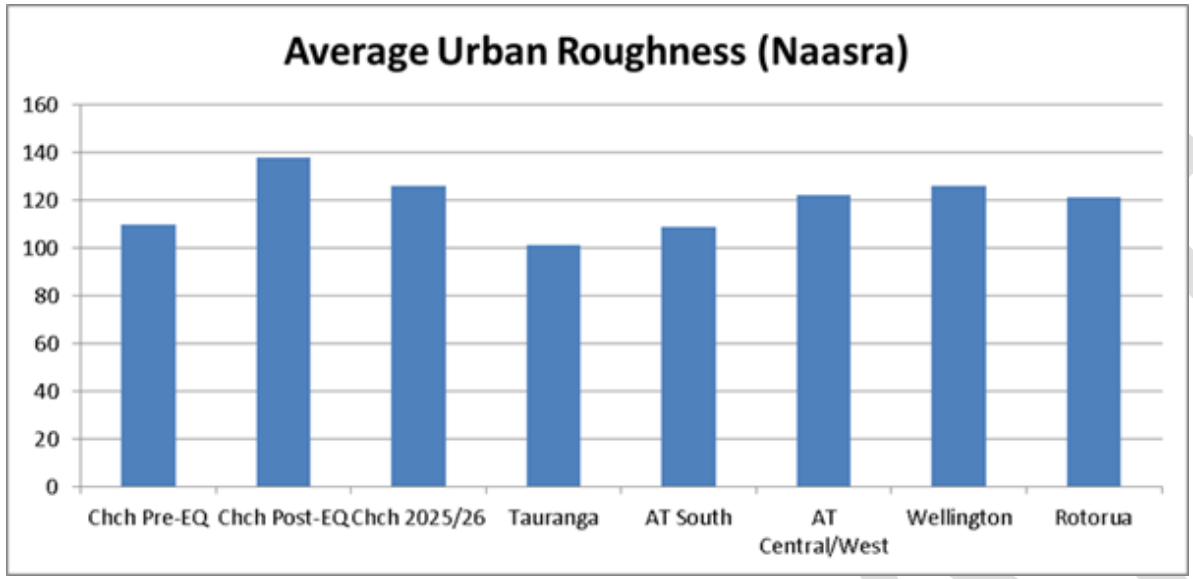


Figure 3.8: Average road roughness compared to other New Zealand cities

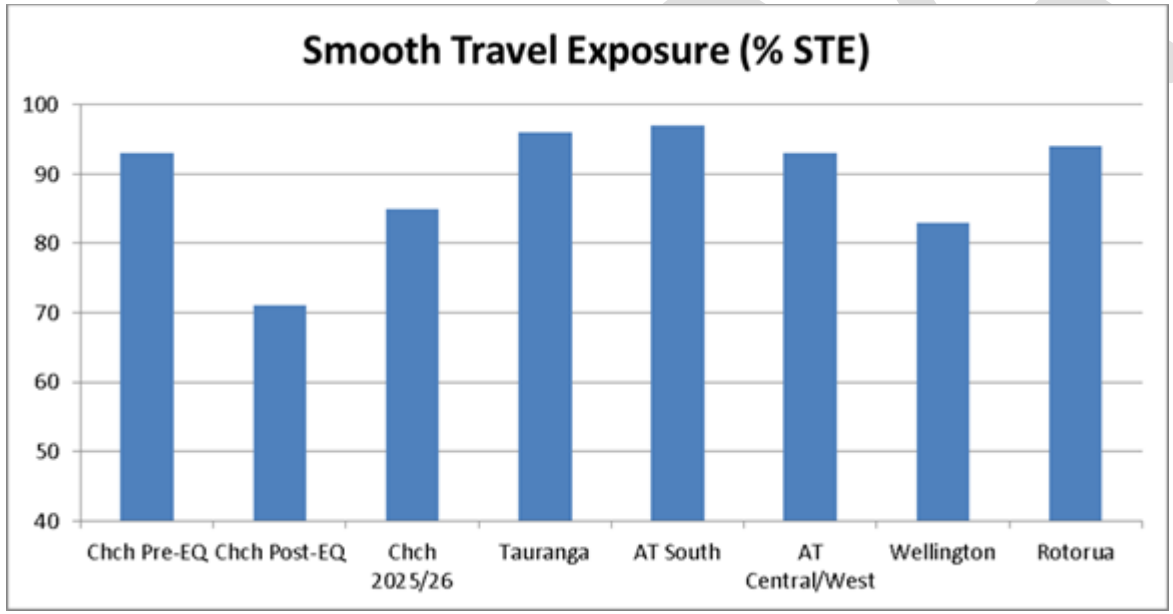


Figure 3.9: Smooth travel exposure compared to other New Zealand cities

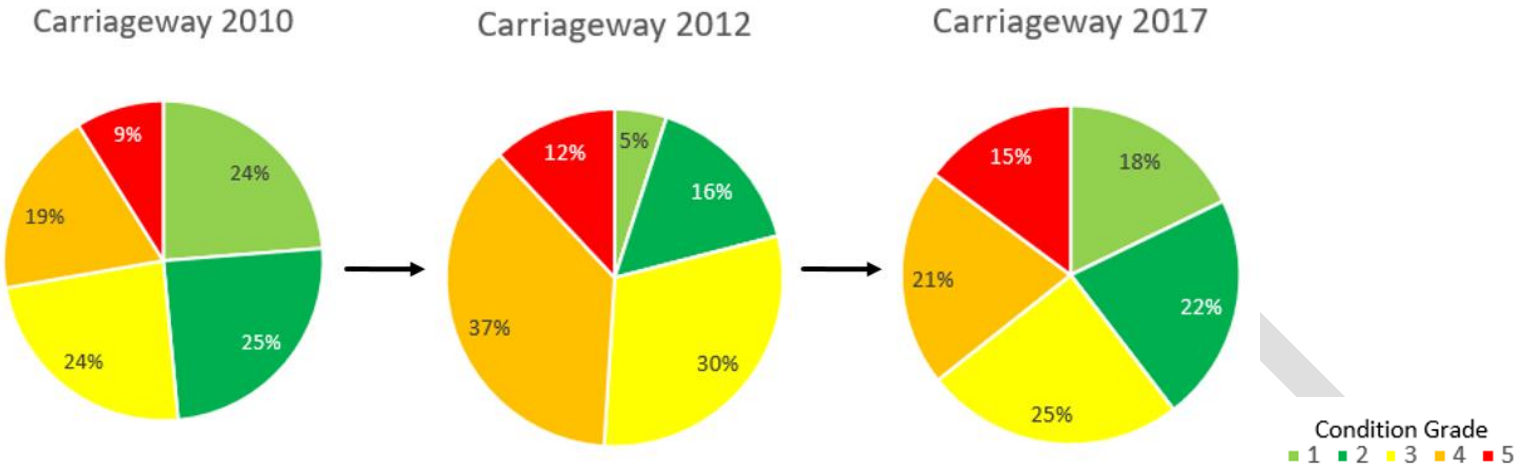


Figure 3.10: Assessed condition of roads, before and after the earthquakes and current

3.1.5 Facilities

The earthquakes of 2010/11 damaged a number of facility assets. Damage to a number of significant community facility assets was such that they were uneconomic to repair, including QEII stadium, Lancaster Park (AMI Stadium), Christchurch Central Library and Centennial Pool. The Council is part way through a major community facility replacement and repair programme including the construction of the Metro Sports Centre and a new central library underway. The programme is also repairing damaged community facilities such as the Town Hall and the Canterbury Provincial Council Buildings. While the Council reached a global insurance settlement, these funds alongside previous capital programmes were not sufficient to meet all identified repair, renewal, strengthening and replacement costs for facilities.

Many facility assets are relatively advanced through their asset lifecycles. For example, more than half of the social housing stock was built in the period from the late 1960s through to the early 1980s. Many facilities assets are approaching or past their mid lives; and are older in terms of construction and functionality. Work required to maintain and keep assets fit for purpose is in many cases deferred, which represents a threat to levels of service being maintained or achieved.

A further complicating factor is that many facility assets have had incremental upgrade work completed on them since original construction, where a portion of the asset remains in original condition and other areas have been revitalised. Such work has not been carried out on an optimised basis due to financial and/or timing constraints.

Population redistribution has altered the need for services in terms of geospatial location. Some areas such as in the southwest of the city are rapidly developing and new facilities are required to meet current levels of service.

In terms of deferred works, due to financial constraints there are limited options for increasing work streams in the immediate budgets. Renewals and replacements are proceeding on a limited basis prioritised alongside reactive work, but where possible taking advantage of synergies between earthquake repair strategies and business as usual renewal programmes.

Careful asset planning has applied and where relevant smoothing and deferral of work streams has occurred to shift renewals further into the future. This has some operational impacts in terms of temporary and patch repairs to extend asset life. This approach also has risk in that future costs are likely to be higher due to inflation

and cost effectiveness is reduced due to added costs from asset degradation. Capital smoothing will allow funds to grow over the short term and provide greater confidence around revenue streams required to fund renewals.

Improvement plans are being implemented for facilities to better quantify and define asset condition and improve the functionality of the asset database. This will improve future planning and provide more clarity for prioritisation across facilities in terms of allocating capital renewal budgets.

The social housing fund is self-funded through rental income and ring fenced from rates. Renewals and replacements are funded solely through the social housing fund. Current policy settings do not allow for further replacement of units lost in the earthquake or growth of the portfolio. This is due to the social housing fund not being sufficient to fund any social housing builds to increase portfolio numbers. Any growth of the portfolio would require funding from sources other than the social housing fund. The social housing demand and supply gap analysis suggests Council should acquire 50 additional units per year for 10 years, which would cost $170 million. Funding for this has not been included in the capital programme due to its inconsistency with current policy settings.

3.1.6 Parks

Constrained capital and operational budgets in recent years has resulted in a decline in the condition and performance of parks assets, particularly public toilets, sports grounds, gardens and hedges, playgrounds, park furniture and hard surfaces (roads, car parks and footpaths). This has resulted in a decrease in satisfaction of community and user groups with the state of assets and quality of services provided by the Council. The result of these are felt the hardest in operations, where staff need to face and provided answers to the community demanding a pre-earthquake level of performance of an ageing portfolio of assets aggravated by a backlog in capital renewal and development in parks that are not meeting standards they expect.

Decreasing capital and operational funding for heritage assets has been at the expense of best practice asset management. Community expectations for the use and standard of heritage assets is increasingly not being met, particularly for heritage buildings. An incomplete maintenance programme has resulted in a considerable increase in the number of assets, particularly artworks that are not being or are being partially maintained. Decreasing or delaying the funding for renewal works is resulting in the objects remaining at an undesirable or deteriorating condition.

3.1.7 Information and communication technology

Council's information and communication technology (ICT) system is fundamental to how public services are accessed and consumed. It enables better informed decision making about local infrastructure. Renewal programmes in the technology environment operate with significantly shorter lifecycles than other types of infrastructure and are driven by the pace of innovation and application of technologies.

ICT assets that are aged or no longer fit for purpose constrain the ability to change with consumer demand, embrace new technologies and integrate with other services. Increasingly, ICT systems and assets need to meet the digital expectations of the people seeking Council services, provide choice and ease of user experience, enable connected and integrated information across technology systems and with other organisations. It also needs to meets the expectations around security of information as exposure to cyber security threats increases. Providing these fit for purpose technology environments for service delivery means that residents and businesses spend less of their value time interacting with Council's transactional services, ultimately leading to lower operational costs.

In addition, ICT environments are increasingly being driven by unlocking the value and sharing of information to support robust and informed decision making, reduce the cost of accessing services for residents and businesses, and to take advantage of emerging technologies for new ways of operating and driving cost efficiencies.

3.2 Options for asset renewals

Three options were developed for asset renewals to align with the Infrastructure Strategy's three overarching options (Option 1 - Medium, Option 2 – Low and Option 3 – High):

- The medium option for asset renewals includes a limited renewals programme to maintain current network condition, except for wastewater and stormwater which would deteriorate. This is the most likely option for asset renewals.
- The low option for asset renewals involves reducing renewals in the first ten years as much as possible for all assets, but results in increased renewals in the second ten years.
- The high option for asset renewals has increased renewals compared to the medium asset renewal option and represents best practice asset management, with assets renewed at the optimal time to minimise whole of life cost.

Under the low asset renewal option, undertaking fewer renewals in the first ten years results in increased operational costs. For example, as the water supply network deteriorates, the frequency of pipe bursts increases and so increased repairs (operational costs) are required. For the road network, deferring renewals will require increased repair costs, such as patches to cover potholes.

The following pages consider the operational cost impacts for each asset class under the three asset renewal options.

3.2.1 Water supply

For water supply renewals, there is a relatively steady planned spend for the medium option, which would maintain the overall condition of the water supply network in its current condition. The planned spend would be significantly reduced for the low option, which would result in increased pipe breaks and therefore would increase the risk of the water supply becoming contaminated. For the high option, more renewals would be undertaken to minimise the whole of life cost of the water supply network.

To calculate the operating costs associated with each of the three asset renewals options a model was used to estimate the probability of pipe failures. Impacts on operational costs compared to current costs were estimated using a probabilistic model based on the proposed programme of work for each option and pipe failure probabilities from a literature search and are shown in Figure 3.11. The model uses the length of pipe with renewal deferred, the number of years deferred and the probability of failure for each deferral length to calculate a probable number of failures occurring in each year. The number of failures each year was multiplied by the average cost to repair a burst water pipe, which is $5,000 for a main and $1,000 for a submain based on maintenance contract records. As each pipe failure also results in an interruption of water supply service, the model was also used to estimate the impact on the level of service for unplanned interruptions per thousand connections – which is currently 16 unplanned interruptions per thousand connections.

As shown in Figure 3.11, under the low option annual operational costs are expected to increase by $327,000 per year after ten years. Under the medium option annual operational costs are expected to be slightly lower than current operating costs after the first three years due to improvements in the condition of the network, with savings of $113,000 after ten years. For the high option, greater savings are expected as the improvements to the network would be more extensive, with savings of $258,000 after three years and $611,000 after 10 years. Note that these figures are in FY19 dollars and do not include inflation.

In FY16, there were 15.8 unplanned water supply interruptions per 1,000 properties, compared to a national average of 7.8. These are expected to remain steady for the medium option, but for the low option would increase to 16.6 in ten years. For the high option, it is predicted they would decrease to 14.7 after ten years, which would still be higher than the national average.

Reduced water supply renewals under the low option would also result in other impacts, such as an increased public health risk from contamination of the water supply from burst water mains.

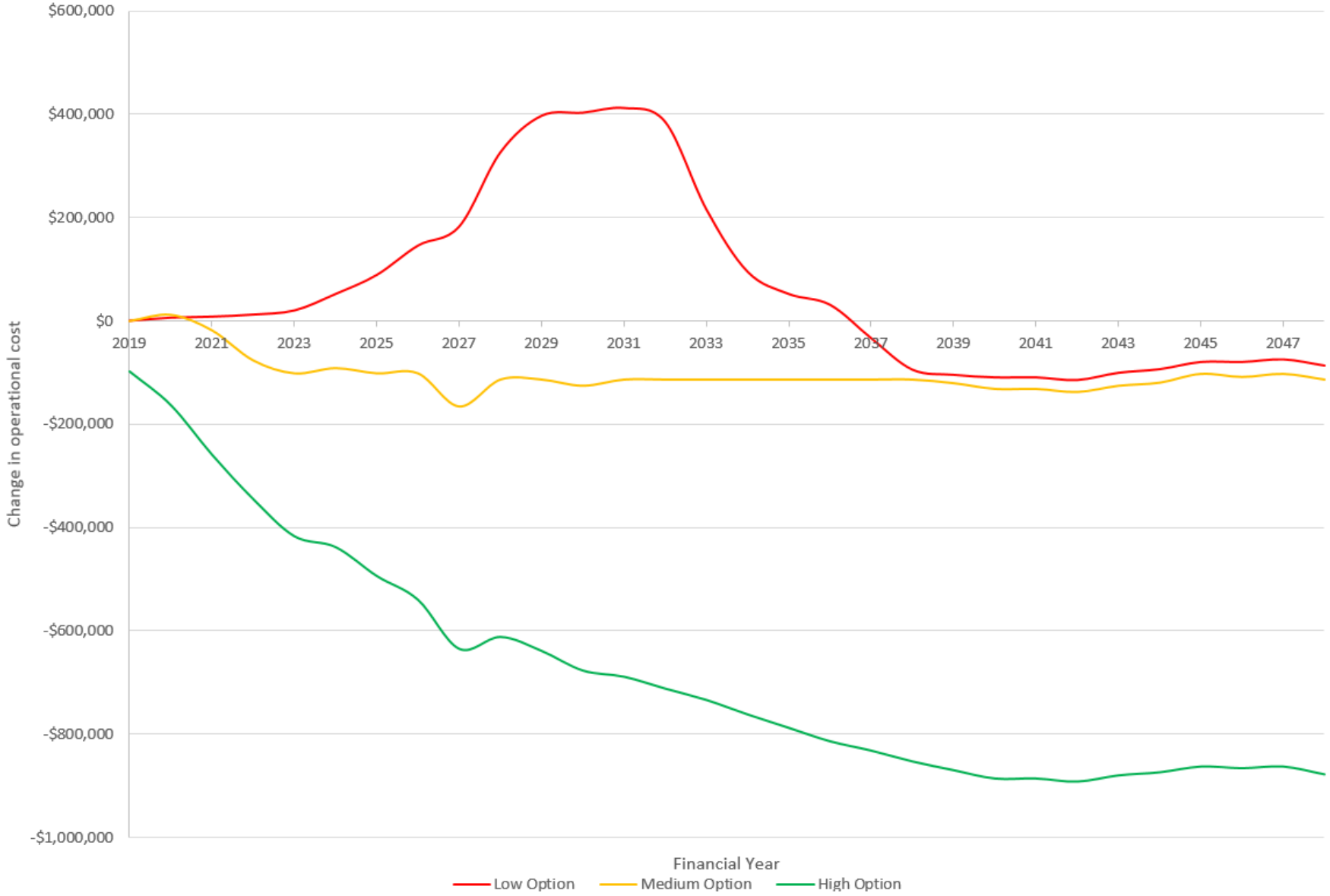


Figure 3.11: Impacts on water supply operational costs of low, medium and high asset renewal options (excluding inflation)

3.2.2 Wastewater

For wastewater renewals, the low and medium asset renewal options are similar, with the same total planned spend over 10 and 30 years. The planned spend the first 10 years would be at a level that is insufficient to maintain the current network condition and so the network would deteriorate, with the percentage of condition grade 5 pipes increasing from 10% currently to 12% in 10 years. This is likely to result in increased pipe blockages and increased groundwater and stormwater entering the network, so will result in increased overflows in both dry and wet weather. For the high option, more renewals would be undertaken to minimise the whole of life cost of the wastewater network, and the overall condition of the network would improve with percentage of condition grade 5 pipes reducing to 1% in 10 years. This would reduce the leakiness of the network and so reduce dry and wet weather overflows.

The Council's current approach for wastewater maintenance is not to repair faults unless they are likely to cause land collapse or major, repeated blockages and overflows. It is difficult to estimate the frequency of these significant failures for the low, medium and high options, so the operational costs resulting from these types of repairs has not been calculated. Therefore, the wastewater operational cost impacts do not include costs to repair additional pipe failures. Instead, operational cost savings from pumping lower flows due to reduced stormwater inflow and groundwater infiltration were estimated.

The total number of failures in the network was predicted using the same methodology as for water supply. It was assumed that half of the current inflow and infiltration is due to faults in the Council network with the remainder due to faults on privately owned laterals. The inflow and infiltration flow from the public network was divided by the number of defects in the network to give an average annual inflow and infiltration flow per defect. The reduction in inflow and infiltration flow was calculated based on the renewal expenditure. This was then multiplied by the electricity cost per cubic metre pumped to give a change in operational cost.

As shown in Figure 3.12, operational cost savings are expected for all three options as replacing leaky pipes reduces inflow and infiltration, with greater savings expected for the high option. Note that these figures do not include inflation.

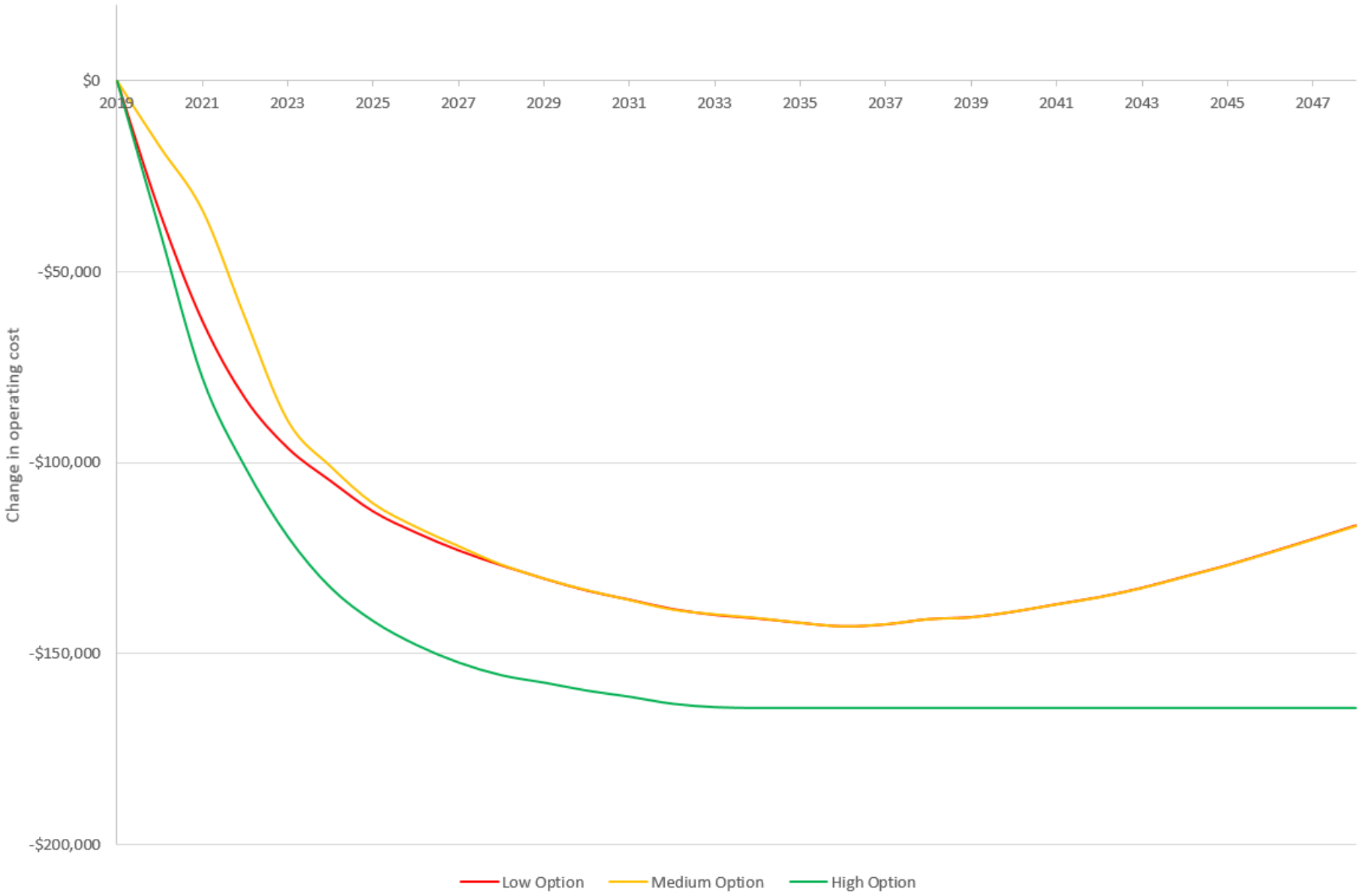


Figure 3.12: Impacts on wastewater operational costs of low, medium and high asset renewal options (excluding inflation)

The change in level of service for wastewater complaint predictions were completed in a similar manner. The current number of defects was divided by the current number of complaints per 1,000 connected properties to give a ratio of defects per complaint. This ratio was then applied to the number of additional defects resulting from deferring renewals to give the increase in complaints per 1,000 connected properties. Adding the increase in complaints to the current number of complaints then gave the predicted complaint numbers.

In FY16, there were 6.2 wastewater system blockage complaints per 1,000 connections, compared to a national average of 9.5 for all types of wastewater complaints. These are expected to increase to 6.5 complaints per 1,000 connections in 10 years for the low and medium options. For the high option, it is predicted they would decrease to 3.3 complaints per 1,000 connections.

Reduced wastewater renewals under the low option would also result in other impacts, such as increased dry weather overflows due to pipe blockages.

3.2.3 Stormwater

For stormwater pipe renewals, the low and medium asset renewal options are the similar, with the same planned spend over 10 years. This is sufficient to maintain the current network condition. For the high option, more renewals would be undertaken to minimise the whole-of-life cost of the stormwater network and the overall condition of the stormwater pipe network would improve, with the percentage of condition grade 5 pipes reducing from 6% at present to 0% after 10 years.

The Council's current approach to stormwater pipe maintenance is not to repair faults unless they are likely to cause land collapse or major, repeated blockages and flooding. Therefore, the stormwater operational cost impacts do not include costs to repair pipe faults. Instead, the ongoing operational costs associated with root cutting and additional cleaning to remove silt and debris from dips has been estimated, which is in line with the approach used by SCIRT when considering the long-term implications of deferring fault repairs.

Where root intrusion or dips were identified through CCTV inspection (approximately 42% of stormwater pipes have been surveyed using CCTV) it was assumed that regular maintenance would be required to keep the pipe operating effectively and the cost of this was based on an average annualised rate per metre length. The pipe renewals were prioritised using a risk based approach that considered condition, criticality and the presence of major faults. The available funding determined how many years the maintenance would need to continue before the pipe was renewed and the total annual increase or decrease in cost relative to medium option was estimated and the results are shown in Figure 3.13. This shows that there is no significant change in operating costs for the first four years for all three options. For the low option, annual operating costs for the low option slowly increase to an extra $49,000 in 2041, then decline due to a large increase in renewals in the second 10 years. For the high option, the increased renewals result in operational cost savings of up to $110,000 in 2031. Note that these figures do not include inflation.

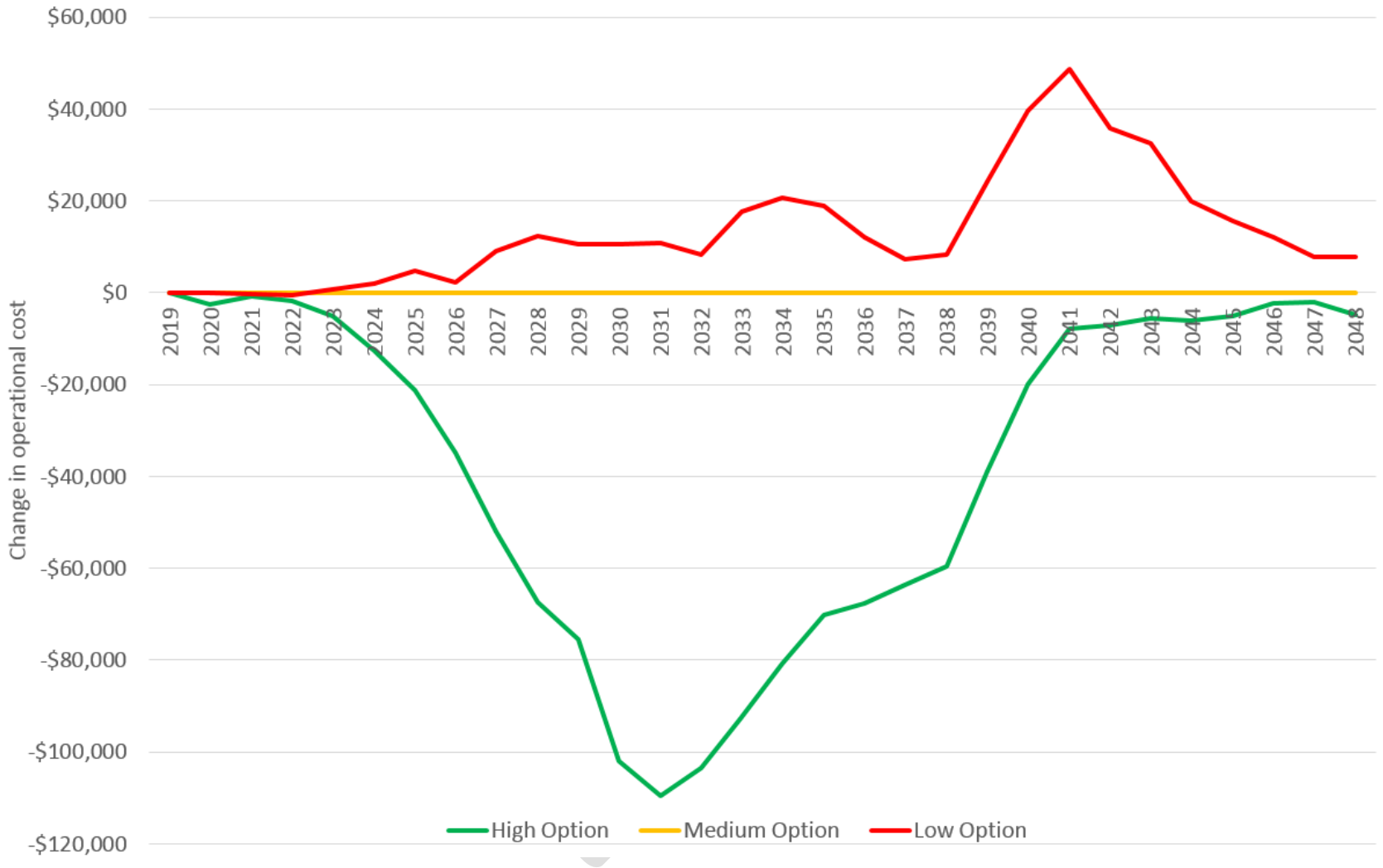


Figure 3.13: Impacts on stormwater pipe operational costs of low, medium and high asset renewal options (excluding inflation)

3.2.4 Transport

Under the low asset renewal option, the budget for kerb and channel renewals would be approximately halved for FY20 – FY23, with the remaining budget directed to targeted kerb and channel repairs (patching). The asphalting of streets across the city would be approximately halved for FY19 – FY21 which will increase the time it takes to restore the network to a reasonable condition. There would be no renewal of retaining walls, street lights, bus stops and shelters, painted cycleways, or carriageway smoothing under the low option. Street lights would not be replaced with LED lights and so there would be no reduction in electricity costs.

As shown in Figure 3.14, operational costs are expected to increase for all three options over the next ten years compared to the current costs, due to the increase in the assets that the Council owns. The increase is highest for the low option, increasing by $1.5 million after three years and $5.9 million after ten years. For the medium option, annual operational costs are expected to increase by $1.5 million after three years and $4.2 million after ten years. Operational costs are also expected to increase for the high option by $890,000 after three years and then reduce to $530,000 after ten years. Note these figures do not include inflation.

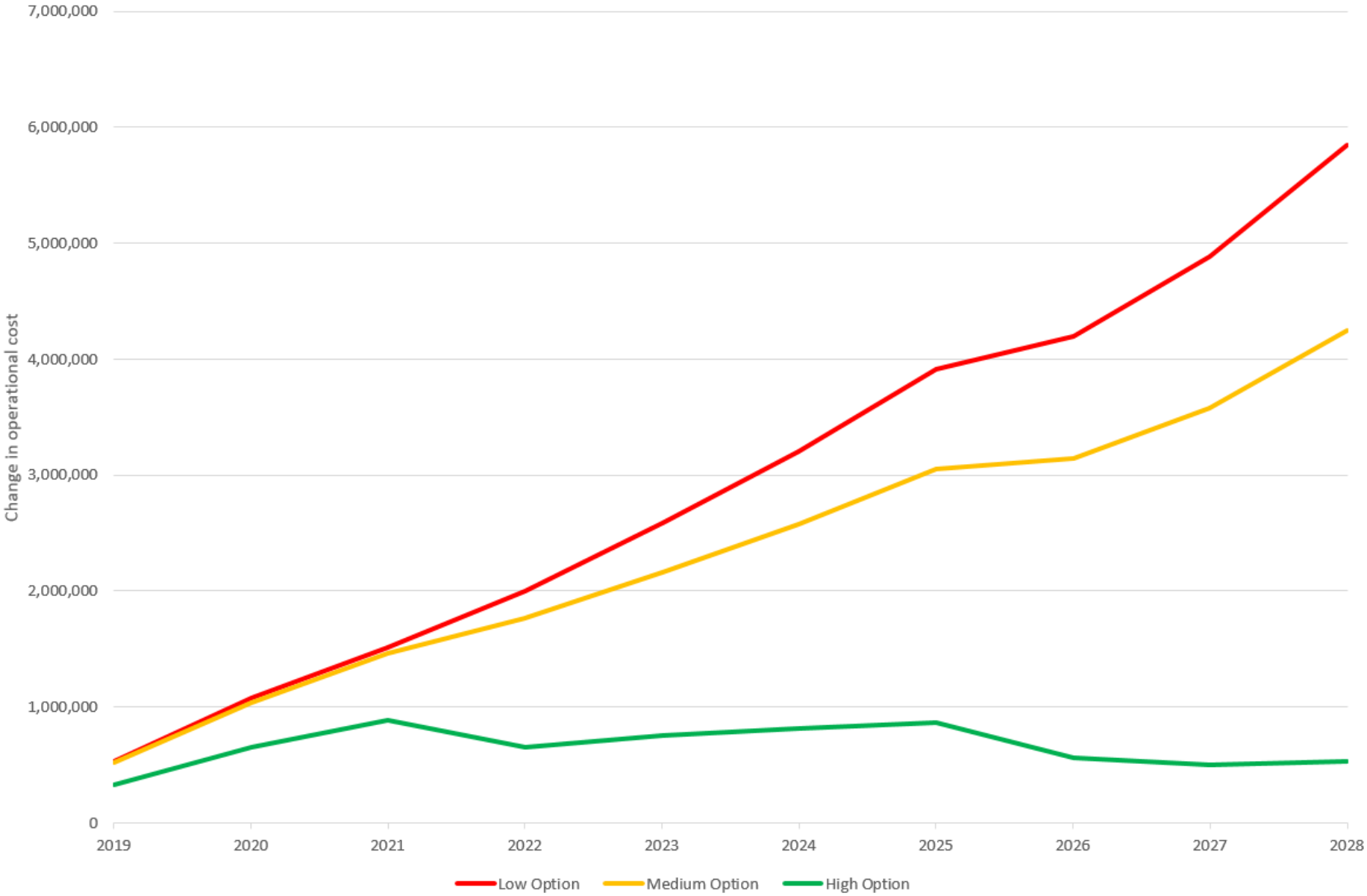


Figure 3.14: Impacts on transport operational costs of low, medium and high asset renewal options (excluding inflation)

3.2.5 Facilities

There is no difference in renewal of facilities assets for the three options.

3.2.6 Parks

For the low asset renewal option, there would be no development of the Lyttelton marina environs or the Harewood nursery, no earthquake repairs to cemetery headstones and no redevelopment of the Botanic Gardens playground. The renewals of hard surfaces in parks (e.g. car parks, tracks) would be reduced by around 40% to $1 million per year for the first three years.

3.2.7 Solid waste

The solid waste renewals programme is the same for all three asset renewal options.

3.2.8 Information and communication technology

For information and communication technology, deferring renewals means that capital costs would increase in the medium term due to legacy solutions and dependencies. As technology is constantly changing, it is not a matter of replacing like for like, but moving to improved and modern technologies when renewals are undertaken. Deferring renewals would mean that technology solutions to support new and improved ways for residents and businesses to interact with Council, and to allow Council staff to undertake their work in more efficient and effective ways, could not be implemented.

For the low asset renewal option, the information and communication technology renewals budgets would be cut by 31-38% compared to the medium option from FY19 – FY22 to around $13 million per year. This would result in increased risks to Council services from cyber security threats and technology failure. The reliability of the Council's digital network, communications and business solutions would be at significant risk of failure thereby compromising a number of the Council's essential services. There would be a significant bow-wave of technology renewal investment from FY22 and an increased cost to ramp-up the capability to deliver. Some renewals have already been deferred leading to risk of hardware and software failures that impact levels of service of many Council activities. The low option does not address existing resilience risks. Capital delivery costs would be likely increase due to legacy solutions and dependencies. The Council would be unable to leverage innovative technologies to deliver more efficient and improved ways of working.

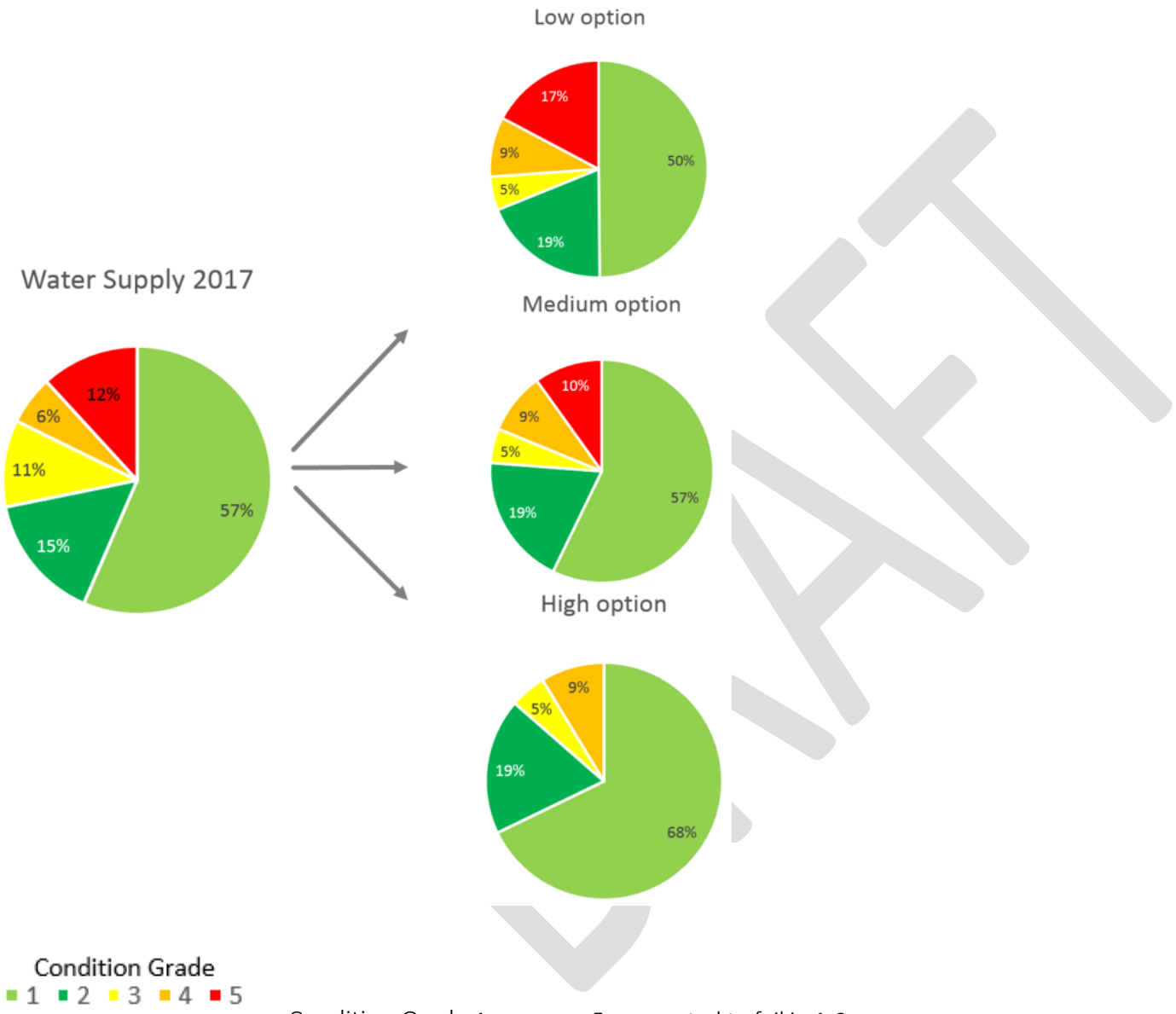
3.2.9 Overall options for asset renewals

The options for asset renewals are summarised in the following table, and the predicted network condition for the three options after ten years is shown in Figures 3.15 – 3.18.

Issue – Asset renewals	
Main options	**Consequences**
Medium Asset Renewal Option Undertake renewals for roads, facilities and parks to improve asset condition Defer renewals for water supply, wastewater and stormwater	• Asset condition improves for roads, facilities and parks • Asset condition maintained for water supply and stormwater • Asset condition deteriorates for wastewater • Largely complies with current legislation, health and safety requirements and resource consents • The Information and Communications Technology system is fit for purpose • Strategic priority of safe and sustainable water supply and improved waterways partially achieved • Community outcome of modern and robust city infrastructure partially achieved • May meet the requirement under the LGA to meet the current and future needs of communities for good-quality local infrastructure • Capital cost of $700 million over 3 years, $2,426 million over 10 years and $7,296 million over 30 years

Issue – Asset renewals	
Main options	**Consequences**
Low Asset Renewal Option Defer water supply, wastewater and stormwater renewals as much as possible in the first ten years Reduce footpath, kerb and channel and bridge renewals for the first four years Delay the repair of the Canterbury Provincial Chambers by three years and the Edmonds Band Rotunda by four years Defer the renewal of the Akaroa Wharf by four years Reduce sport and recreation, parks and ICT renewals to no more than depreciation for the first four years Reduce expenditure on library resources by 3% for two years	• Deteriorating asset condition resulting in increased asset failures • Increased public health risk from contaminated water supply due to increases in burst water mains and reduced well replacements • Increased wastewater overflows due to increased blockages and pipe failures • More frequent service interruptions for water supply, wastewater and stormwater • Increased risk of flooding houses and businesses due to increased failures of stormwater pipes, waterway blockages and burst water mains • Increased renewals expenditure in second ten years for water supply, wastewater and stormwater due to deferred renewals • Roughness of roading network gets worse • The reliability of the Council's digital network, communications and business solutions would be at significant risk of failure, compromising a number of Council's essential services • Increased threat to Council services from cyber security and/or technology failure. Significant bow-wave of technology renewal investment from FY22, and increased cost to ramp-up capability to deliver • Renewals already deferred would be at risk of hardware and software failures that impact levels of service for many Council activities • Existing resilience risks relating to ICT not addressed • ICT capital delivery costs likely to increase due to legacy solutions and dependencies • Decreased resident satisfaction with infrastructure • Lower levels of service targets for unplanned water supply interruptions and wastewater and stormwater complaints • Strategic priority of safe and sustainable water supply and improved waterways not achieved • Community outcome of modern and robust city infrastructure not achieved • May not meet the requirement under the LGA to meet the current and future needs of communities for good-quality local infrastructure • Capital cost of $677 million over 3 years, $2,127 million over 10 years and $6,497 million over 30 years

Issue – Asset renewals	
Main options	**Consequences**
High Asset Renewal Option Undertake additional renewals to minimise the whole of life cost for the water supply, wastewater, and stormwater networks Undertake renewals to smooth roads to be similar to roads in other NZ cities after 10 years and renew ancillary transport assets For parks and facilities, undertake renewals that are not essential	As for medium option except: • Water supply, wastewater and stormwater infrastructure restored to its pre-earthquake condition over 30 years • Road network smoothness similar to other NZ cities after 10 years • Unplanned interruptions of service minimised • Strategic priority of safe and sustainable water supply and improved waterways achieved • Community outcome of modern and robust city infrastructure achieved for all infrastructure • Meets the requirement under the LGA to meet the current and future needs of communities for good-quality local infrastructure • Capital cost of $954 million over 3 years, $3,335 million over 10 years and $8,112 million over 30 years
Time period	2018 - 2048
When decision is required	2018 Long Term Plan



Condition Grade 1 – as new, 5 – expected to fail in 1-2 years.

Figure 3.15: Assessed current water supply pipe condition grade and predicted condition grade after 10 years for low, medium and high options

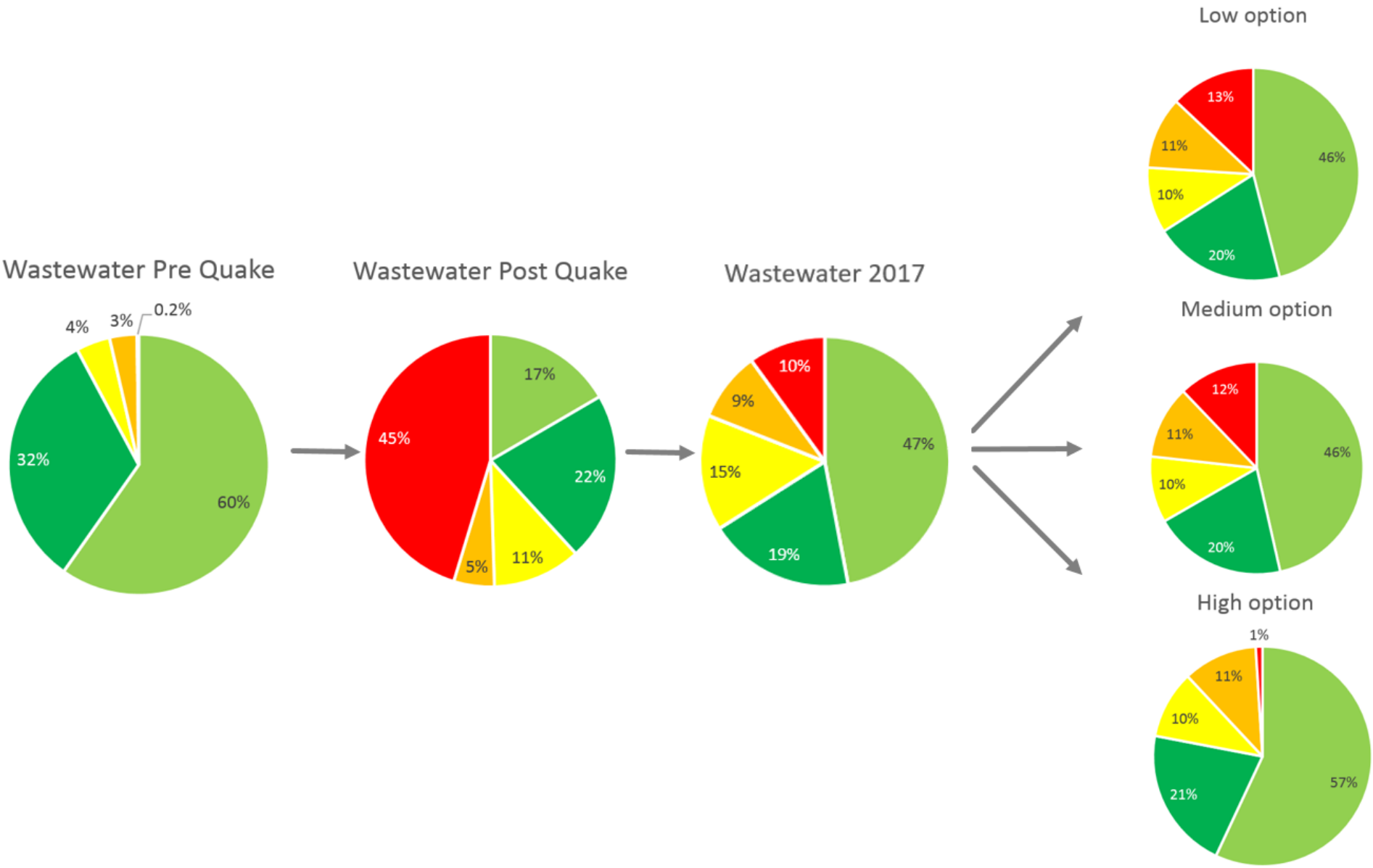


Figure 3.16: Assessed wastewater pipe condition grade and predicted condition grade after 10 years for low, medium and high options

Figure 3.17: Assessed current stormwater pipe condition grade and predicted condition grade after 10 years for low, medium and high options

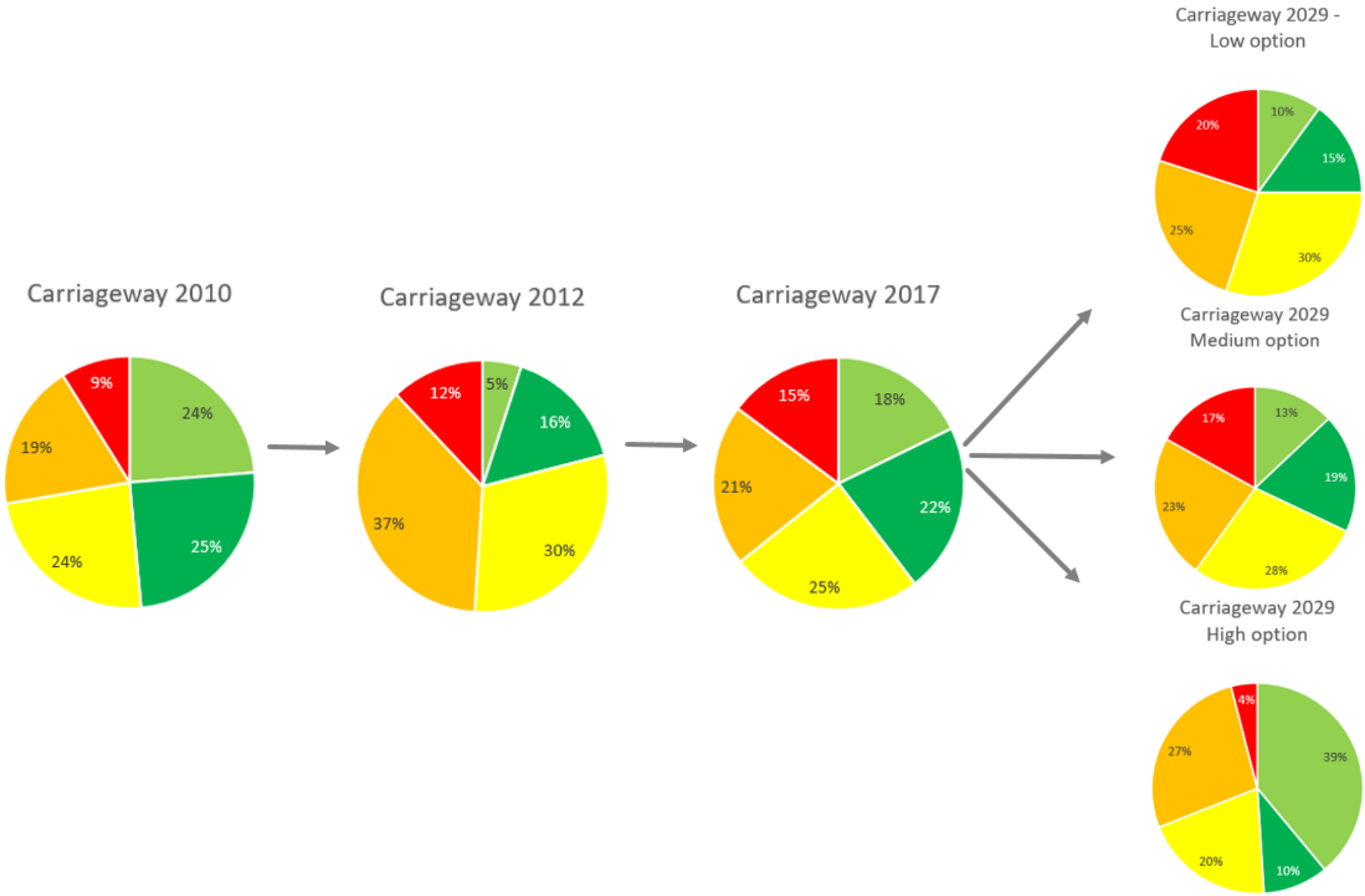


Figure 3.18: Assessed road condition grade and predicted condition grade after 10 years for low, medium and high options

3.3 Climate change

Climate change is a change in global and regional climate patterns caused by the increased concentration of carbon dioxide and other greenhouse gases in the atmosphere. Based on current information, climate change is expected to affect Christchurch in the following ways:

- Rising sea levels and more frequent storm surges causing more frequent and extensive flooding
- Increased coastal erosion
- Rising groundwater levels near the coast and rivers
- Fewer rainfall events which may result in rivers with lower flows
- Higher intensity storms resulting in increased flood and landslide risk during those events.

Projections of the degree of increases in rainfall and sea level are periodically updated for Christchurch by the Ministry for Environment, based on the best international information provided by the International Panel on Climate Change (IPCC). These projections will continue to be updated and the Council will always use the accepted range of projections in its adaptive management. The whole catchment approach will consider how projected increases in sea level, rainfall intensity and other key processes (e.g. changes in freshwater salinity and sedimentation) will vary together with temperature, and attribute these to estimated timescales based on IPCC options.

The Council has long recognised the risk to the city posed by climate change and has made climate change leadership a strategic priority. Christchurch must respond to the challenges of changing climate and associated natural hazards.

The Council has responsibilities to manage coastal hazards under the Local Government Act 2002 and the Resource Management Act 1991.The New Zealand Coastal Policy Statement requires the Council to:

- Identify priority areas of the coast that are potentially affected by coastal hazards
- Reduce hazard risk in areas of significant existing development
- Locate new development away from risk-prone areas
- Consider responses, including managed retreat for existing developments
- Protect or restore natural coastal hazard defences.

The Coastal Hazard Assessment for Christchurch and Banks Peninsula (Tonkin & Taylor, 2017) is the most detailed and up-to-date information on coastal hazards for Christchurch and Banks Peninsula. It will inform any future changes to coastal hazard provisions in the Christchurch District Plan, and help the Council and communities make informed decisions about adapting to challenges in coastal areas. A range of climate change scenarios (RCP: representative greenhouse gas concentration pathways (median projections)) were modelled. The number of properties predicted to be affected by inundation and erosion in 50 years and 100 years under these scenarios are shown in Figures 3.19 and 3.20.

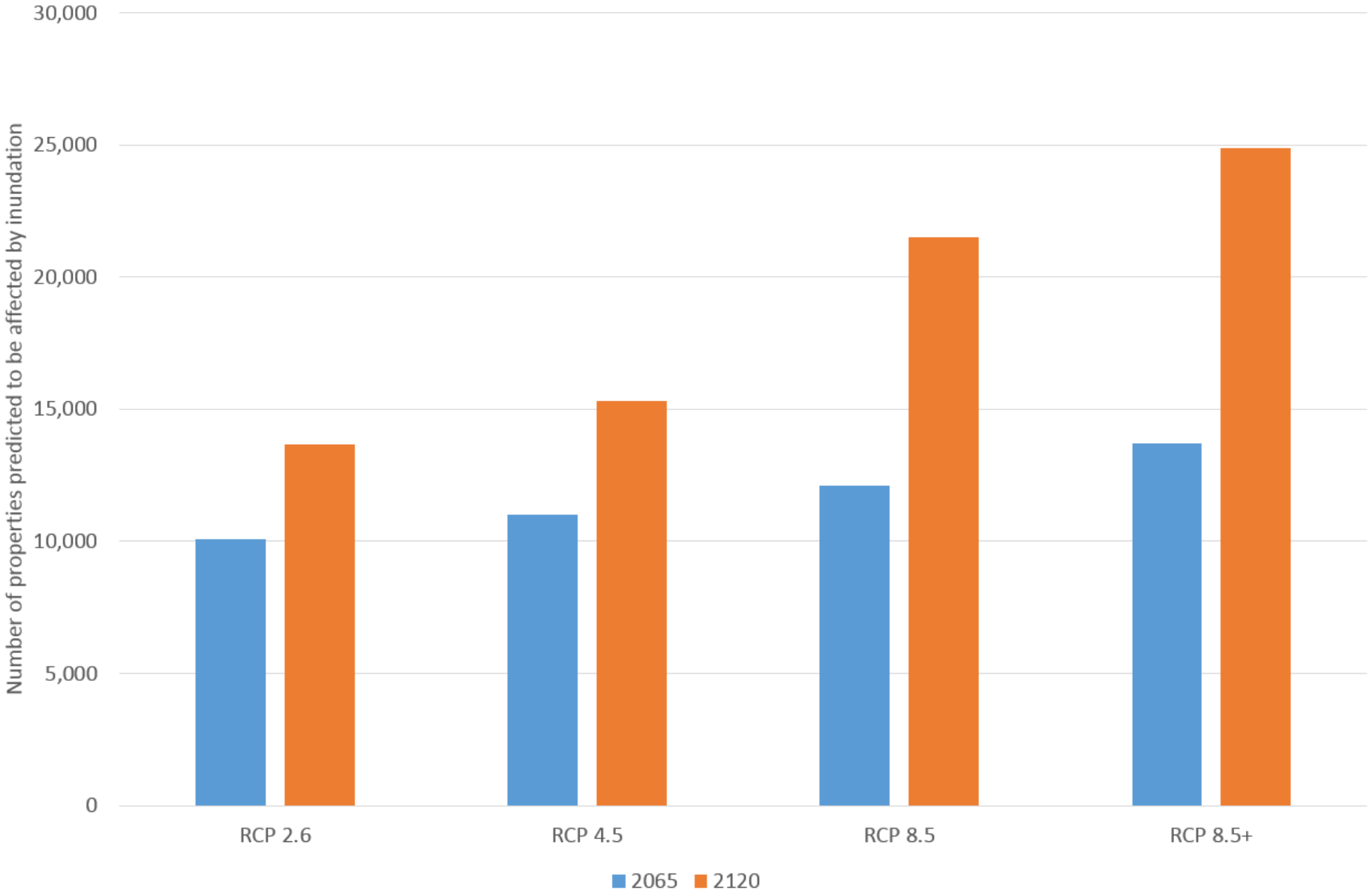


Figure 3.19: Number of properties predicted to be affected by inundation under a range of climate change scenarios by the years 2065 and 2120

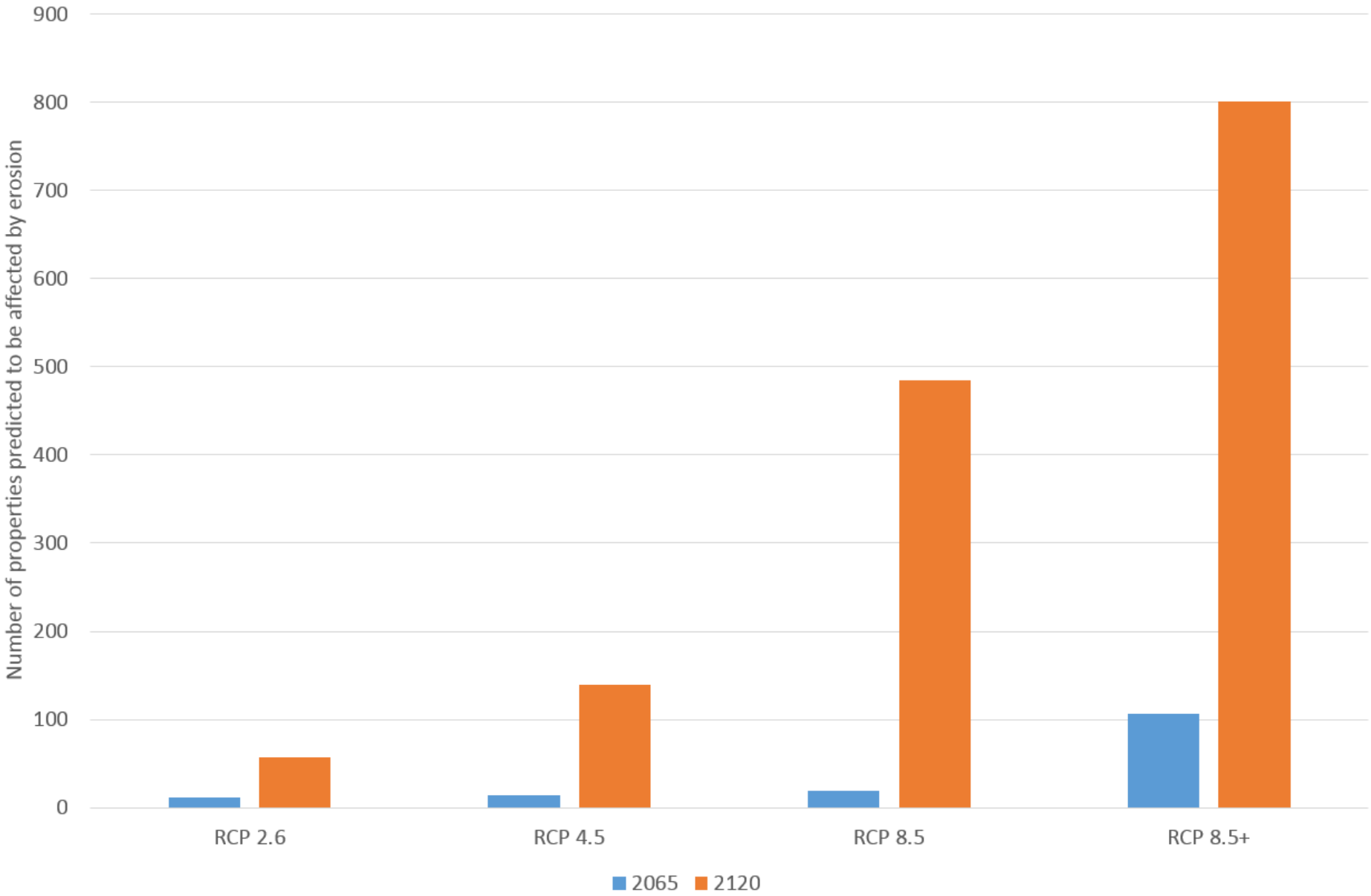


Figure 3.20: Number of properties predicted to be affected by erosion under a range of climate change scenarios by the years 2065 and 2120

The Council has begun to plan and respond to the likely effects of climate change. For example, the District Plan now incorporates requirements that anticipate increased flooding under climate change. Many asset management programmes now take the climate change effects into account for example, the Land Drainage Recovery Programme considers likely future flooding caused by earthquake damage and climate change.

The Council is also proposing to adopt an all hazards approach to floodplain management and coastal inundation, which will take into account the impacts of climate change and sea level rise. A multi hazards study is underway and will include options, costs and risks and development of adaptation pathways.

However, the Council needs to do more and is developing a climate resilience approach. This will provide clear direction about how the city plans to manage the impacts of climate change and associated natural hazards, such as including increased flooding and sea level rise. This will include identifying which areas may be defended, and from which areas the city may need to retreat. This will be incorporated into the 2021 Infrastructure Strategy. In the meantime, this Infrastructure Strategy does not include any specific climate adaption projects and their costs. Also, infrastructure renewals will continue to be undertaken across the city as the Council is yet to decide which, if any, areas to retreat from. This creates a risk that newly replaced infrastructure will need to be abandoned and that other renewals that could have happened instead are not carried out.

Learning to adapt to a changing environment and make decisions in the face of uncertainty will be important steps in addressing the impacts of climate change. Identifying adaptive pathways (which allow changes to be made in the future as circumstances change) will be key to appropriate infrastructure investment across a range of Council activities. For example, the Council's design guidance calls for allowances for increased rainfall intensity and sea level rise. This design guidance is applied to projects, with increased capacity being provided where possible and careful consideration being given to construction of new infrastructure in areas affected by climate change. This does not respond to the overarching climate change issue where decisions on future infrastructure investment and land use will be required. For example, if the plan is to retreat from an area then the Council may reduce investing in infrastructure in that area, rather than continuing to build and renew infrastructure that will one day be abandoned.

The possible impacts of climate change on the different types of infrastructure are described below.

3.3.1 Water supply

It is expected that demand for water will increase as the temperature increases and average rainfall declines.

Christchurch, Lyttelton, Governors Bay and Diamond Harbour water supplies are fed from groundwater sources beneath Christchurch. Sea level rise could lead to salt water contaminating water supply bores. However artesian pressure should prevent salt water ingress, provided there is no over pumping of the aquifers.

Water supplies for Little River, Wainui and Birdlings Flat are not expected to be adversely impacted by climate change, as they all have groundwater sources. Once the Duvauchelle water treatment plant is upgraded to improve its treatment when its surface water source is turbid, it will be more resilient to increasing storms from climate change.

Akaroa, Takamatua and Pigeon Bay water supply schemes may be affected by decreased rainfall as these mainly rely on surface water. Additional water sources may be needed for these settlements.

3.3.2 Wastewater

Climate change predictions include an increase in the frequency of high intensity rain events and are therefore expected to increase wastewater overflows unless network upgrades are completed. Upgrades could include a combination of increased network capacity and storage tanks. Measures to reduce wastewater production, inflow and infiltration reduction measure and smart pressure sewer systems which allow the Council to monitor and control pumps on individual properties, will help reduce the demand on the wastewater system.

3.3.3 Stormwater

While the earthquakes reduced the capacity of the stormwater network over substantial areas and increased flood risk to many low lying parts of the city, far greater challenges than this are likely to result from climate change and sea level rise, and these challenges must be faced across the city. Increased rainfall intensity will result in greater flows and this is likely to increase flooding. Rising sea levels increase river levels, and this reduces the ability of the stormwater network to discharge and may affect large areas within the eastern suburbs.

Climate change will increase flood risk through increases in rainfall intensity and rising sea levels. These impacts will be particularly acute in those low lying parts of Christchurch which are already close to water bodies. As an example, Figure 3.21 shows the increase in the number of houses at risk of above floor flooding from the Heathcote River between Colombo and Radley Streets for a 50 year storm. This shows that the number of houses affected increased as a result of the earthquakes, but increases significantly more as a result of climate change and 1 metre sea level rise over the next 100 years, even with post-earthquake storage measures in place.

Any infrastructure investment made needs to be able to adapt to the changes that may occur. Infrastructure mitigation measures may include increased storage, stopbanks and pump stations. Upgrades to the stormwater network will be needed including:

- Increasing pipe capacity to cater for increased flows and decreased discharge capacity
- Flap gates to prevent flow of river water back up the network
- Pump stations to allow discharge during high tide or river levels
- With rising groundwater levels, there may also be an increased requirement to manage groundwater through the stormwater network.

In addition to projects undertaken by Council, developers are required to provide on-site storage of stormwater when there is not a communal stormwater detention pond, to reduce the demand on the stormwater network.

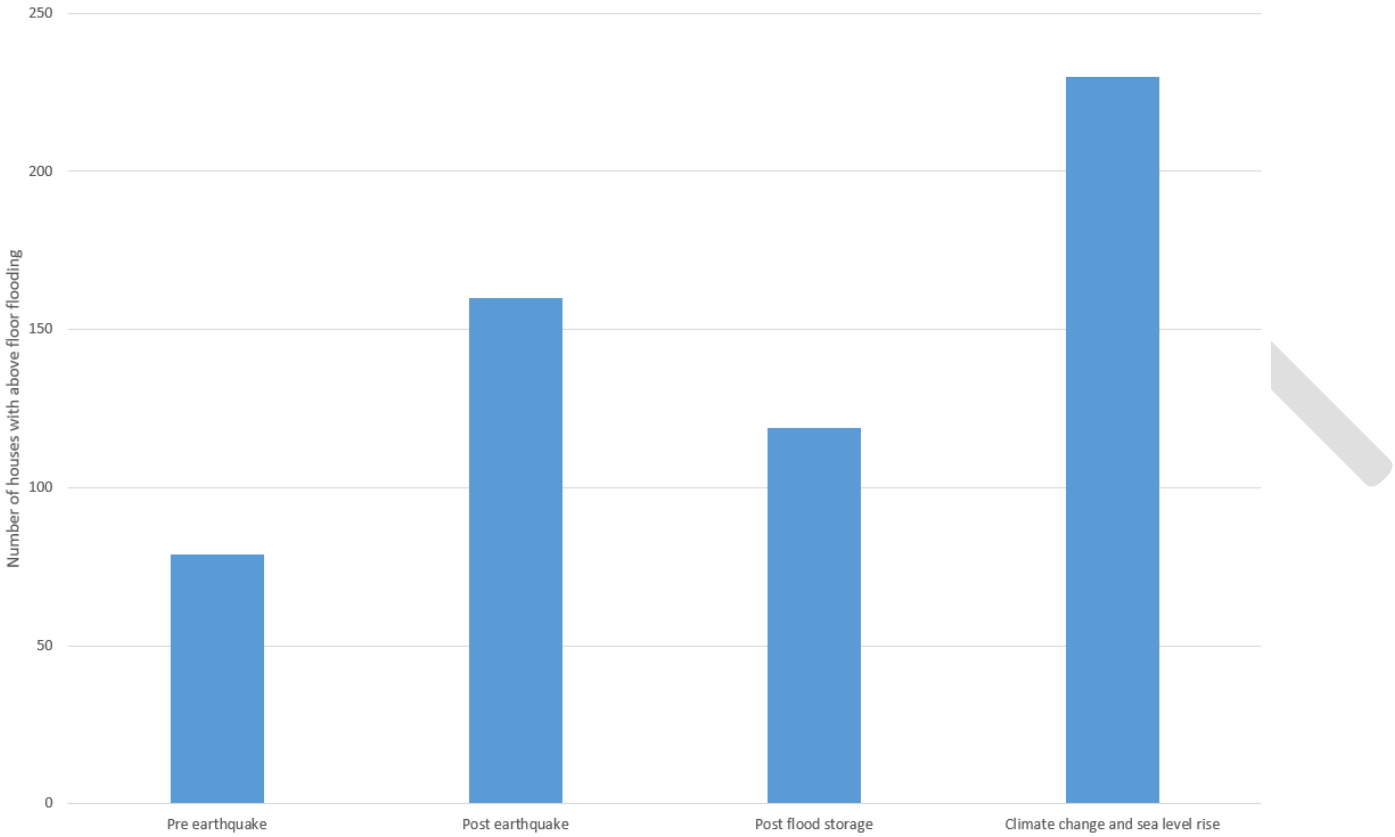


Figure 3.21: Number of houses at risk of above floor flooding between Colombo Street and Radley Street in a 50 year storm

3.3.4 Roads

Transport infrastructure is likely to be adversely affected by climate change. Intense rain events may lead to storm damage including landslips, subsidence and potholes. Sea level rise may also erode road protection and associated infrastructure.

Sustainable urban drainage, rain gardens and porous surfaces (for example in car parks), help to reduce the amount of surface run-off from transport infrastructure and help to manage the effects of flooding.

Changes can be made to transport infrastructure to provide improved transport choices by walking, cycling, shared, slower streets and public transport. These changes will deliver more resilient transport networks as there will be alternative travel options and routes available if damage occurs. This will also result in greenhouse gas emission reductions.

3.3.5 Parks

There is an unknown level of impact of sea level rise affecting coastal, estuary, riverbank and low-lying reserves, marine structures and seawalls. However, maintenance and renewal work on foreshore land will be required at an increasing level over the next 30 years. Other impacts of climate change may be hotter, dryer summers which will result in increased turf and plant stress, rising cost of irrigation or landscape and plant biodiversity adaptions to absorb and respond to these gradual environmental changes. Scoping work is being undertaken and options, such as design changes, to address any impacts on all parks land will inform future versions of the Infrastructure Strategy.

3.3.6 Facilities

A few community facilities may be affected by the impacts of climate change. Primarily these are located adjacent to the coastal regions such as New Brighton, Sumner and Redcliffs. Forward planning for renewals of relevant facilities in these areas will need to take into account up to date sea level rise and coastal erosion projections.

3.4 Post-earthquake recovery and regeneration

There is a significant amount of Council's infrastructure which is earthquake-damaged and has not been repaired yet. Much of the physical damage is hidden in below-ground infrastructure, or in shortened lifespans of existing assets. The Council knows more now than the Council ever has about the condition of its underground assets. And although a significant repair and replacement programme has been undertaken by the SCIRT, the Council still has a long journey ahead to replace the many assets that have suffered partial damage, or assets for which longevity has been compromised. This has added substantially to the asset renewals programme.

In terms of facilities, the combination or earthquake related repair strategies along with business as usual repairs and renewals has required careful prioritisation and planning for the allocation of capital budgets. This includes community facilities, recreation and sport facilities, libraries, art galleries, corporate accommodation, vehicle fleet and shared plant, and social housing. Prior to the earthquakes, some of these facilities were already at mid-asset lifecycle (or beyond) and requiring renewal investment.

Regeneration of the city will place further financial pressure on the Council. Decisions need to be made on how the Council will address this pressure alongside tackling the issues of renewing old and damaged infrastructure and adapting infrastructure to the likely impacts of climate change.

The Council is working with a range of other agencies to regenerate key areas of the city. These areas are the Central City which includes the Cathedral Square and surrounds, the residential red zone (Ōtākaro Avon River corridor), East and South Frame precincts and New Brighton. The Council will be responsible for meeting some of the infrastructure costs for this regeneration.

There are no complete regeneration plans or strategies at this time, other than the Cranford Regeneration Plan. There is also no clarity about how the costs of implementation will be allocated, particularly for the Ōtākaro Avon River corridor. Due to this uncertainty, only a limited budget for regeneration has been included in this Infrastructure Strategy.

Three options were developed for post-earthquake recovery and regeneration to align with the Infrastructure Strategy's three overarching options (Option 1 - Medium [the most likely option], Option 2 – Low and Option 3 – High). These options are detailed later in this section. For Option 1 – Medium, this includes $14 million for New Brighton regeneration, $9 million for Cathedral Square and surrounds and $114 million for stormwater management in the Ōtākaro Avon River corridor. However, early indications are that the eventual call on Council capital funding could be much more significant, particularly for the Ōtākaro Avon River corridor and Cathedral Square. Other areas of Christchurch may also require post-earthquake regeneration projects within the 30 year period of this strategy. Given the Council's financial situation, the Council will have some significant decisions to make regarding funding, timing and scope of regeneration projects beyond what is already approved.

In early 2017 the city also experienced the Port Hills fires – which caused widespread damage to more than 2,000 hectares of land, and caused widespread deforestation of the Port Hills. Recovery from this event will take many years and the cost will be significant. In the short-to-medium term, significant sediment control activities will be required so that soil from the Port Hills does not enter the river systems. Over the medium-to-long term, the Council has an opportunity to re-plant the Port Hills with native plantings to enhance the city and make a natural playground for recreation with enhanced ecological value.

In the period since the devastating earthquakes of 2010-2011, the Council has spent approximately $8 billion in capital and operating costs in providing services, undertake repairs and improve the city. Although the Council has a greater understanding today of the financial and infrastructure consequences of the earthquake, the physical damage caused by the earthquakes is still being uncovered – and therefore is impossible to exactly quantify.

The additional investment by the Council in recent years – through necessity – has in part been funded through deferring otherwise planned renewals. Compounding this situation, many infrastructure assets that were built in Christchurch during earlier building booms such as in the 1950s are approaching the end-of-life.

3.4.1 Ōtākaro Avon River corridor

The Minister for Greater Christchurch Regeneration is likely to consider a regeneration plan for the Ōtākaro Avon River corridor (residential red zone) towards the end of 2018.

The regeneration of the Ōtākaro Avon River corridor is likely to require the Council to provide stopbanks, stormwater treatment, roading and cycleways. For example, transport changes may include changes to and closure of some roads and bridges, complemented by improvements to cycling and walking opportunities.

Any residential redevelopment of the river corridor will also have implications for water supply and wastewater infrastructure, as the area is now largely unserviced.

Some transport and stormwater projects within the Ōtākaro Avon River corridor are included in the proposed capital programme, to meet the Council's "business as usual" infrastructure planning requirements. However, no specific provision has been made in any of the options in the Infrastructure Strategy for the additional projects which the regeneration plans propose for the corridor. These plans are currently undergoing public consultation, with scope and costs for preferred options yet to be determined.

The Council will be talking with the Crown about the options for land ownership, governance and funding of the development of the Ōtākaro Avon River corridor, including the timeline for development over the coming decades.

3.4.2 Cathedral Square and surrounds

The Council will be a substantive financial contributor to the regeneration of Cathedral Square and the surrounding area, broadly defined as the area bounded by Cambridge Terrace, Hereford, Kilmore and Manchester Streets. This is a key part of the Central City's regeneration.

The Council allocated an initial $9.2 million to Cathedral Square as part of the Cost Share Agreement negotiated with the Crown in 2013. However a much higher amount than $9.2 million is needed to achieve a comprehensive improvement of this area.

The Cathedral Square regeneration process will be an ongoing project for the Council over the lifetime of this Infrastructure Strategy.

3.4.3 New Brighton

A series of projects have been initiated that aim to revitalise New Brighton's foreshore and commercial core to attract new residents and visitors and provide better public amenity.

Development Christchurch Ltd is leading the New Brighton regeneration project with the support of the Council. This project encompasses delivery of the hot salt water pools, a new beachside playground, and the revitalisation of the commercial core, all of which will be funded, in large part, by the Council.

3.4.4 Cranford

The Cranford Regeneration Plan took effect in August 2017 and enables additional residential development in the Papanui and St Albans area. It will require some Council investment. However, the bulk of expenditure in this area will be from the private developers responsible for residential property development.

Issue – Post-earthquake recovery and regeneration	
Main options	**Implication of options**

Medium Regeneration Option
Only contribute to post-earthquake regeneration where commitments have already been made
Implement the Avon stormwater management plan and Avon floodplain management
	• Current commitments kept
	• No additional contribution to regeneration projects
	• Flood risk and stormwater quality improves in the Avon River catchment
	• Avon River stormwater management plan and flood plain management plan projects are included in the preliminary regeneration plans for the Ōtākaro Avon River corridor
	• Capital costs:
	  ○ New Brighton regeneration $26 million ($12 million for New Brighton public realm improvements, $10 million for hot salt water pools, $3 million for master plan streetscape enhancements and $1 million for other master plan projects)
	  ○ Cathedral Square and surrounds $9 million
	  ○ Avon flood plain management $98 million over 10 years, $454 million over 30 years
	  ○ Avon stormwater management plan $20 million over 10 years, $174 million over 30 years

Low Regeneration Option
As for medium option, except:
Delay Avon floodplain management by 4 years to start in FY27
Avon stormwater management plan not implemented
	As for medium option except:
	• Flood risk in Avon catchment remains higher for longer
	• Stormwater quality deteriorates in the Avon River catchment
	• Capital costs as for medium option except:
	  ○ Avon flood plain management $17 million over 10 years, $408 million over 30 years
	  ○ Avon stormwater management plan $0

High Regeneration Option
Accelerate Avon floodplain management, starting 3 years earlier in FY19
Accelerate Avon stormwater management plan implementation, complete 12 years earlier, by FY36
	As for the medium option except:
	• Flood risk and stormwater quality in the Avon catchment improve sooner
	• Capital costs in addition to the medium option:
	  ○ Avon flood plain management (total of $231 million over 10 years, $516 million over 30 years)
	  ○ Avon stormwater management plan $46 million over 10 years, saving of $33 million over 30 years as these would be completed by FY36 rather than by FY48 (note that the overall cost in today's dollars is the same) (total of $66 million over 10 years, $141 million over 30 years)

Time period	2018 - 2048

When decision is required	2020 Annual Plan

Not included in any of the options are contributions to regeneration projects in addition to those in the table above.

3.5 Affordability

The community's largest investment which has been vested in Council is infrastructure. The Council is required to maintain this investment in a cost-effective manner over its lifetime. Much of this infrastructure will provide benefits that are multigenerational. Multigenerational affordability is a key element to consider in an Infrastructure Strategy. This investment underpins the environmental, cultural, social and economic wellbeing of the community in both the short and long term.

The current ratepayers have contributed to the significant investment required to repair the city's infrastructure following the 2010/11 earthquakes. The Council recognises that is a limit to how much current ratepayers can afford. It is also important for current and future generations that appropriate investment in infrastructure is made now.

There are multiple levers that the Council can pull in relation to affordability. The easily identifiable ones are rates increases, level of capital spend and borrowing. There are however other levers such as increasing revenues, releasing capital from assets, recycling assets and also potential savings from organisational or structural changes. The Council also has the ability to examine what it is absolutely essential to be delivered by the Council and what services and assets could be placed in the category of nice to have.

The Council needs to determine the priority of issues to be addressed and the associated timing and funding for the relevant infrastructure projects. These decisions need to take into account the costs and benefits of those projects over the short, medium and long term.

The Council is continually balancing the need to re-invest in the city post-earthquake, achieve the strategic priorities and community outcomes, and reduce costs for ratepayers. The Infrastructure Strategy provides the opportunity to take a 30 year view and develop a plan that balances the benefits for current and future residents.

The Council has had to increase rates to service the city – above the rate of inflation – in each year since the earthquakes. Rates do not necessarily distribute the cost equitably across the community. The Council is exploring all avenues to keep rate increases to a minimum. This includes exploring alternative ways of funding the work that needs to be done, alongside prioritising capital investment (both in new assets and replacement of assets) and being prudent with day-to-day operational expenditure.

To address in part the issue of affordability, three options have been developed:

- **Option 1 - Medium [the most likely option]** – approximately the total current budget in the amended Long Term Plan. Under this option, the focus would be on improving roads, facilities and parks, and water supply, wastewater and stormwater assets would deteriorate. Legal requirements would be met, infrastructure projects to support growth would be provided and commitments would be kept (e.g. cost share agreements and most commitments made by Council through the previous Annual Plan and Long Term Plan). This is the most likely option.
- **Option 2 - Low** – a reduced budget option compared to Option 1 Medium, with reduced renewals and some projects deferred. Infrastructure condition would deteriorate under this option.
- **Option 3 - High** – an increased budget compared to Option 1 Medium, with additional projects to restore infrastructure to its pre-earthquake condition, provide for medium and long term growth areas, and to reduce operational costs.

These are described in more detail in Section 5, including the costs, benefits, consequences and key projects and programmes.

4.0 SPECIFIC SIGNIFICANT ISSUES AND OPTIONS

This section describes the issues that are of high significance for each type of infrastructure, in accordance with the Council's Significance and Engagement Policy. It also describes the options for dealing with each of these issues, and the implications and costs of those options. There are no issues of high significance for Facilities, Parks or Information and Communication Technology.

4.1 Treating drinking water

Quality standards for drinking water are set by the Ministry of Health (MoH), through the Drinking-water Standards for New Zealand 2005 (revised 2008) (DWSNZ).

DWSNZ apply to the water supplied to customers and are monitored through testing of water supplies. The 2005 update of the DWSNZ added standards for protozoa in supplied water. Compliance with the protozoa criteria is currently not achieved in Christchurch's Northwest water supply and the Banks Peninsula water supplies, other than those in Lyttelton Harbour Basin and Wainui water supplies which are from secure groundwater.

Ministry of Health water supply risk grades provide a public statement of the extent to which a water supply achieves and can ensure a consistently safe and wholesome product. The Christchurch Northwest water supply currently does not meet the risk grade that the Ministry of Health recommends for the population served and all Banks Peninsula water supply schemes (other than the Lyttelton Harbour Basin and Wainui water supplies) are currently ungraded.

Drilling of deeper wells is currently in progress in the Northwest water supply zone and is expected to satisfy both the DWSNZ and Ministry of Health requirements by changing the water source from unsecure to secure groundwater. To reduce the risk to people in the Northwest zone in the meantime, the Council has stopped using all unsecure bores in the Northwest water supply zone and will only use these in an emergency (e.g. to supply water for firefighting) and would chlorinate the water from these bores if this occurred.

The Christchurch Central, Brooklands/Kainga, Lyttelton Harbour Basin and Wainui water supplies are currently fed from secure groundwater supplies.

Recent changes to legislation mean that the Christchurch District Health Board could direct the Council to fluoridate its water supply. *Costing of the Fluoridation of Christchurch Water Supply* (City Care, 2017) estimated that the capital cost of fluoridating the city's water supply was $20 million plus operating costs of nearly $1 million per year. Budget for fluoridating the city's water supply is included in FY30 – FY32 for the high option.

The 2016 Havelock North water supply contamination events have called into question the appropriateness of using untreated water from groundwater sources that are deemed to meet the DWSNZ criteria for secure groundwater. Stage 2 of the Havelock North drinking water inquiry is underway and will make recommendations about the way water supplies should be managed to reduce the risk of waterborne disease outbreaks. This may include a requirement to treat all drinking water supplies, or more stringent requirements to demonstrate that the groundwater is secure and does not require treatment.

The cost of providing full treatment (chlorinating and UV disinfection) for the city's water supply would be expected to cost around $100 million plus operating costs of around $5 million per year, based on experience in other places around New Zealand. Disinfection of the city's water supply with chlorine and/or UV is not included in any option for the capital programme as the Council is committed to providing untreated water supply to Christchurch. The focus instead is on maintaining and renewing and water supply assets including well heads to reduce the risk of contamination, along with much more frequent monitoring of water quality than is required by the DWSNZ.

4.2 Treated wastewater discharges

The discharge consent for the Akaroa wastewater treatment plant expires in 2020. The options for disposing and reusing Akaroa's wastewater are currently being explored and possible areas for irrigating treated wastewater have been identified. Non-potable re-use is also being considered, but would need to be in tandem with another option so that the Council has certainty about being able to dispose of all of the treated wastewater. Deep well injection of the treated wastewater is another option. The Council will need to make a decision in 2018 on which disposal option to progress. The cost estimates for the options are still being developed.

The discharge consent for the Duvauchelle wastewater treatment plant expires 2023. Irrigation to land is being considered as an alternative to the current harbour discharge, with the Council-owned golf course being a possible site. The Council will need to make a decision in 2019 on which disposal option to progress, so that resource consents can be obtained and any construction undertaken before the consent expires in 2023.

The discharge consent for the Christchurch wastewater treatment plant expires in 2041. Options include continuing to use the sea outfall or discharge to land. The discharge to land option will require significant areas of reasonably flat land and therefore would be substantially more expensive. The Council will need to consider options for Christchurch's treated wastewater and make a decision in about 2033 about which option to pursue, to allow sufficient time for consenting and any land acquisition and construction before the discharge consent expires in 2041. If a decision to irrigate all of Christchurch's treated wastewater to land was made, this could cost over $1 billion, but this is not included in the capital programme for any option of the Infrastructure Strategy.

Wastewater from Lyttelton, Governors Bay and Diamond Harbour is planned to be piped to the Christchurch wastewater treatment plant. This will enable the three local wastewater treatment plants to be decommissioned, and will eliminate the discharge of treated wastewater to Lyttelton Harbour. This is being constructed and is included in all options for the Infrastructure Strategy.

Three options for treating wastewater discharges were developed to align with the Infrastructure Strategy's three overarching options (Option 1 - Medium [the most likely option], Option 2 – Low and Option 3 – High).

Issue – Treated wastewater discharges for Akaroa and Duvauchelle	
Main Options	**Consequences**
Medium option Continue with the current approach of discharge to harbour for Akaroa, change to discharge to land for Duvauchelle	• Continued negative effects on the Ngāi Tahu, the local rūnanga and others in the community • Lowest cost option as most of the infrastructure is already in place • May be difficult to obtain resource consents as discharge to water is not sustainable management under the Resource Management Act unless land-based options have been adequately investigated and reasonably discounted • Opportunities missed for the beneficial use of the resources in treated wastewater (water and nutrients) • Capital cost of $35 million for Akaroa wastewater scheme and $5 million for Duvauchelle wastewater scheme

Low option Same as for the medium option	
High option Change reuse and/or disposal of treated wastewater to land for Akaroa rather than discharge to the harbour	• The treated wastewater can be beneficially reused • Would need to install another pipe network if non-potable reuse was chosen • Non-potable reuse would reduce the volume of drinking water the Council needed to supply and the volume of wastewater needing to be discharged • Contributes to strategic priority of safe and sustainable water supply and improved waterways • May be opposed by neighbouring communities • Capital cost of $13 million for the land based reuse and/or disposal of Akaroa's wastewater
Time period	2018 – 2041
When decision is required	Akaroa – 2018 Duvauchelle – 2020

4.3 Wastewater overflows

Wastewater overflows occur when flows increase due to high levels of inflow and infiltration during storm events. Climate change predictions include an increase in the frequency of high intensity rain events and are therefore expected to increase overflows unless network upgrades are completed.

Urban development leads to increased flows in the wastewater network. There are already capacity issues with some parts of the network, with overflows of untreated wastewater to the environment during storm events. Unless urban development is well managed in tandem with upgrades to the wastewater network, overflows will increase.

Detailed wastewater network modelling has been carried out to establish the frequency and volume of overflows from the wastewater network, and this has found that the Council is compliant with its wet weather overflow consent for discharges to waterways. However, modelling shows that there are also 261 manholes that overflow during a 3 year average recurrence interval storm, with a total overflow volume of 1.6 million m^3.

All areas upstream of manholes which overflow in the 3 year average recurrence interval storm are wastewater constraint areas (see Figure 4.1), and development projects in these areas are required to provide on-site storage with a pump the Council can remotely monitor and control, until the wastewater capacity constraints have been removed through network upgrades. These pumps are prevented from pumping during a storm when the network is at capacity, thus accommodating growth without exacerbating overflows. However, this makes development more difficult and costly.

The options for resolving wastewater overflows are to increase network capacity, provide storage and reduce inflow and infiltration. A city-wide wastewater optimisation project has been undertaken to determine the most cost effective suite of capital projects to reduce overflows so that compliance with the Council's wet weather overflow consent is maintained. The optimisation project has also identified the projects that would need to be undertaken to prevent wastewater overflowing from manholes during 6 month, 1 year and 3 year average recurrence interval storms.

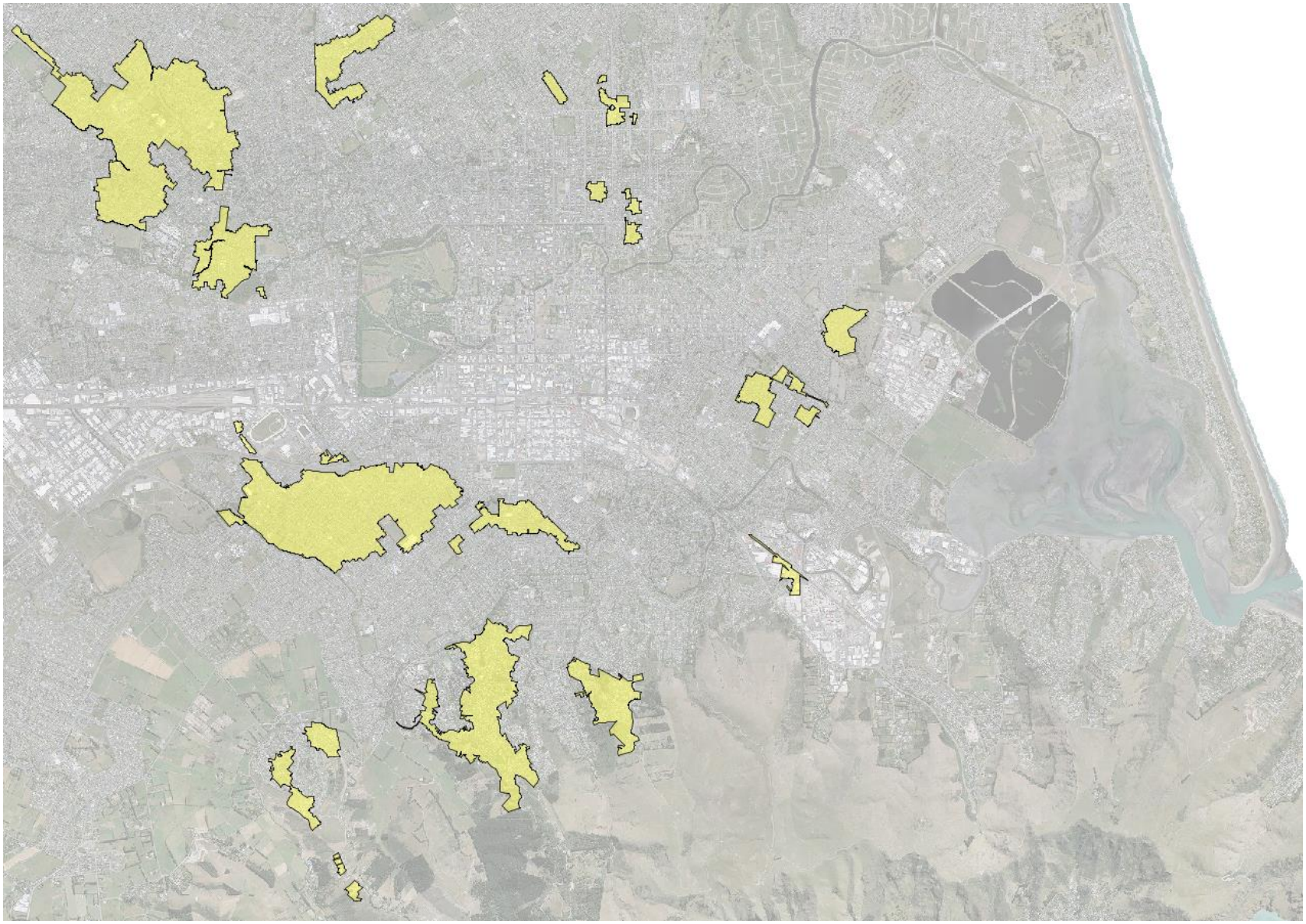


Figure 4.1: Wastewater capacity constraint areas

Three options were developed for wastewater overflows to align with the Infrastructure Strategy's three overarching options (Option 1 - Medium [the most likely option], Option 2 – Low and Option 3 – High).

Issue – Wastewater overflows	
Main options	**Consequences**
Medium option Complete wastewater network upgrade projects to comply with wet weather wastewater overflow consent for discharge to waterways Undertake improvements to the wastewater network to reduce overflows from manholes in FY29 – FY37	• Compliance with wet weather wastewater overflow consent for discharge to waterways achieved • Some reduction in wastewater overflows from manholes in the long term • Capital cost of $10 million over first 4 years, $37 million over 30 years
Low option Only complete wastewater network upgrade projects to comply with wet weather wastewater overflow consent for discharge to waterways	• Compliance with wet weather wastewater overflow consent for discharge to waterways achieved • No reduction in wastewater overflows from manholes • Wastewater capacity constraint areas continue to limit intensification • Capital cost of $10 million over first 4 years
High option Undertake improvements to reduce wastewater overflows from manholes so that they only occur in storms greater than a 3 year return period	• Wastewater overflows reduced so that no manholes overflow in a 3 year average return period storm • Reduced public health risk and cultural effects from wastewater overflows • Removes all wastewater capacity constraint areas which are currently limiting intensification • Capital cost of $84 million over 10 years, $246 million over 30 years
Time period	2018 - 2048
When decision is required	2018 Long Term Plan

Increased environmental and cultural awareness is resulting in the public being less tolerant of wastewater overflows to water bodies and public pressure for the goal of eliminating overflows may eventuate. If the Council wished to eliminate wastewater overflows altogether, this would require converting the whole city to a pressure sewer system. While this would address the cultural offence caused by wastewater overflows, this would have little effect on water quality as modelling has shown that wastewater overflows contribute 0.01% of contaminants to the rivers when an overflow is occurring, with the remainder coming from stormwater. The capital cost would be in the order of $3 billion and this is not included in the capital programme for any option.

4.4 Increased flooding as a result of earthquake impacts

The earthquakes caused land movement – subsidence and uplift – that has made some areas more prone to flooding. In addition, the capacity of river systems has been reduced through a combination of uplift in river bed levels, lateral spreading of river banks, siltation and subsidence of surrounding land. Likewise, the estuary has changed with two thirds being raised in the quakes, and one third lowered. The impact of these changes has increased flood risk in many areas and this is acutely felt with every major storm event that the city experiences. Unfortunately, these major storm events, combined with rising sea levels, will mean many low lying coastal and river areas have an increased vulnerability to flooding and inundation.

The earthquakes damaged the stormwater network in a number of different ways. Waterway structures, such as bridges, retaining structures, concrete channel lining, timber waterway lining and outfall structures have also suffered direct damage. Some of this damage has been addressed by the SCIRT work programme. There was also land damage and changing stream bed slopes have increased flood risk to properties and houses.

Increases in flood risk has resulted in social, health and safety, and economic effects on communities. If flood risk at the higher post-earthquake levels is not addressed then this will result in damage to houses, business and infrastructure, increased clean-up costs and psychosocial impacts on people directly affected. It will also have several indirect impacts, including reduced economic activity, inefficiency in transport network, increased insurance costs, stress on the public health system, delays in access for emergency response vehicles and social degradation from repeated flooding.

Three options were developed for flooding to align with the Infrastructure Strategy's three overarching options (Option 1 - Medium [the most likely option], Option 2 – Low and Option 3 – High).

Issue – Increased flooding as a result of earthquake impacts	
Main options	**Consequences**
Medium option Continue programme as previously approved within prior Long Term Plan, to work towards achieving pre-quake levels of flood risk through the Land Drainage Recovery Programme and proceed work preferentially in the Heathcote River catchment in advance of the Avon River catchment	• Reduced flood risk for houses at high risk of flooding across the city (e.g. Opawa, St Albans, Woolston, Shirley) • Economic benefits of works, in terms of reduced flooding impacts • Reduced health and safety risk and psychosocial impacts on residents and businesses • Reduced risk to infrastructure and emergency services access • Contributes to the strategic priority of an informed and proactive approach to natural hazard risks • Delivery of the Heathcote floodplain management projects (starting with the flood intervention policy i.e. purchase of houses at high risk of flooding) in advance of the Avon floodplain management projects but with ongoing investigations and design for the Avon • Additional investment required beyond 30 years to return flood risk to pre-earthquake levels • Capital cost $262 million over 10 years, $1,255 million over 30 years
Low option Priority given to addressing flood risk in the Heathcote catchment for the first 20 years, with the Avon River and Wairarapa Stream flood mitigation projects delayed by 10 years	• High flood risk remains for houses in the Avon River catchment (e.g. St Albans, Shirley) and Wairarapa Stream catchment • Flood risk gradually reduces for houses in the Heathcote River catchment • Limited economic benefits of works, in terms of reduced flooding impacts • Health and safety risk and psychosocial impacts on residents and businesses remains high in a major flood event • Continued risk to infrastructure and emergency services access • Limited progress on the strategic priority of informed and proactive approaches to natural hazard risks • Potential residents' dissatisfaction with unequal distribution of flood mitigation across city • Possible loss of synergy with the Regenerate Christchurch plans for the Ōtākaro Avon River corridor due to delay of Avon catchment projects • Engineering projects delayed to provide funding for application of the flood intervention policy in the Heathcote River • Capital cost $153 million over 10 years, $545 million over 30 years
High option Undertake programme over a much shorter period so that pre-earthquake flood risk is restored within 30 years	• Reduced flood risk for a wider areas of the city (suburbs adjoining the Avon and Heathcote Rivers and the Estuary) • Increased economic, psychosocial, infrastructure and emergency services access benefits of the works in terms of reduced flooding impacts • Restore pre-earthquake flood risk over 30 years • Capital cost $451 million over 10 years, $1,658 million over 30 years
Time period	2018 – 48

When decision is required	2018 Long Term Plan

4.5 Transport significant issues and options

The Council's vision for transport is to keep Christchurch moving forward by providing transport choices to connect people and places (Christchurch Transport Strategic Plan, 2012-2041). The goals for the transport system are to:

- Improve convenience and connectivity of walking, cycling and public transport to increase their use (in preference to single occupancy vehicles)
- Improve journey time reliability on key corridors
- Reduce transport fatalities and serious injuries.

These goals primarily help to deliver the community outcome of *a* well-connected and accessible city and the strategic priority of increasing active, public and shared transport opportunities and use.

The partner agencies responsible for transport in Christchurch have been working together in recent years, to review the transport issues and opportunities to provide transport solutions for people and businesses in Greater Christchurch. From a wide range of issues an integrated approach has been taken to develop preferred options. This has been done through a series of capital investment business cases, prepared both city-wide, for the central city and for some leading transport modes. Each one has involved comprehensive stakeholder engagement workshops. These have led to an agreement on a recommended transport programme of activities for the Council and in partnership with New Zealand Transport Agency, Selwyn District Council, Waimakariri District Council, Environment Canterbury and KiwiRail.

The key transport issues facing Christchurch over the next 30 years as agreed by the transport agencies are:

- **Connectivity and accessibility**: the convenience of private cars and lack of continuity of bus and cycle networks means it is difficult to get more people to walk, cycle or use the bus.
- **Reliability**: People in Christchurch remain dependent on their cars, with the last census finding that 83% of journeys to work were taken by private vehicle. The reliance on the private car is constraining the ability of the transport system to move people and goods efficiently and is resulting in congestion, low corridor productivity and poor journey time reliability for all modes. This results in a poor user experience and economic loss.
- **Safety**: Despite reductions over recent years in the number of people killed and seriously injured on Christchurch roads, further work is needed to target areas of high risk, particularly intersections, vulnerable users (cyclists and pedestrians), education and driver distraction.
- **Road asset condition**: SCIRT has completed their repair programme to address the significant earthquake damage to the transport system. However, not all earthquake damage was repaired and there remains issues with maintaining the condition of the network and corresponding levels of service. There are an increased number of roads requiring maintenance, renewal and replacement. If this is not planned for, asset condition related levels of service will continue to be below the New Zealand average and safety compromised. This issue is covered in more detail in Section 3.1.
- Emerging is the issue of transport to provide:
    - Mobility as a service
    - Shared fleet
    - Autonomous and semi-autonomous vehicles
    - Connected vehicles and the technology infrastructure needed to support this transition

The root cause of these issues, as agreed by stakeholders, evidenced in the city-wide business case and reflected in the other investment business cases, are related to a combination of post-earthquake damage, future economic, population and employment growth, and the way people currently choose to travel (predominantly by private car). To address the issues a number of different options have been considered.

Connectivity and accessibility

Three options were developed for connectivity and accessibility to align with the Infrastructure Strategy's three overarching options (Option 1 - Medium [the most likely option], Option 2 – Low and Option 3 – High).

Issue – Connectivity and accessibility	
Main options	**Consequences**

Medium option
Continue elements of current programme:
• Major cycleways will be completed
• Christchurch Northern Arterial will be completed
• Complete planned network improvements to the cycle and public transport network
• Complete commitments to connect growth areas (e.g. Roads of National Significance and downstream effects)
In addition:
• Improve road network connectivity and connection to new housing and business areas
• Complete phase 2 of An Accessible City - streetscape, parking and public realm improvements for the central city.
	• Use of the road network continues to grow and reliance on private vehicles continues
	• New subdivisions and growth areas are not well connected by walking, cycling and public transport, and are reliant on private vehicle use
	• Travel demand continues to grow over the long term, resulting in the need for intersection and corridor upgrades in the long term
	• Community outcome of a well-connected and accessible city partially achieved
	• Strategic priority of increasing active, public and shared transport opportunities and use partially achieved
	• Capital costs over 10 years:
	  ○ $206 million for major cycleways
	  ○ $29 million for Christchurch Northern Arterial
	  ○ $5 million for local cycleways
	  ○ $62 million for public transport infrastructure
	  ○ $44 million for An Accessible City
	  ○ $17 million for projects for Roads of National Significance and downstream effects.

Issue – Connectivity and accessibility	
Main options	**Consequences**

Low option
Continue elements of current programme:
• In construction cycleways will be completed.
• Christchurch Northern Arterial will be completed.
• Complete limited network improvements to the cycle and public transport network
• Complete commitments to connect growth areas (e.g. Roads of National Significance and downstream effects)
	• The improvement in connectivity and accessibility would be limited
	• Use of the road network continues to grow and reliance on private vehicles continues
	• The use of public and active transport would not be as great as for the medium option
	• New subdivisions and growth areas are not well connected by walking, cycling and public transport, and are reliant on private vehicle use
	• Travel demand would continue to grow over the long term, resulting in the need for intersection and corridor upgrades in the long term
	• Community outcome of a well-connected and accessible city not achieved
	• Strategic priority of increasing active, public and shared transport opportunities and use not achieved
	• Capital costs over 10 years:
	  ○ $93 million for major cycleways
	  ○ $29 million for Christchurch Northern Arterial
	  ○ $44 million for public transport infrastructure
	  ○ $2 million for An Accessible City
	  ○ $16 million for projects to connect with Roads of National Significance and downstream effects.

Issue – Connectivity and accessibility	
Main options	**Consequences**

High option
 	
In addition to the medium option, undertake projects that support the agreed transport programme:
 	
• Complete major cycleways in 5 years instead of 10 years
• Complete streetscape, parking and public realm improvements for the central city (An Accessible City)
• Expand the cycle network and provide local connections
• Network and intersection changes to prioritise public transport and support future rapid public transport options
• Network improvements to prioritise walking and to enhance the public realm, with a focus in the Central City and suburban centres
• Growth improvements to connect growth areas and subdivisions by all modes
• Support network changes with education programmes to manage demand
• Invest in technology to support new ways of travelling over the next 30 years (such as electric vehicles, autonomous vehicles, demand responsive shared transport)
	• Improved network connectivity and convenience for all modes makes it easier to walk, cycle and take public transport
	• Reduced reliance on private vehicles coupled with behaviour change helps to manage pressure on the network
	• In the long term, reduced reliance on private vehicles, investment in technology will embrace new ways to travel and reduce the need for further infrastructure expansion (supply) upgrades
	• Makes a positive contribution to regional and national outcomes, including economic growth, regeneration and productivity. These include benefits to:
	  ○ Public transport patronage growth
	  ○ Increased uptake of active travel modes
	  ○ Environment and air quality
	  ○ Health
	  ○ Asset lifecycles
	  ○ Wider economic benefits.
	• Community outcome of a well-connected and accessible city not achieved
	• Strategic priority of increasing active, public and shared transport opportunities and use not achieved
	• Capital costs over 10 years:
	  ○ $189 million for major cycleways
	  ○ $29 million for Christchurch Northern Arterial
	  ○ $85 million for public transport infrastructure
	  ○ $118 million for An Accessible City
	  ○ $18 million for projects to connect with Roads of National Significance and downstream effects.

Time period	2018 - 2028
When decision is required	2018 Long Term Plan

4.5.1 Reliability

Three options were developed for reliability to align with the Infrastructure Strategy's three overarching options (Option 1 - Medium [the most likely option], Option 2 – Low and Option 3 – High).

Issue – Reliability	
Main options	**Consequences**
Medium option Continue current programme: • Traffic management changes to improve congestion at hotspots • Intersection improvements at very high priority hot spots only to improve traffic journey times • Complete local improvements to support Roads of National Significance and downstream effects	• Traffic management helps to manage demand on the network and relieve hotspots • Over the long term there is continued reliance on intersection and corridor upgrades to accommodate population and traffic growth • Capital cost $152 million over 10 years, $476 million over 30 years
Low option Defer projects from current programme: • Annex/Birmingham/Wrights intersection • Cashmere/Hoon Hay/Worsleys intersection • Main South to South-West Hornby link	• This will have an impact on the network efficiency at those locations. These sites have been identified as deficient, and will continue to operate in a sub-optimal fashion. • Capital cost $104 million over 10 years, $141 million over 30 years

High option
 	
In addition to the medium option, undertake projects that support the agreed transport programme:
 	
• Traffic management changes to improve journey time reliability for all modes
• Targeted corridor improvements to improve journey times for all modes
• Travel demand management programme to reduce reliance on single occupancy vehicles and to support network management
• Invest in smart infrastructure and technology (such as intelligent transport systems) to improve the management of the transport system
	• Traffic management helps to manage demand and improve journey times on the network to support all modes of transport
	• Investment in education, behaviour change and technology helps to reduce demand on the network and supports new ways of travelling
	• In the long term, the need for further intersection and corridor upgrades to accommodate population and traffic growth reduces
	• Makes a positive contribution to regional and national outcomes, including economic growth, regeneration and productivity. These include benefits to:
	  ○ Public transport patronage growth
	  ○ Increased uptake of active travel modes
	  ○ Environment and air quality
	  ○ Health
	  ○ Asset lifecycles
	  ○ Wider economic benefits
	• Capital cost $294 million over 10 years, $509 million over 30 years

Time period	2018 - 2028
When decision is required	2018 Long Term Plan

4.5.2 Road safety

Three options were developed for road safety to align with the Infrastructure Strategy's three overarching options (Option 1 - Medium [the most likely option], Option 2 – Low and Option 3 – High).

Issue – Road safety	
Main options	**Consequences**
Medium option Continue current programme: • Basic education programme • Targeted safety improvements at black spot intersections • Minor safety improvements	• Road safety improved at specific sites • Capital cost $26 million over 10 years, $169 million over 30 years
Low option Only complete the following road safety projects: • Road lighting safety • Intersection safety Aldwins/Buckleys/Linwood • Intersection safety Ilam/Middleton/Riccarton	• Reduced road safety • Capital cost $4 million over 10 years, $11 million over 30 years
High option In addition to the medium option, undertake projects that support the agreed transport programme: • Increased education focus combined with specific road corridor improvements • Targeted safety programmes (education and infrastructure), based on the high-risk areas of death and serious injury within Christchurch, as prioritised by the cross agency Road Safety Action Plan (part of the national Safer Journeys framework) • Investment in technology to support safety	• Improved safety for all road users • Improved road user behaviour from education programmes and improved road safety with decrease in the number of deaths and serious injuries • Health benefits (reduced cost to health system) • Operating cost of $20 million for education • Capital cost $92 million over 10 years, $157 million over 30 years
Time period	2018 - 2028
When decision is required	2018 Long Term Plan

The Citywide Transport Programme Business Case (2017) and the draft Transport Asset Management Plan (2017) describe a comprehensive 30 year programme for transport to address these significant issues, with a strong focus on improving convenience and connectivity. It aims to address the problems associated with the way people currently choose to travel (predominantly by private, often single occupancy vehicles), by improving the convenience and connectivity of walking, cycling and public transport. The programme also requires Council to address the key safety and journey time reliability problems. Convenience and connectivity means it will be easier for people to get to, and move around the city whether by public transport, motor vehicle, cycle or on foot. Journeys will be more enjoyable and there will be improved travel time reliability and a safer network. The recommended programme sets the direction and intent of future transport projects and requires a strong commitment to enabling and influencing travel behaviour.

Overall the transport programme aims to optimise and manage travel demand on the existing transport network, with limited infrastructure supply upgrades and improvements supported by behaviour change initiatives. This may be done through:

- Traffic management changes, such as improved network management, signal optimisation, improved street design, localised intersection capacity, parking removal, speed management, high occupancy or managed vehicle lanes
- Travel demand management, such as education, encouragement and promotion of travel choices, use of emerging technologies, prioritisation of modes, traffic management
- Public transport improvements, such as more high frequency services, signal priority, bus priority and higher amenity passenger facilities, adoption of increasing demand responsive community services

- Lower road safety risk, through education and enforcement for high crash risk areas, speed limit changes, and casualty reduction infrastructure improvements addressing high risk locations and crash causes
- Cycle network facilities, such as signal priority, low speed zones, local cycle routes and major cycle routes
- Pedestrian convenience and connectivity, including pedestrian priority, pedestrian crossings, footpath improvements, speed management in centres, improved universal access facilities to support an ageing population
- Short term, targeted supply improvements.

5.0 FINANCIAL OPTIONS

There are three broad financial options the Council could choose for its management and delivery of infrastructure: Option 1- Medium (the most likely option), Option 2 – Low and Option 3 – High.

Each option has its own implications in terms of capital cost, operational cost and levels of service. The options reflect the Council's strategic priorities and community outcomes to varying degrees. The options differ in how effectively they address the overarching significant issues of asset renewals, climate change, post-earthquake recovery and regeneration, and affordability.

A capital prioritisation framework was developed to prioritise the capital programme across all types of infrastructure and this was used as a starting point to determine what projects are included in Option 1 - Medium, Option 2 - Low and Option 3 - High (see Appendix 3 for a copy). Subsequent changes were made to Option 1 - Medium to include other projects that are a priority for Council and to reduce the planned spend on other projects that are a lower priority so that the total planned spend is similar to the current amended Long Term Plan budget.

This section highlights the options and trade-offs the Council is likely to consider in its decision-making and the implications these could have on the future of Christchurch. Option 1 - Medium is presented first, as this is the most likely option.

5.1 Option 1 – Medium

The planned spend for the medium option approximately matches the total current budget in the amended Long Term Plan. Under this option, the focus would be on improving roads, facilities and parks, maintaining water supply and stormwater assets, but wastewater assets would deteriorate. Legal requirements would be met, infrastructure projects to support growth would be provided and commitments would be kept (e.g. cost share agreements and most commitments made by Council through the previous Annual Plan and Long Term Plan). Rates would increase by 4.5% per year on average over the next 10 years. This is the most likely option.

Included in this option are:

- **In construction** – projects that are already being built
- **Holding renewals 1** – infrastructure renewals that hold the asset network at its current overall condition, other than wastewater assets which would deteriorate. Customer/community renewals that are essential because there would be a significant increase in operational or capital cost later if not renewed, to maintain current level of service, or because there is a demonstrated critical need in that locality to ensure equitable provision and spatial distribution. Assets that have reached the end of their life and require replacement as no alternative asset can be used.
- **Legal –** a project that Council is required to undertake to meet legal obligations (e.g. to meet resource consent conditions, drinking water standards, landfill after care, signs for the road network, ICT upgrades to meet legal obligations).
- **Committed** – cost share payments (e.g. multi use arena), signed infrastructure provision agreements. Committed and signed agreements/contracts where the cost to break the contract is disproportionate to the benefit. Projects which the Council has already made a political commitment to undertake (e.g. through the previous Long Term Plan or Annual Plan).
- **Growth – critical –** projects that are needed for new developments and subdivisions that are either proceeding or have a high probability of proceeding in 1 to 3 years.
- **Internal – holding renewals –** internal service capital renewal projects that hold the asset/service at its current overall planned condition.

Also included in this option are some projects that fall into the following prioritisation categories:

- **Holding renewals 2** – Customer/community renewals that are not essential i.e. deemed end of life and not recommending renewal, or there is no critical need in that locality. The only project in this category for the medium option is cemetery headstone earthquake repairs.
- **Level of service recovery –** projects that bring the delivered level of service up to the current agreed level of service (backlog) and/or restore damage or loss of capacity created by the earthquakes. Projects in this category for the medium option include the land drainage recovery programme, Heathcote stormwater management plan, wastewater overflow reduction programme carriageway smoothing, road safety improvements, An Accessible City, community and regional parks development programmes, Botanic Gardens master plan and earthquake repairs to the South Library.
- **Growth – desirable –** projects that are needed for developments and subdivisions where probability/timing of increased demand is less certain. The project is primarily required to meet the agreed levels of service for the incoming community. Projects in this category for the medium option include the Avon stormwater management plan projects, Addington Brook and Riccarton Drain filtration devices, the Upper Riccarton wastewater interceptor, Avonhead Road wastewater main upgrade, and route and intersection improvements.
- **Economic benefits** – projects that primarily reflect opportunities to reduce total cost of ownership through capital contributions and or reduced operating costs. The only projects in this category for the medium option are converting street lights to LED (light emitting diodes), monitoring systems for the vacuum sewer systems, developing the Harewood nursery and replacing a diesel boiler with ground source heating for the Botanic Gardens.
- **Need/demand –** where there is a demonstrated critical need for a new customer/community asset in that locality to ensure equitable provision and spatial distribution. Projects in this category for the medium option include new equipment for solid waste, new art acquisitions for the art gallery, developing the environs around Lyttelton Marina and upgrading the toilets in Hagley Park.
- **Increase level of service –** Projects that result in an increase above the current agreed level of service provided. Projects in this category for the medium option include projects to implement the stormwater management plans for the Avon, Styx, South West and Heathcote, road safety improvements and some projects for An Accessible City.
- **New services** – where a project adds a new service to Council. The only project in this category for the medium option is smart cities innovation.

5.1.1 Key projects and programmes

The key projects and programmes that would be delivered for the medium option are shown in Table 5.1 and the capital spend over the next 30 years is summarised in Figure 5.1, with the columns showing the planned spend and the line showing the current budget (set in the 2015 Long Term Plan and amended by the two subsequent annual plans). The planned spend is greater than the current budget in FY22-FY25 due to increased asset renewals. Figure 5.2 shows the planned spend split by capital prioritisation category.

Figure 5.3 shows the planned operations and maintenance costs alongside the capital costs for each year for the medium option. Operations and maintenance costs include operations, maintenance and direct staff costs. Not included are indirect staff costs (i.e. overheads), debt servicing, depreciation or consultants fees.

Table 5.1: Option 1 - Medium - key projects and programmes

Water supply $495M	Water supply mains renewals $283M	Water supply submains renewals $36M	Water supply headworks well renewals $35M
Wastewater $641M	Wastewater pipe renewals $308M	Lyttelton Harbour wastewater scheme $42M	Akaroa wastewater scheme $35M
Stormwater $678M	Land drainage recovery programme (LDRP) 521 Avon floodplain management $98M	Waterway lining renewals $89M	Styx stormwater management plan $55M
	Stormwater pipe renewals $49M	LDRP 517 Flood Intervention $49M	South west stormwater management plan $24M
	LDRP 528 Eastman Wetlands $21M	LDRP 539 Heathcote low stopbanks $21M	Avon stormwater management plan $19M
Transport $1,049M	Major cycleway routes $206M	Carriageway sealing and surfacing $115M	Kerb and channel renewals $63M
	Footpath renewals $59M	An Accessible City $44M	Road lighting renewals $35M
	Carriageway smoothing $32M	Sumner Road geotechnical risk mitigation $30M	Road pavement renewals $31M
	Northern Arterial extension including Cranford Street upgrade $29M	Central city transport interchange $23M	Pages Road bridge replacement $20M
Facilities $837M	Multi purpose arena $254M	Metro Sports Facility $123M	Social housing renewals and replacements $63 million
	Library resources programme $53M	Recreation and sport buildings and plant renewals $35M	Hornby library, customer services and south west leisure centre $32M
	Recreation and sport mechanical and electrical renewals $25M	Nga Puna Wai sports hub – Stage 1 $24M	Performing arts precinct $22M

Parks and Heritage $267M	Community parks buildings and assets renewals $39M	Community park development programme $26M	Former Municipal Chambers $18M
Information and communication technology $192M	Technology systems renewals and replacements $81M	Business technology solutions $69M	Continuous improvement technology programme $38M
Solid waste $28M	Solid waste new equipment $10M	Solid waste renewals $7M	Waste transfer stations renewals $5M

Capital prioritisation category key				
Renewals	Contractually committed	Need/demand	Growth – critical	Increased level of service
In construction	Community committed	Level of service recovery	Growth – desirable	
Legal	Internal renewals	Economic benefits	New service	

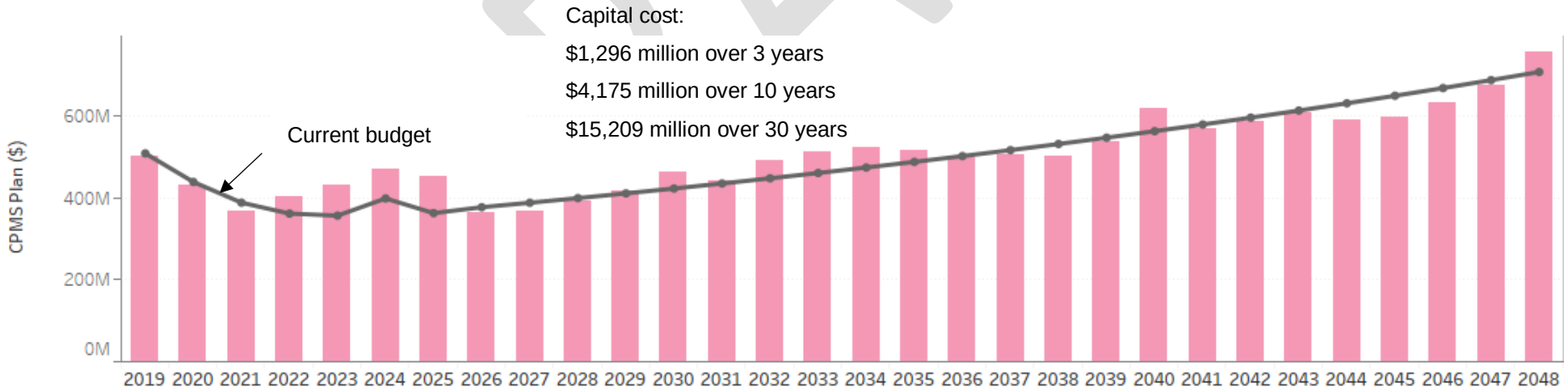


Figure 5.1: Option 1 – Medium – overall planned capital spend

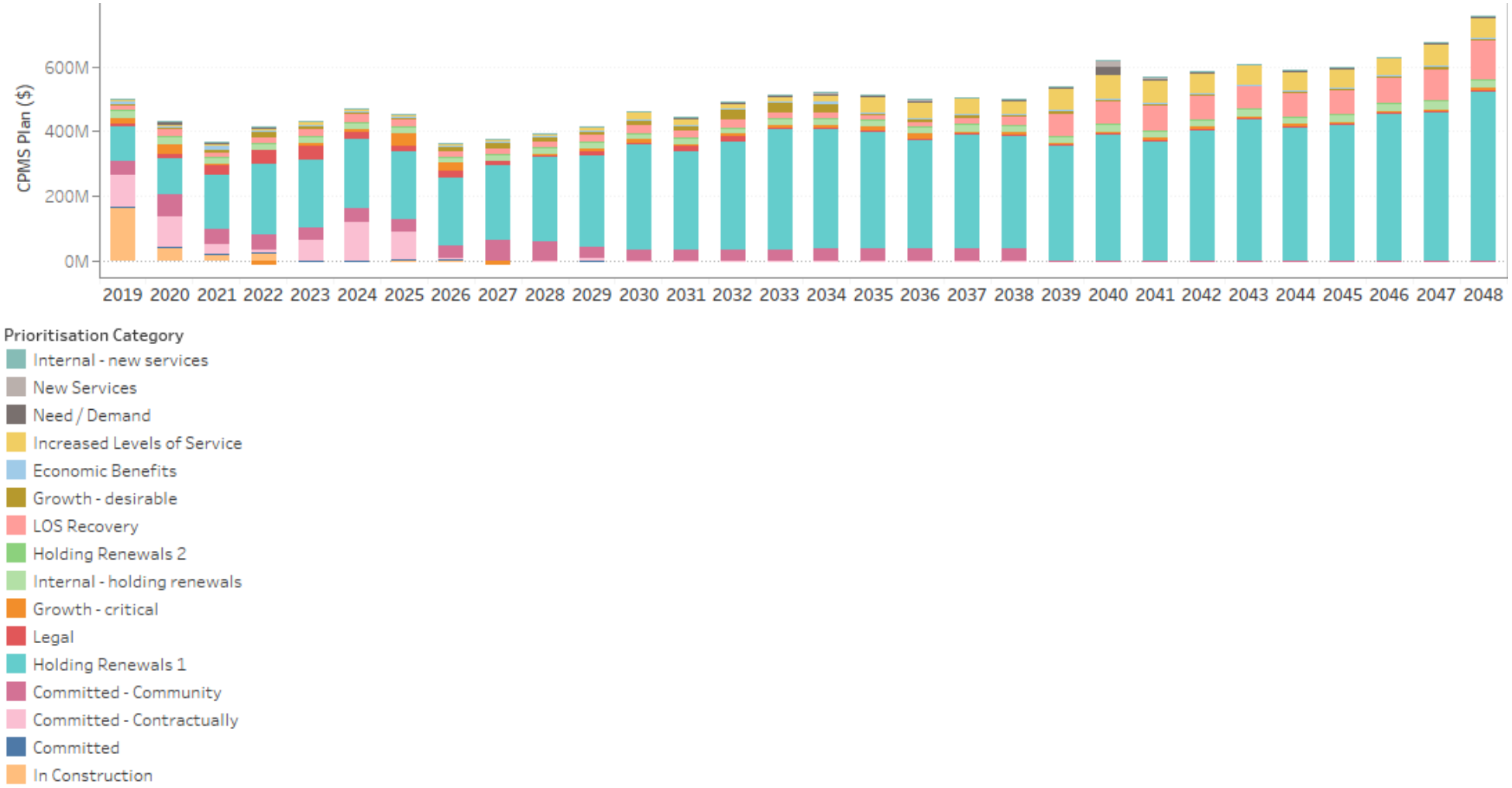


Figure 5.2: Option 1 – Medium – planned capital spend by capital prioritisation category

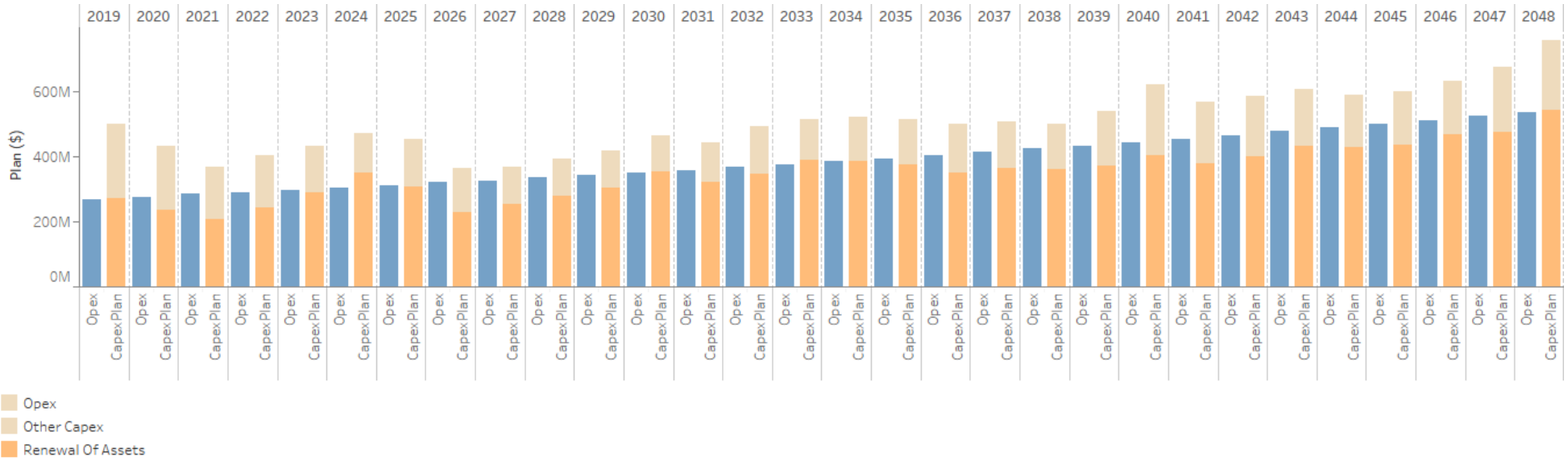


Figure 5.3: Option 1 – Medium – planned capital and operating and maintenance spend

5.1.2 Benefits

The capital programme generally fits within the current budget, although it would be exceeded in FY22 – FY25 mostly due to increases in the land drainage recovery programme, renewals of three waters, parks and ICT assets, and carriageway sealing and smoothing. The overall condition of roads, facilities and parks assets would improve, and asset condition for water supply and stormwater would be maintained. The medium option complies with current legislation, health and safety requirements and resource consents and provides horizontal infrastructure for growth areas. It keeps to the commitments that Council has made, both in terms of contractual commitments and political commitments.

There would be some reduction in flood risk across the city and it is likely that the global stormwater network discharge consent could be obtained. Major cycleway routes would be completed by FY28, resulting in increased use of active transport. There would be some improvement in road safety, as known black spots would be addressed. Road smoothness would return to a level similar to other New Zealand cities over 20 years. Suburban master plans would be implemented as planned.

Technology systems would be fit for purpose and meet expectations of residents and businesses around choice, ease and access of information and services while supporting imminent infrastructure growth of facilities and emerging disruptive technology in core infrastructure. The resilience of ICT would be improved and the risk from cyber security threats would be lower.

5.1.3 Consequences

However, the condition of the wastewater network would deteriorate due to insufficient renewals. This would result in increased dry weather and wet weather overflows, due to increased pipe blockages and failures and an increasingly leaky network allow groundwater and stormwater to enter the wastewater system. Pre-earthquake flood risk would not be restored after 30 years and investment in future years would be required. Unserviced areas would remain unserviced (e.g. Wainui wastewater).

5.1.4 Addressing the significant issues

The medium option addresses this strategy's significant issues as follows:

- **Asset renewals**: This option improves roads, parks and facilities assets, maintains water supply and stormwater assets in their current condition, but wastewater assets would deteriorate. Additional operational budget would be required.
- **Climate change**: This issue is not addressed unless there is an opportunity to build new assets to take into account climate change. However, this will not always be possible due to limited budgets.
- **Post-earthquake recovery and regeneration**: This option partially addresses post-earthquake regeneration with some contribution to regeneration of New Brighton and Cathedral Square and surrounds. However, this option does not include restoring horizontal infrastructure such as roads and pipes to their pre-earthquake condition, nor would flood risk return to pre-earthquake levels.
- **Affordability**: This option generally fits within the Council's current financial budget, although this would be exceeded in FY22 – FY25.

5.2 Option 2 – Low

This option is a reduced budget option compared to Option 1 - medium, with reduced renewals and some projects deferred. The total budget is within and generally lower than the current amended Long Term Plan budget, and would limit rates rises to an average of 3.7% per year over the next 10 years.

5.2.1 Key projects and programmes

The key projects and programmes that would have a reduced budget or be deferred for the low option, compared to the medium option, are shown in Table 5.2. The capital spend over the next 30 years is summarised in Figure 5.4, with the columns showing the planned spend and the line showing the current budget (set in the 2015 Long Term Plan and amended by the two subsequent annual plans). Figure 5.5 shows the planned spend split by capital prioritisation category and Figure 5.6 shows operating costs alongside capital costs.

The total capital spend for the low option over the 30 year period is similar for the medium option, due to deferred renewals, but is lower in the short term. Compared with the medium option, the main differences are (see section 3.1.8 for more detail):

- Water, wastewater and stormwater renewals significantly reduced in the first ten years, but increased by the same amount in the second ten years
- Kerb and channel, footpath and bridge renewals reduced in the first four years
- Sport and recreation, parks and information and communication renewals reduced in the first four years
- Library resources reduced in the first two years

Table 5.2: Option 2 - Low – reduced key projects and programmes, compared to the medium option (10 year budgets) (reductions shown in red)

Water supply $320M Reduced by $175M	Water supply mains renewals $150M Reduced by $133M	Water supply submain renewals $19M Reduced by $17M	Water supply new pump stations for growth $0 Reduced by $11M

Wastewater $621M Reduced by $19M	Riccarton wastewater interceptor – Upper Riccarton $0 Reduced by $8M	Avonhead Road wastewater main upgrade $0 Reduced by $5M	Belfast pump station 62 capacity upgrade $0 Reduced by $3M
Stormwater $420M Reduced by $258M	Waterway lining renewals $36M Reduced by $53M	Stormwater pipe renewals $34M Reduced by $15M	Land drainage recovery programme (LDRP) 521 Avon floodplain management $17M Reduced by $81M
	LDRP 517 flood intervention $15M Reduced by $34M	Avon stormwater management plan $0 Reduced by $19M	Heathcote stormwater management plan $0 Reduced by $14M
	Addington Brook and Riccarton Drain Filtration Devices $0 Reduced by $13M	Waterways and wetlands land purchases $0 Reduced by $7M	Open waterway systems – utility drain improvements $0 Reduced by $7M
Transport $709M Reduced by $327M	Major cycleway routes $93M Reduced by $113M	Kerb and channel renewals $56M Reduced by $7M	Suburban master plan projects $14M Reduced by $1M and delayed by up 1 – 5 years
	Asphalt surfacing $7M Reduced by $8M	An Accessible City $2M Reduced by $43M	Road lighting renewals $0 Reduced by $35M
	Carriageway smoothing $0 Reduced by $32M	Route improvement Northcote Road $0 Reduced by $13M	Lincoln Road passenger transport improvements $0 Reduced by $10M
	Coastal pathway $0 Reduced by $6M	Core passenger transport route and facilities: South-West (Wigram and Halswell) $0 Reduced by $5M	Local Cycleway: Northern Arterial Link Belfast to Waimakariri $0 Reduced by $5M

Facilities $850M Increased by $15M	South library and service centre earthquake repairs $0 Reduced by $10M	Art collection acquisitions $0M Reduced by $4M	Smart cities innovation $0 Reduced by $3M
Parks and Heritage $184M Reduced by $83M	Community parks development programme $0 Reduced by $26M	Regional parks development programme $0 Reduced by $15M	Lyttelton marina environs development $0 Reduced by $10M
Information and communication technology $173M Reduced by $19M	Technology systems renewals and replacements $78M Reduced by $3M	Business technology solutions $57M Reduced by $12M	Continuous improvement technology programme $34M Reduced by $4M
Solid waste $17M Reduced by $11M	Solid waste new equipment $0 Reduced by $10M		

Capital prioritisation category key				
Renewals	Contractually committed	Need/demand	Growth – critical	Increased level of service
In construction	Community committed	Level of service recovery	Growth – desirable	
Legal	Internal renewals	Economic benefits	New service	

Capital cost:

$1,087 million over 3 years

$3,040 million over 10 years

$7,960 million over 30 years

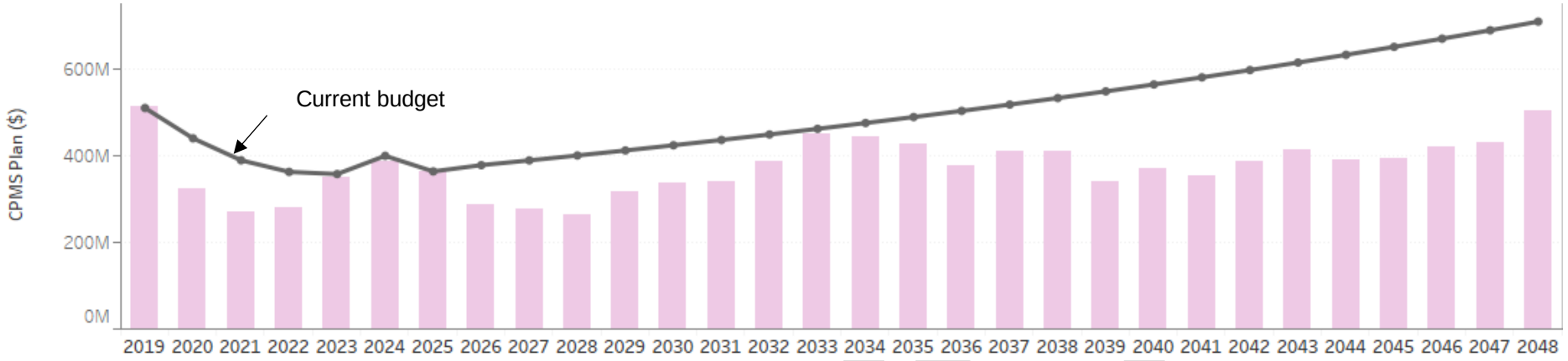


Figure 5.4: Option 2 – Low – planned capital spend

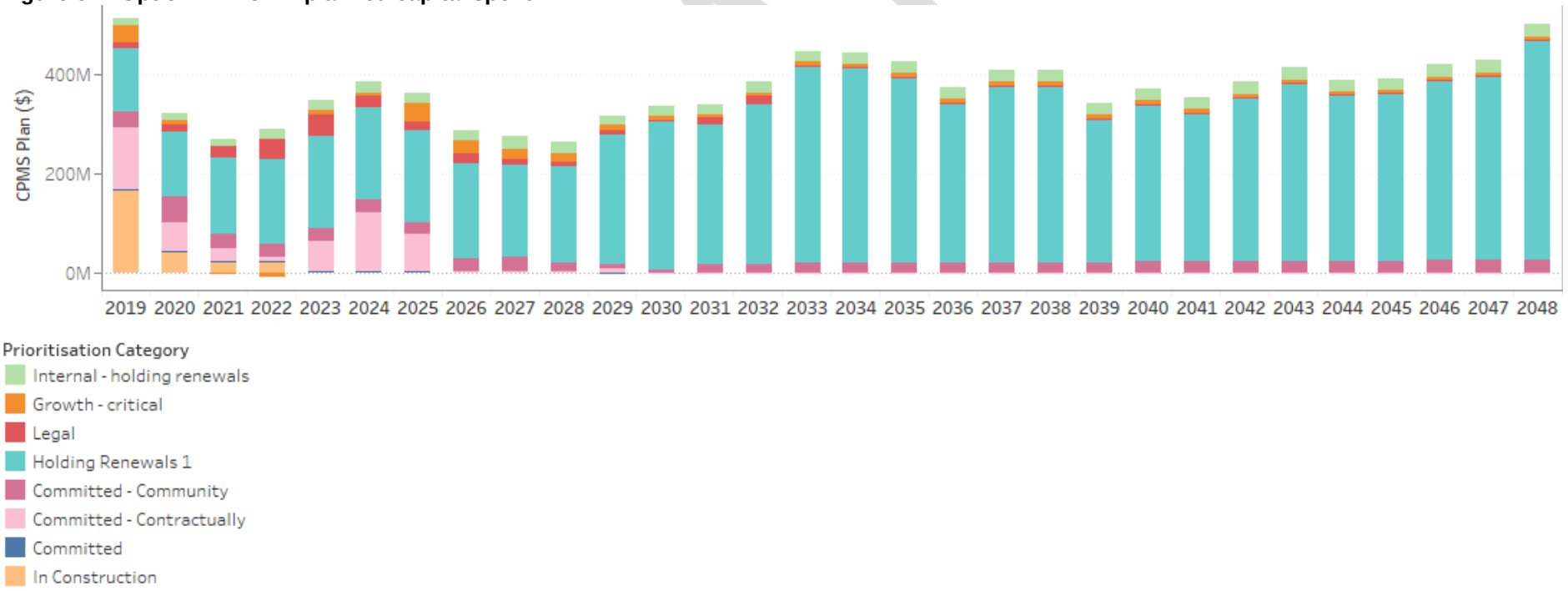


Figure 5.5: Option 2 - Low – planned capital spend by capital prioritisation category

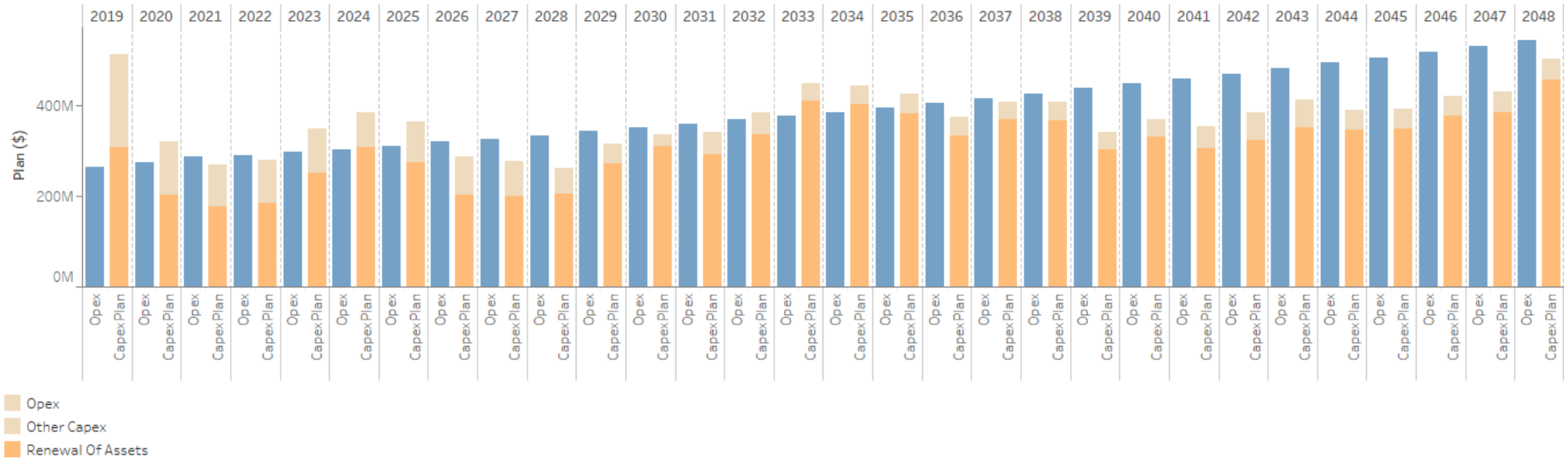


Figure 5.6: Option 2 – Low – planned capital and operating and maintenance spend

5.2.2 Benefits

Compared to the medium option, the benefit of the low option is that it has the lowest capital expenditure, resulting in lower rate increases initially.

5.2.3 Consequences

However, there are major consequences if the low option is adopted, and these are summarised below in comparison to the medium option. The consequences of the medium option also apply to the low option.

Short term consequences

If the low option was adopted for the first three years, the following consequences are expected.

The low and medium options are similar for the first three years for water supply and wastewater.

The land drainage recovery programme would be significantly reduced, so houses would be at an increased risk of flooding for longer. There would be delays in building new stormwater treatment and flood detention ponds. There would be no projects to improve waterway ecology, no utility drain improvements and no land purchased for waterways and wetlands.

If the low option was adopted, the budget for kerb and channel renewals would be approximately halved for FY20 – FY23, with the remaining budget directed to targeted kerb and channel repairs (patching). The asphalting of streets across the city would be approximately halved for FY19 – FY21 which would increase the time

it takes to restore the network to a reasonable condition. There would be no renewal of retaining walls, street lights, bus stops and shelters, painted cycleways, or carriageway smoothing. Street lights would not be replaced with LED lights and so there would be no reduction in electricity costs. An Accessible City would be discontinued, so there would be no further improvement in the way people move around the central city. There would be minimal improvement in road safety, as known black spots would not be addressed. It is predicted there would be five more serious injuries and deaths on our roads in the first year and ten more after three years, compared to the medium option.

Under the low option for facilities, the smart cities innovation programme would cease. There are no other significant differences between the three options for facilities in the first three years.

- For the low option, compared to the medium option, in the first three years there would be no development of:Naval Point development in Lyttelton
- Botanic Gardens master plan projects, including access and carparks, buildings, ground source heating, wifi, irrigation, garden furniture and playground developments
- Hagley Park assets, buildings and toilet developments
- South New Brighton Park and Bexley Park developments
- Ferrymead Park and Edmonds factory gardens developments
- Play and recreation spaces developments across the district, including in Little River and the Sumner to Ferrymead skate facility
- Purau foreshore and reserves development
- Harewood plant nursery development
- Extensions and improvements to sports fields
- Port Hills/Banks Peninsula and Coastal/Plains developments, including estuary green edge pathway project
- Community parks improvements, including new signs, furniture, structures, tracks, carparks, trees and gardens, irrigation assets and Groynes/Roto and Kohatu/Otukaikino developments
- Wigram village green parking

There would also be no earthquake repairs to the citizens' war memorial or cemetery headstones. The renewals of hard surfaces in parks (e.g. car parks, tracks) would be reduced by around 40%.

For the low option, the information and communication technology renewals budgets would be cut by 31-38% compared to the medium option from FY19 – FY22 to around $13 million per year. This would result in increased risks to Council services from cyber security threats and technology failure. The reliability of the Council's digital network, communications and business solutions would be at significant risk of failure thereby compromising a number of the Council's essential services. There would be a significant bow-wave of technology renewal investment from FY22 and an increased cost to ramp-up the capability to deliver. Some renewals have already been deferred leading to risk of hardware and software failures that impact levels of service of many Council activities. The low option does not address existing resilience risks. Capital delivery costs would be likely increase due to legacy solutions and dependencies. The Council would be unable to leverage innovative technologies to deliver more efficient and improved ways of working.

Longer term consequences

Horizontal infrastructure assets (water supply, wastewater, stormwater, flood protection and roads) and some facilities would deteriorate and would be at increased risk of failure, resulting in more frequent service interruptions. There would be an increased public health risk from water supply contamination, due to increases in burst water mains and reduced well replacements.

It would also result in higher renewals budgets in the second ten years, to compensate for the deferred renewals. There would be no further progress on earthquake recovery for horizontal infrastructure.

There would be an increased risk of flooding of houses and businesses due to increased failures of stormwater pipes, waterway blockages and burst water mains. This flooding could also impact on infrastructure owned by Council, including roads. Flood levels would not return to pre-earthquake levels and many houses would still be at an increased risk of flooding. Projects to address flooding from the Avon River and Wairarapa Stream would take longer to implement, resulting in unequitable flood protection.

Road roughness would get worse due to reductions in transport renewal budgets. Only projects already underway on An Accessible City would be completed and none of the remaining planned projects would be started, resulting in increased traffic congestion. The budget for major cycleway routes would be significantly reduced and so use of active transport would not increase as much as planned. Traffic congestion would increase and more road corridor improvements to increase capacity would be required in the long term. Suburban master plans would be delayed by up to five years.

The low option does not meet the legal requirements of the National Policy Statement for Urban Development Capacity to include plans for core infrastructure for medium term growth areas in the Long Term Plan and to include plans for core infrastructure for long term growth areas in the Infrastructure Strategy (see Section 6.2 for more information on the National Policy Statement).

It is expected that as a result of the above, minimal progress would be made on the Council's strategic priorities, particularly safe and sustainable water supply and improved waterways, and increasing active, public and shared transport opportunities and use. The community outcomes for modern and robust city infrastructure and community facilities, and healthy waterways, would not be achieved. It is expected that resident satisfaction with Council services would decline if the low option was adopted.

5.2.4 Addressing the significant issues

The Option 2 - Low addresses this strategy's significant issues as follows:

- **Asset renewals**: Infrastructure assets would deteriorate under this option due to insufficient renewals being undertaken in the short term, and this would require additional operational budget to for services to continue to function, and increased capital expenditure in the long term for renewals that had been deferred. There would be increased asset failures and lower levels of service than at present.
- **Climate change:** This issue is not addressed unless there is an opportunity to build new assets to take into account climate change. However, this is unlikely to be possible due to limited budgets.
- **Post-earthquake recovery and regeneration:** This option partially addresses post-earthquake regeneration with some contribution to regeneration of New Brighton and Cathedral Square and surrounds. However, this option does not include restoring horizontal infrastructure such as roads and pipes to their pre-earthquake condition, nor would flood levels return to pre-earthquake levels. Many flood improvement projects would be delayed and expenditure beyond 30 years would be required to restore flood risk to pre-earthquake levels.
- **Affordability:** This option is more affordable in the short term, but increased expenditure in the medium term would be required due to deferred renewals.

5.3 Option 3 - High

This option would be an increased budget compared to the Option 1, with additional projects to restore infrastructure to its pre-earthquake condition, provide for medium and long term growth areas, and to reduce operational costs. The budget would be higher than the current amended Long Term Plan budget, and would result in rate increases averaging 6.3% per year over the next ten years.

There are many projects and programmes included in the high option that are not included in the medium option and these fall into the following categories:

- **Holding renewals 2** – Customer/community renewals that are not essential i.e. deemed end of life and not recommending renewal, or there is no critical need in that locality.
- **Level of service recovery –** projects that bring the delivered level of service up to the current agreed level of service (backlog) and/or restore damage or loss of capacity created by the earthquakes.
- **Growth – desirable –** projects that are needed for developments and subdivisions where probability/timing of increased demand is less certain. The project is primarily required to meet the agreed levels of service for the incoming community.
- **Economic benefits** – projects that primarily reflect opportunities to reduce total cost of ownership through capital contributions and or reduced operating costs (e.g. streetlight conversions to LED).
- **Internal – increase level of service –** internal service projects that increase the current agreed levels of service.
- **Need/demand –** where there is a demonstrated critical need for a new customer/community asset in that locality to ensure equitable provision and spatial distribution.
- **Increase level of service –** Projects that result in an increase above the current agreed level of service provided (e.g. new libraries, bus priority lanes and water supply upgrades)
- **New services** – where a project adds a new service to Council
- **Special projects –** special one-off projects such as contributions to third-party capital programs or projects (e.g. museum, Court Theatre, heritage projects)
- **Internal – new services –** internal service projects that add a new service to Council.

5.3.1 Key projects and programmes

There are many additional projects and programmes that would be delivered if the high option was adopted, compared to the medium option, and the key ones are shown in Table 5.3. The capital spend over the next 30 years is summarised in Figure 5.7, with the columns showing the planned spend and the line showing the current budget. Figure 5.8 shows the planned spend split by capital prioritisation category.and Figure 5.9 shows operating costs alongside capital costs.

5.3.2 Benefits

Compared to the medium option, the benefits of the high option are summarised below.

Short term benefits

If the high option was adopted more water supply pipes would be renewed. It is predicted by FY21 we would have 71 fewer pipe breaks, saving $258,000 in pipe repair costs. Four wells would be renewed each year, rather than three, reducing our use of groundwater taken from shallow aquifers which are more at risk of contamination. Water supply pipes nearing the end of their life could be replaced at the same time as road reconstruction projects, avoiding the need to dig up new streets. The water supply re-zoning project would proceed which would create smaller water supply zones with lower pressure in some areas, reducing pipe breaks, pumping costs and enabling water supply services to be restored more quickly after a disaster. New water supply mains would be built to service medium term growth areas, including

the southern half of the Highfield residential greenfield area. The Duvauchelle water treatment plant would be replaced with one that can reliably treat turbid surface water.

More wastewater pipes would be renewed, which would reduce the leakiness of our network and the risk of dry weather overflows. It is predicted in FY21 the overall condition of our wastewater pipe network would have improved with condition grade 5 pipes (expected to fail within 1-2 years) reducing from 10% currently to 9.3% by FY21. Improvements would be made to the network to reduce wastewater overflows in wet weather. Biogas storage would be improved at the Christchurch wastewater treatment plant, allowing more electricity to be produced from wastewater and reducing electricity costs. Wastewater servicing would be extended to the southern half of the Highfield residential greenfield area.

Under the high option, the land drainage recovery programme would be progressed more quickly, reducing the risk of flooding sooner. More stormwater treatment and flood detention ponds would be built and more projects to improve waterway ecology would be undertaken. Projects to implement the South West and Heathcote stormwater management plans would improve water quality in the Halswell and Heathcote Rivers.

There would be more road pavement renewals, carriageway smoothing and footpath renewals, improving the overall condition of our roads and footpaths. The programme of work for An Accessible City would be completed, improving the way everyone moves around the city. More traffic signals would be renewed and the school road safety programme would continue. Traffic and crime prevention cameras would be installed. Improvements to intersections and road routes would be made. The Sumner to Ferrymead coastal pathway programme would continue. More local cycleways would be built.

There is minimal difference between our proposal and the higher-cost scenario for parks. There would be additional development work in Burnside Park, Canterbury Agricultural Park, Cuthberts Green, Drayton Reserve, Regional Park developments in Styx River Reserve, Seafield Park, Spencer Park and Travis Wetland. Voelas Playground development and land reinstatement works in Linwood Nursery, Hagley Park (lighting enhancements) would also be delivered.

For facilities there is very little difference between the medium and high options in the short term, and there is no difference for information and communication technology.

Longer term benefits

Under the high option, assets would be renewed at the optimal time to minimise whole-of-life costs. Projects would be undertaken with economic benefits, resulting in operational cost savings, including the water supply re-zoning project which is expected to save $840,000 per year.

Water supply, wastewater and stormwater infrastructure to be restored to its pre-earthquake condition over 30 years and renewals would be undertaken to minimise whole of life costs. Wastewater overflows from manholes would reduce. New services would be provided for areas that are currently unserviced, including wastewater schemes for Little River and Birdlings Flat and an expanded wastewater scheme for Wainui. Additional budget would allow beneficial reuse of Akaroa's treated wastewater, rather than continuing with the current discharge to the harbour.

Flood risk would be returned to pre-earthquake levels over 30 years. Projects to enhance waterways would be undertaken, including naturalising lined drains.

An Accessible City would be completed, encouraging more use of active and public transport and reducing traffic congestion and the need for road capacity upgrades in the long term. Road condition would be restored to a level comparable with other New Zealand cities in 10 years rather than 20 years.

Current levels of service would be retained and would improve in some aresa. It is expected that strategic priorities and community outcomes would be achieved, and that resident satisfaction with Council services would be highest for the high option.

5.3.3 Consequences

However, the high option requires the highest capital investment (see Figure 5.7). The resulting increases in rates may be unaffordable for some people.

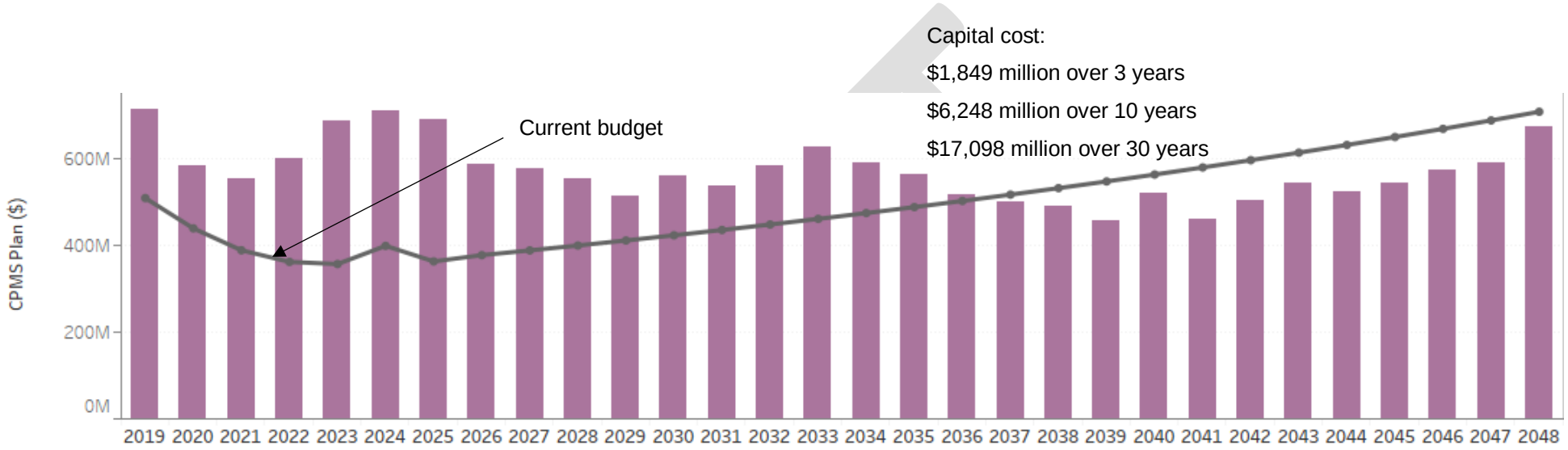


Figure 5.7: Option 3 – High – planned capital spend

Figure 5.8: Option 3 - High – planned capital spend by capital prioritisation category

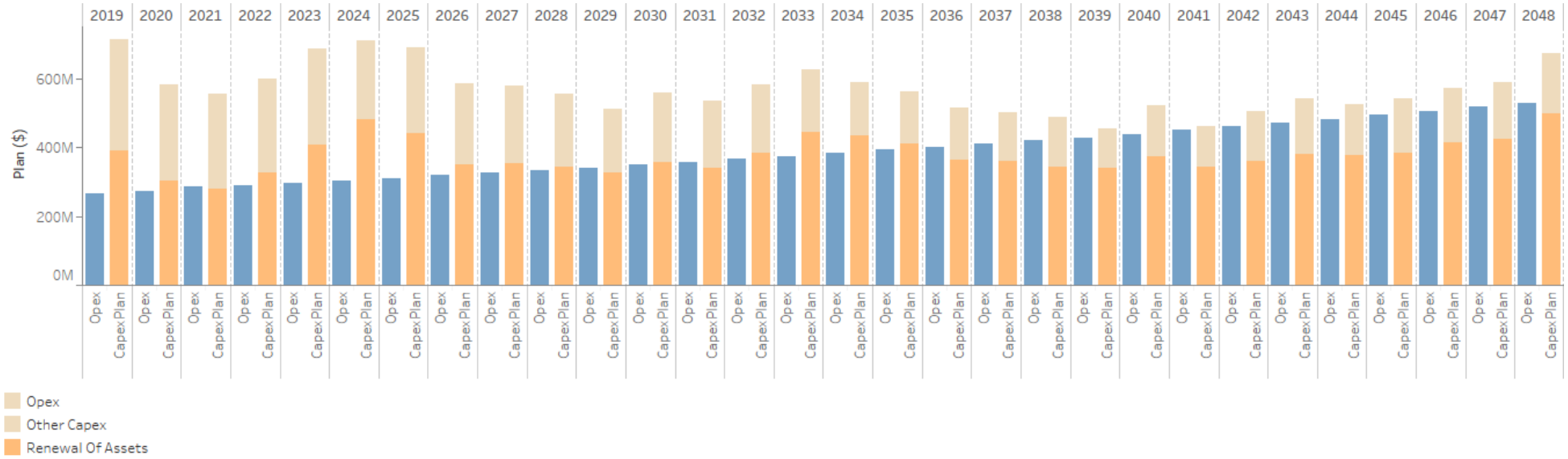


Figure 5.9: Option 3 – High – planned capital and operating and maintenance spend

Table 5.3: Option 3 - High - key projects and programmes (in addition to medium option)

Water supply $779M Increased by $283M	Water supply mains renewals $496M Increased by $213M	Water supply reticulation submain renewals $60M Increased by $24M	City water supply re-zoning $23M Increased by $23M
Wastewater $1,230M Increased by $589M	Wastewater pipe renewals $729M Increased by $421M	Wastewater overflow reduction programme $84M Increased by $74M	Belfast northern wastewater pump station $33M Increased by $33M
	Akaroa wastewater land based reuse and disposal $13M Increased by $13M	Wainui wastewater scheme $11M Increased by $11M	Christchurch wastewater treatment plant channel improvements $9M Increased by $9M

Stormwater $1,200M Increased by $522M	LDRP 521 Avon Floodplain Management Implementation $231M Increased by $133M	Stormwater reticulation renewals $191M Increased by $142M	Styx stormwater management plan $121M Increased by $66M
	Avon stormwater management plan $66M Increased by $46M	South west stormwater management plan $57M Increased by $31M	Heathcote stormwater management plan $27M Increased by $13M
Transport $1,563M Increased by $514M	An Accessible City projects $118M Increased by $73M	Carriageway Sealing and Surfacing Programme $115M Increased by $115M	Road safety improvements $92M Increased by $67M
	Intersection improvements $76M Increased by $52M	Foothpath renewals $70M Increased by $11M	Route improvements $54M Increased by $31M
	Suburban master plans $32M Increased by $17M	Local cycle network $30M Increased by $25M	Road pavement renewals and replacements $28M Increased by $28M
Facilities $936M Increased by $101M	Belfast library and service centre $18M Increased by $18M	Linwood library rebuild $13M Increased by $13M	Nga Puna Wai sports hub – Stage 2 $10M Increased by $10M
Parks and Heritage $320M Increased by $53M	Land acquisition for new parks $16M Increased by $16M	Marine facility development $11M Increased by $11M	Residential red zone new park development $9M Increased by $9M

Capital prioritisation category key				
Renewals	Contractually committed	Need/demand	Growth – critical	Increased level of service
In construction	Community committed	Level of service recovery	Growth – desirable	

Legal	Internal renewals	Economic benefits	New service	

5.3.4 Addressing the significant issues

The high option addresses the significant issues as follows:

- **Asset renewals**: This option represents best practice asset management, with assets renewed at the optimal time to minimise whole of life cost. Water supply, wastewater and stormwater infrastructure would be returned to its pre-earthquake condition over 30 years. Road smoothness would be restored to a level comparable with other New Zealand cities over 10 years.
- **Climate change**: This issue is partly addressed with new assets designed and built to accommodate climate change. This option does not provide for more extensive, proactive adaption to climate change.
- **Post-earthquake recovery and regeneration**: This option restores flood risk to pre-earthquake levels, completes all suburban master plan projects and makes some provision for costs of post-earthquake regeneration in New Brighton and Cathedral Square and surrounds. However, it does not include regeneration of the Ōtākaro Avon River corridor, apart from stopbanks and stormwater ponds.
- **Affordability**: This option requires more expenditure than can be provided for within the Council's current budget and the resulting rates rises may be unaffordable for some people.

6.0 PROVIDING FOR CHANGING DEMAND FOR SERVICES

This section broadly outlines the requirements of the National Policy Statement on Urban Development Capacity 2016. It also explains how the Council plans to respond to growth or decline in demand for services.

6.1 Population projections

Based on Statistic New Zealand's medium population projections, Christchurch's 2018 population of 387,200 residents is projected to grow to 467,900 by 2048, an increase of over 80,000 (see Figure 6.1). This equates to approximately another 40,000 homes required between 2018 and 2048, based on an average of 2.4 people per household. This growth will require a significant amount of housing and business development in Christchurch.

The low projections indicate that the city's population would reach 388,100, an increase of 31,400 people or around 20,800 households between 2013 and 2048. The high projections suggest that the city's population could reach 549,000 by 2048. This is an additional 192,300 people or 84,700 households when compared to the 2013 base.

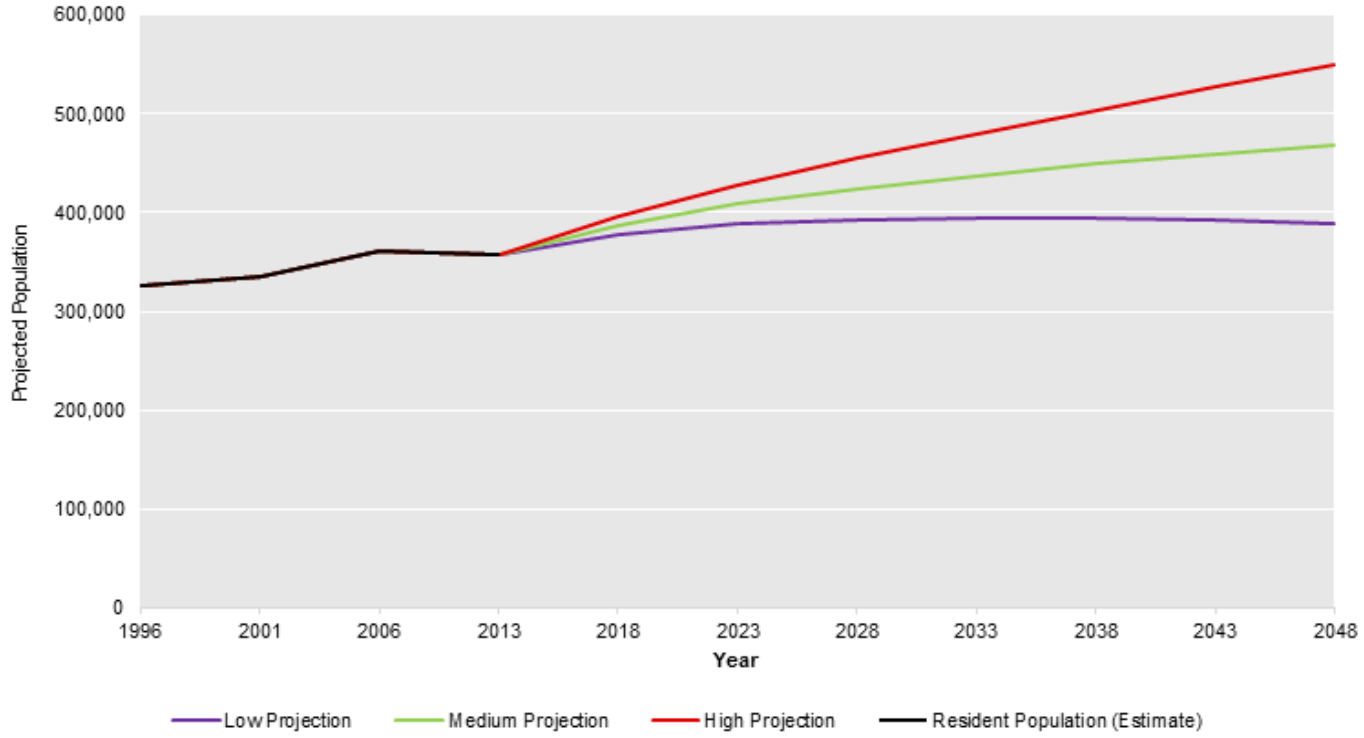


Figure 6.1: Population projections to 2048

The Council will produce demand assessments that will show how population projections will translate into demand for housing and business land. These assessments will consider both housing and business land typology, and the geographical distribution of demand across the Greater Christchurch area.

6.2 National Policy Statement for Urban Development Capacity

The 6.2 National Policy Statement for Urban Development Capacity directs that in the short term (3 years) development capacity[1]must be serviced with development infrastructure, in the medium term (3-10 years) development capacity must be serviced with development infrastructure or the funding for the development infrastructure required to service that development capacity must be identified in a Long Term Plan; and in the long term (10-30 years) development capacity must have the required development infrastructure identified in the Infrastructure Strategy. It further directs that local authorities of high growth areas (including Christchurch) produce a future development strategy. The future development strategy must demonstrate that there will be sufficient, feasible development capacity in the medium and long term and identify the broad location, timing and sequencing of future development capacity. The future development strategy shall be informed by the Long Term Plan and Infrastructure Strategy, and it is imperative that the directions of this Infrastructure Strategy takes account of these requirements.

6.3 Development capacity

For housing, the Council's strategic planning approach is for approximately 20% of future housing growth to be in new greenfield developments (previously undeveloped land) and 80% within the existing urban area through the intensification of land use. Intensification is a net increase in housing on any site. It includes infill development on vacant and underutilised land, comprehensive redevelopment of existing housing sites, and the redevelopment of brownfield sites. Most intensification is anticipated to be in the form of comprehensive redevelopment of existing sites as medium density housing. These areas are generally in the central city, the inner ring of suburbs around the central city, and in the areas around a number of key activity centres. The intention is for most medium density housing to be close to a significant retail, commercial and facilities hub. There is a strong policy emphasis on the central city to accommodate new housing, with a target of increasing the number of homes to approximately 8,000 by 2048, which equates to 20,000 people.

For business growth, the Council's planning approach is to direct retail and office activity into the network of existing commercial centres. In addition, the District Plan provides for the establishment of new commercial centres in residential growth areas such as North Halswell and Wigram along with enabling limited commercial development in brownfield areas such as the old Islington Freezing Works. The District Plan review rezoned 383 hectares of formerly rural land for industrial purposes to meet the foreseeable demand for industrial land in Christchurch. This includes land in Hornby, Belfast and several areas near the airport.

6.4 Development infrastructure

Water supply, wastewater, stormwater and transport infrastructure is required to support housing and business development. This will include extending infrastructure networks to the new greenfield housing developments and, where necessary, increasing the capacity of existing infrastructure to cater for both intensification and greenfield development. Infrastructure requirements over the short, medium and long term to support growth are broadly outlined below.

[1] Development capacity is defined under the National Policy Statement on Urban Development Capacity to mean "…in relation to housing and business land, the capacity of land intended for urban development based on: a) the zoning, objectives, policies, rules and overlays that apply to the land, in the relevant proposed and operative regional policy statements, regional plans and district plans; and b) the provision of adequate development infrastructure to support the development of land."

6.4.1 Short term (0-3 years)

In the short term, there is sufficient infrastructure to support development. There will be accelerating greenfield housing development and housing intensification around existing commercial centres. Rebuilding of the central city remains a focus for development activity in Christchurch, with more limited rebuilding and redevelopment in suburban locations, including key activity centres. Immediate industrial land needs will be met in the recently rezoned industrial zones, particularly at Hornby, Islington and Belfast.

The Christchurch District Plan outlines the expected development over the short term. Outline Development Plans have been prepared for all housing and business greenfield sites, such as Halswell and Highfield. This includes the core infrastructure requirements and their connections to existing systems.

However, the Council needs to be agile to address changing needs for infrastructure should the recovery of the city occur at accelerated or decelerated levels compared with current levels of expected development. For instance, there is uncertainty around red zone redevelopment and other potential regeneration projects.

6.4.2 Medium term (3-10 years)

Development infrastructure capacity for new greenfield development (both housing and business land) will be largely provided for over the next 10 years by existing plans for new and upgraded infrastructure.

However, providing for development in the existing urban area in the medium term is problematic for some asset types in some parts of the city. For example, there are limitations on development in some areas until transport infrastructure is in place. In areas where there are wastewater capacity constraints, site-specific solutions allow development, where developers are required to install on-site tanks and pumps. This enables the retention of wastewater on site which can then be discharged into the network when there is capacity. Some industrial areas have maximum daily average sewage flows due to existing capacity constraints (e.g. South West Hornby Industrial Zone).

Planned wastewater network upgrades to reduce overflows will gradually relieve wastewater capacity constraints. This will enable more development to occur without the need for on-site mitigation. Upgrade projects will be prioritised to address the areas with the most growth pressures.

6.4.3 Long term (10-30 years)

Over the long term, the Council's capital renewal programme provides cost-effective opportunities to upgrade assets to cater for forecast growth. The long term development infrastructure capacity assessments are underway and when complete could show a lack of infrastructure capacity in certain areas. This could have potential impacts on the Infrastructure Strategy. This is mostly relevant to the 80% of housing growth that will occur through intensification of existing land use.

6.5 Servicing changing demand

This section outlines general approaches potentially considered to meet the long-term requirements. These are largely focussed on providing for growth. It is not expected that demographic change (e.g. aging population) will have a significant impact on the provision of infrastructure or the cost.

6.5.1 Water supply

Water supply for growth areas will be serviced by increasing the number of deep bores and pump stations. Master plans have been prepared which describe how water supply services will be provided to all unserviced greenfield areas, and these have informed the projects and programmes for the Infrastructure Strategy. Projects are prioritised based on where there is the most demand for growth. For efficiency, water and wastewater servicing for greenfield areas is delivered in parallel.

There is sufficient groundwater to supply the growing population until 2051 at current per capita water consumption rates. To cater for longer term growth, reduced demand for water, or treated water from the Waimakariri River are options that will need to be considered. Non-potable reuse of treated wastewater may also reduce the volume of drinking water that needs to be supplied.

Intensification does not tend to result in a change in water demand, as increased household use is offset by reduced garden irrigation.

6.5.1 Wastewater

Master plans have been prepared which describe how wastewater services will be provided to all unserviced greenfield areas, and these have informed the projects and programmes for the Infrastructure Strategy. Projects are prioritised based on where there is the most demand for growth. For efficiency, water and wastewater servicing for greenfield areas is delivered in parallel.

Intensification within the city may require upgrades to wastewater infrastructure. Detailed wastewater network modelling has been carried out to determine where there are wastewater capacity issues. A city wide wastewater optimisation project has been undertaken to determine the most cost effective suite of capital projects to resolve wastewater capacity issues in the network and these are included in the 2018 Long Term Plan. These upgrades include provision for growth to 2068.

6.5.2 Stormwater

New developments are designed to manage stormwater requirements, including the effects of climate change. This is undertaken through stormwater treatment and detention, raised floor levels in flood prone areas and a requirement to provide on-site detention where a communal pond is not available.

6.5.3 Transport

For the Central City, the “An Accessible City” programme of transport projects has been established to address future transport needs. It was predicted that the central city would experience severe congestion by 2041 due to an estimated extra 70,000 car trips being made per day. To avoid this option, a significantly larger share of future trips will need to be made using public transport, walking and cycling. An Accessible City is intended to deliver a more balanced transport network in the central city.

Integrated multi-modal networks in the wider city, such as improved public transport corridors and the major cycleways network will support this. Further work integrating land and transport planning is required to facilitate and support effective and efficient public transport networks, such as intensification focused around key activity centres and creating walkable neighbourhoods with access to facilities and services.

Commercial and industrial growth is assisted by locating these developments near high-capacity transport routes (rail, road and airport).

Autonomous vehicles are in development and will be a disruptive technology. At this stage it is unclear when or how this will affect the transport network or the services that Council provide. What is known is that within the next 10 years vehicles and people still will require a corridor for transport purposes - roads, footpaths and

cycleways - and Council will need to maintain its assets and services accordingly. Further to this traffic volumes will change as the public makes different travel choices and this will affect future engineering design decisions.

6.5.4 Solid waste

There is mounting concern in New Zealand about the effects of the Chinese ban on accepting some recycling materials and the immediate as well as the future viability of these commodities traded on global markets. This ban, notified to the World Trading Organisation and effective at the end of 2017, targeting poor quality plastics and paper recycling, presents a risk to the Council both in a financial sense and in meeting waste diversion targets, as the city generates some 2,700 tonnes of plastic and 24,000 tonnes of paper and cardboard each year.

During the 30 year life of the strategy, other major contracts will come to an end, and include arrangements for the processing of:

- 54,400 tonnes per annum of greenwaste to the organics processing plant
- 3,420 tonnes per annum of dried wastewater biosolids from the wastewater treatment plant (most of which currently is transported to the West Coast for use in mine remediation).
- 24,000 tonnes of paper and cardboard each year
- Plus 125,000 tonnes of general waste delivered to EcoDrop to go to Kate Valley landfill.

The existing markets for these waste and recycling streams are likely to change significantly over the next decade. If recycling becomes un-economic it is likely that volumes to landfill could continue to increase.

In anticipation of the coming disruption to the existing recycling and disposal markets, the Christchurch City Council has commenced work on a programme business case (based on the Treasury's better business case methodology) to identify future options for Waste and Recycling Management.

The Programme Business Case considers the case for improving the sustainability, efficiency and effectiveness of the City's waste and recycling operations and management. Options in the programme business case range from status quo through to various forms of beneficial reuse, including waste to energy technologies and carbon sequestration that do not rely on changeable foreign markets to ensure their viability. The commercial case concludes that a new approach to beneficial re-use of waste and recyclables is viable and recommends that a detailed business case is prepared.

6.5.5 Information and communication technology

In a world of constant and exponential change, new technology continues to adapt at an increasing rate. While it is not possible to accurately predict the exact timing and extent of technological changes, the pace of change and disruption is likely to continue and intensify. However, great advantages come with these changes including opportunities for citizens and businesses to interact and consume services in a way that meets their expectations around ease, choice and access. In addition, technology enablement derives opportunities for reducing operational costs to the ratepayer.

Council services will be disrupted by such change and create new business models and partnerships to deliver great outcomes for Christchurch communities. Information and communication technology services need to be flexible and continuously leverage relevant emerging technology to support such business change in a digital world.

7.0 RESILIENCE AND NATURAL HAZARDS

This section sets out how the Council provides for the resilience of infrastructure assets and manages risks relating to natural hazards.

An emerging issue is that the Council may need to adapt its infrastructure to prepare for the likely impact of an Alpine Fault rupture of Magnitude 8 (AF8). This issue has not been included in this significant issues section as an assessment has yet to be made about the level of readiness for AF8 is yet to be completed. However, given the extensive infrastructure rebuild following the earthquakes of 2010-11, it is expected that Christchurch is better placed for AF8 than most other places in New Zealand.

In September 2016 the Greater Christchurch Partnership endorsed the Resilient Greater Christchurch Plan prepared as part of Greater Christchurch's membership of the 100 Resilient Cities Network pioneered by the Rockefeller Foundation.

Earthquakes, flooding, coastal erosion, storm surge, wind and tsunamis are the most significant shocks that are likely to occur in Greater Christchurch. The Alpine Fault, which extends down the spine of the South Inland, is Christchurch's primary seismic threat. There is roughly a 30% to 65% chance that there could be a magnitude 8.0 earthquake on this fault in the next 50 years. Chronic stresses for Greater Christchurch include climate change.

The Council makes financial provision for natural hazards by maintaining headroom in its ability to borrow money in the event of a major disaster. 'Headroom' (the ability to borrow more if required without breaching financial covenants) has a low point of $380 million in 2024, significantly less than the 2016 amended LTP's figure of $529 million in 2020. This is largely due to Council borrowing $160 million in lieu of receiving it as a capital release from CCHL. The value of headroom is that it allows for a degree of flexibility in the future if unforeseen circumstances arise. This is considered a prudent level of headroom.

Council has insurance of $2.5 billion for all its assets, including $500 million for underground assets. This is significantly less than the replacement cost of $12.5 billion for all assets. It is assumed that the government would contribute 60% of the cost of repair of the depreciated value of the assets in the event of another natural disaster, as was the case after the 2010/11 earthquakes.

It also designs and constructs new and replacement infrastructure in accordance with Council Standards including the Infrastructure Design Standards and the Construction Standard Specifications, both of which have been updated to improve resilience based on innovations developed through the SCIRT programme. The standards aim to insure infrastructure is more resilient when future disasters occur. Council ensures that these design standards are implemented for its own infrastructure, as well as that built by developers through the resource consent process.

7.1 Water supply

The decentralised nature of Christchurch City's water sources provides a resilient network that is less likely to be affected by failures at individual bores or pump stations. A master plan has been prepared for rezoning the city's water supply. This will create smaller, more manageable water supply zones that will improve resilience and emergency response capability. It will also allow the pressure to be dropped in eastern zones where pressure is currently high, which will reduce pipe breaks and will reduce electricity consumption for pumping water.

Sea level rise may mean the need to build water and wastewater infrastructure elsewhere and relocate some water supply wells further away from the coast. Higher groundwater will result in greater buoyancy and increased liquefaction potential that may affect structures during earthquakes.

To maintain the resilience of the water supply to the Lyttelton Harbour Basin, multiple pipes need to be maintained through the Port Hills. Additional water sources may be required for Akaroa, Takamatua and Pigeon Bay due to climate change.

The water supply asset renewal programme provides for the progressive replacement of older assets and subsequently contributes to improving resilience.

7.2 Wastewater

The SCIRT programme introduced the innovative use of pressure and vacuum sewer systems to improve resilience in areas with high risk of liquefaction. Over 6,000 properties are now connected to these systems. If, in a future earthquake event, the land subsides or rises the wastewater collection systems in these areas should remain functional.

An approved drainlayer program and an approved materials list are maintained and updated on a regular basis to ensure that new assets meet Council requirements.

Climate change predictions include an increase in the frequency of high intensity rain events. Network upgrades have been undertaken and further upgrades are planned to increase capacity, provide storage and reduce inflow in order to decrease the likelihood of wastewater overflows. These upgrades are being designed to account for population growth. Measures to reduce wastewater flows, such as smart pressure sewer systems, are also being implemented in greenfield development areas. Pressure and vacuum sewer systems are more resilient to natural hazards than gravity wastewater systems.

7.3 Stormwater and flood protection

The functionality of stormwater infrastructure will be compromised over time as the climate changes. During flood events stormwater in low lying suburbs may need to be pumped from areas below sea level into waterways at with higher water levels. In time this will affect most stormwater systems east of Fitzgerald Avenue. To address this longer term mitigation measures will need to be implemented. These could include stopbanks, pump stations and additional storage, in combination with policy changes to facilitate managed retreat from the worst-affected areas.

A number of short term measures have been identified to address flood risk to the most flood-prone households in Christchurch, however longer term mitigation measures need to be developed to address the extreme flooding which will result from climate change and sea level rise. Adaptation pathways will be identified to respond to uncertainties with climate change. The goal is to set out a series of decisions that will need to be made that do not result in outcomes that future generations regret.

The role and impact of stormwater assets in terms of lifeline readiness is not well understood (or at least, not well documented). This includes definition of the stormwater lifeline assets and the potential impact of stormwater assets on other lifeline infrastructure.

Predicted sea level rise (as much as 0.8 metre by 2090) will increase the area at risk of coastal and tidal flooding. The earthquakes have accelerated the need for Christchurch to develop a longer term plan for dealing with the effects of sea level rise and climate change. It is important that current investment in flood protection infrastructure is compatible with the longer term approaches developed.

Climate change predictions are for a warmer and drier climate, but with increased intensity of rain storms. The stormwater pipe network is designed to deal with a 5 year storm. Any event beyond this scale results in secondary flow paths including flooding on roads. Sea level rise combined with extreme storm events will increase the likelihood of the Avon and Heathcote Rivers overtopping their banks.

To reduce the impact of flooding, the District Plan requires new houses in the Floor Level and Fill Management Areas to have habitable floor levels 0.4 metres above the 200 year ARI flood level, or 0.4 metres above the 200 year tide level taking into account 1 metre sea level rise. Other areas must comply with the Building Code, which is 0.9 metres above the 50 year ARI flood level (0.4 metres freeboard plus 0.5 metres sea level rise).

To reduce peak stormwater flow and contaminants entering the stormwater network and the environment, new developments are required to provide storage and treatment on site, where a communal facility such as a stormwater pond is not available.

7.4 Transport

The earthquakes showed the transport network is reasonably resilient and the sections that needed to be closed to mitigate hazards were primarily due to geological reasons rather than the condition of the road surface. Christchurch's transport network has alternative routes and different ways to travel other than the car which provide viable alternatives during severe weather and emergency events. This primarily applies to within the city itself, links to the north and south are reliant on several key bridges, such as the two bridges north over the Waimakariri River.

The current priority is to protect key lifeline routes, such as connections to isolated parts of the community (Sumner, Lyttelton and Banks Peninsula) and key elements of infrastructure (Christchurch Airport and Lyttelton Port). Having alternative routes where topography allows is preferable, otherwise infrastructure needs to be designed and constructed to a sufficient level of robustness and maintained appropriately.

Intense rain events may lead to flooding damage including landslips to roads, bridges, culverts, footpaths and retaining walls. Damage may include roads, bridges and culverts being swept away, subsidence and potholes. Sea level rise may increase flooding and could erode roads and associated infrastructure in low lying areas.

Sustainable urban drainage, such as rain gardens and detention ponds is being implemented to help to manage the effects of flooding on the transport network. Note that many of these fails during high groundwater levels.

Low lying roads adjacent to rivers are subjected to flooding and restricts access to property particularly near the Heathcote River and Avon River.

Fitzgerald Twin Bridges are a key link and remain a risk. The 2010/11 earthquake showed that despite a number of options through local streets, the arterial roads are critical to maintaining community links.

7.5 Facilities

A number of community facilities were severely damaged during the earthquakes, including pools, libraries, the art gallery, stadium and community halls. The repair and replacement programme has provided and continues to provide opportunities for the Council to incorporate improved resilience in the new facilities. Community halls are also used as places of refuge and control centres in times of civil defence.

Sea level rise and coastal erosion may impact facilities located in areas vulnerable to flooding or coastal erosion. Facilities planning will take into account climate change risks to facilities to ensure appropriate use of halls in response to an event.

7.6 Parks

Due to sea level rise, maintenance and renewal work on foreshore land and assets will be required at an increasing level over the next 30 years and beyond. Strengthening and repairs on sea walls will mitigate some of the effects, but in time some assets will need to be abandoned or moved to higher ground. Rock fall risk in the Port Hills will remain an issue and will be managed by a combination of rock fall mitigation and park access management.

7.7 Solid waste

Detailed disaster recovery manuals have been developed for the three transfer stations, recycling plant organics processing plant in Christchurch, and Kate Valley regional landfill in North Canterbury. The manuals have been developed to ensure that in the event of an emergency of any magnitude including natural hazards, the facilities have effective response and recovery procedures to cope with the disruption of business and services over the short to medium term.

7.8 Information and communication technology

The Council has undertaken investment to improve resilience of information and communication technology services. Planned renewals and investments will improve the level of resilience of Council's networks, communications and information systems. Further migration to 'as a service' (cloud-based) solutions will continue to increase resilience of information and communication technology services.

Delivery of online services, open data and collaboration improves community resilience through communication of critical information and accessibility of Council services. Investments in spatial information and asset information systems will further improve Council's effectiveness in planning, preparedness, response and recovery. New technologies such as unmanned aerial vehicles (drones) support safe access to hazardous locations for rapid access to information.

8.0 ASSET MANAGEMENT

8.1 Levels of service

Council has established a suite of levels of service for each activity that link to the community outcomes. These levels of service are detailed in the service plan for each particular activity.

The more community-oriented levels of service are presented in the draft Long Term Plan and Annual Plan to enable the community to provide feedback on the proposed levels of service for each activity.

The more technical levels of service are included in the Council's in-house services documents. These are reported to the Executive Leadership Team and to elected members through formal reporting. All performance information is able to be provided on request.

Many services have been significantly affected by the earthquakes. The ability to provide services to pre-quake measures has been difficult and in many cases impossible due to the extent of damage to the infrastructure.

Every level of service will be underpinned by some element of information and communications technology to support delivery and enable residents and businesses to interact with the Council and use its services.

The SCIRT rebuild programme finished in June 2017. However, not all damage was repaired and this now forms part of the Council's infrastructure renewal programme. It will take many years to address the remaining damage and service impairment as part of the routine maintenance programmes and renewals.

The Council has initiated targeted responses to restoring levels of service in some cases. For example, the Land Drainage Recovery Programme is aiming to get flood protection levels of service back to pre-earthquake levels to address the effects of land level changes.

The changes to levels of service for the three options is summarised in Table 8.1, with reductions in levels of service compared to the medium option shown in red text and improvements shown in green text.

Table 8.1 – Changes to levels of service for low, medium and high options

Level of service performance measure	Target level of service		
	Option 2 – Low	**Option 1 – Medium (most likely)**	**Option 3 - High**
Water supply			
Number of unplanned interruptions per 1,000 connections per year	Year 1: ≤ 16 Year 2: ≤ 16 Year 3: ≤ 16 Year 10: ≤ 20	Year 1: ≤ 16 Year 2: ≤ 16 Year 3: ≤ 16 Year 10: ≤ 16	Year 1: ≤ 16 Year 2: ≤ 16 Year 3: ≤ 16 Year 10: ≤ 15

Level of service performance measure	Target level of service		
	Option 2 – Low	**Option 1 – Medium (most likely)**	**Option 3 - High**
Number of continuity of supply complaints per 1,000 connections per year	Year 1: ≤ 2 Year 2: ≤ 2 Year 3: ≤ 2 Year 10: ≤ 3	Year 1: ≤ 2 Year 2: ≤ 2 Year 3: ≤ 2 Year 10: ≤ 2	Year 1: ≤ 2 Year 2: ≤ 2 Year 3: ≤ 2 Year 10: ≤ 1
Number of pressure or flow complaints per 1,000 connections per year	Year 1: ≤ 2 Year 2: ≤ 2 Year 3: ≤ 2 Year 10: ≤ 3	Year 1: ≤ 2 Year 2: ≤ 2 Year 3: ≤ 2 Year 10: ≤ 2	Year 1: ≤ 2 Year 2: ≤ 2 Year 3: ≤ 2 Year 10: ≤ 1
Proportion of residents satisfied with the safety of Council water supplies	Year 1: ≥ 85% Year 2: ≥ 85% Year 3: ≥ 85% Year 10: ≥ 80%	Year 1: ≥ 85% Year 2: ≥ 85% Year 3: ≥ 85% Year 10: ≥ 85%	Year 1: ≥ 85% Year 2: ≥ 85% Year 3: ≥ 85% Year 10: ≥ 85%
Wastewater			
Proportion of residents satisfied with the reliability of wastewater services	Year 1: ≥ 80% Year 2: ≥ 70% Year 3: ≥ 65% Year 10: ≥ 60%	Year 1: ≥ 80% Year 2: ≥ 75% Year 3: ≥ 75% Year 10: ≥ 75%	Year 1: ≥ 80% Year 2: ≥ 80% Year 3: ≥ 80% Year 10: ≥ 85%
Number of wastewater system fault complaints per 1,000 connections per year	Year 1: ≤ 0.6 Year 2: ≤ 0.7 Year 3: ≤ 0.8 Year 10: ≤ 1.5	Year 1: ≤ 0.6 Year 2: ≤ 0.6 Year 3: ≤ 0.6 Year 10: ≤ 0.6	Year 1: ≤ 0.6 Year 2: ≤ 0.6 Year 3: ≤ 0.6 Year 10: ≤ 0.5
Number of wastewater system blockage complaints per 1,000 connections per year	Year 1: ≤ 10 Year 2: ≤ 12 Year 3: ≤ 14 Year 10: ≤ 20	Year 1: ≤ 10 Year 2: ≤ 11 Year 3: ≤ 12 Year 10: ≤ 15	Year 1: ≤ 10 Year 2: ≤ 11 Year 3: ≤ 12 Year 10: ≤ 10
Proportion of residents satisfied with the health protection provided by Council wastewater services	Year 1: ≥ 80% Year 2: ≥ 80% Year 3: ≥ 80% Year 10: ≥ 70%	Year 1: ≥ 80% Year 2: ≥ 80% Year 3: ≥ 80% Year 10: ≥ 80%	Year 1: ≥ 80% Year 2: ≥ 80% Year 3: ≥ 80% Year 10: ≥ 90%

Level of service performance measure	Target level of service		
	Option 2 – Low	**Option 1 – Medium (most likely)**	**Option 3 - High**
Number of dry weather overflows from the wastewater system per 1,000 connections per year	Year 1: ≤ 0.7 Year 2: ≤ 0.7 Year 3: ≤ 0.7 Year 10: ≤ 0.5	Year 1: ≤ 0.7 Year 2: ≤ 0.7 Year 3: ≤ 0.7 Year 10: ≤ 0.7	Year 1: ≤ 0.7 Year 2: ≤ 0.7 Year 3: ≤ 0.7 Year 10: ≤ 0.5
Stormwater			
The number of stormwater system performance complaints per 1,000 connections to the stormwater network per year	Year 1: ≤ 10 Year 2: ≤ 12 Year 3: ≤ 15 Year 10: ≤ 20	Year 1: ≤ 10 Year 2: ≤ 10 Year 3: ≤ 9 Year 10: ≤ 8	Year 1: ≤ 10 Year 2: ≤ 9 Year 3: ≤ 8 Year 10: ≤ 5
Proportion of residents satisfied with the condition of waterway channels	Year 1: ≥ 37% Year 2: ≥ 35% Year 3: ≥ 40% Year 10: ≥35%	Year 1: ≥ 37% Year 2: ≥ 37% Year 3: ≥ 40% Year 10: ≥ 50%	Year 1: ≥ 37% Year 2: ≥ 37% Year 3: ≥ 50% Year 10: ≥ 70%
Annual reduction in number of predicted floor levels at risk of flooding in the design rainfall event	Year 1: ≥ 50 Year 2: ≥ 50 Year 3: ≥ 40 Year 10: ≥ 25	Year 1: ≥ 50 Year 2: ≥ 50 Year 3: ≥ 50 Year 10: ≥ 50	Year 1: ≥ 50 Year 2: ≥ 50 Year 3: ≥ 60 Year 10: ≥ 70
Proportion of residents satisfied with Council management of the stormwater system to minimise flood risk	Year 1: ≥ 50% Year 2: ≥ 50% Year 3: ≥ 45% Year 10: ≥35%	Year 1: ≥ 50% Year 2: ≥ 50% Year 3: ≥ 75% Year 10: ≥ 80%	Year 1: ≥ 50% Year 2: ≥ 50% Year 3: ≥ 80% Year 10: ≥ 90%
Average modelled annual reduction in zinc in stormwater discharges	Year 1: ≥ 0% Year 2: ≥ 0% Year 3: ≥ 0% Year 10: ≥ 0%	Year 1: ≥ 0% Year 2: ≥ 1% Year 3: ≥ 1% Year 10: ≥ 2%	Year 1: ≥ 0% Year 2: ≥ 1% Year 3: ≥ 2% Year 10: ≥ 4%
Average modelled annual reduction in sediment in stormwater discharges	Year 1: ≥ 0% Year 2: ≥ 0% Year 3: ≥ 0% Year 10: ≥ 0%	Year 1: ≥ 0% Year 2: ≥ 1% Year 3: ≥ 2% Year 10: ≥ 3%	Year 1: ≥ 0% Year 2: ≥ 1% Year 3: ≥ 2% Year 10: ≥ 5%
Average modelled annual reduction in copper in stormwater discharges	Year 1: ≥ 0% Year 2: ≥ 0% Year 3: ≥ 0% Year 10: ≥ 0%	Year 1: ≥ 0% Year 2: ≥ 1% Year 3: ≥ 2% Year 10: ≥ 2%	Year 1: ≥ 0% Year 2: ≥ 1% Year 3: ≥ 2% Year 10: ≥ 4%

Level of service performance measure	Target level of service		
	Option 2 – Low	**Option 1 – Medium (most likely)**	**Option 3 - High**
Proportion of repaired length of stop-bank requiring repair carried out within 9 months	Year 1: ≥ 70% Year 2: ≥ 60% Year 3: ≥ 60% Year 10: ≥50%	Year 1: ≥ 70% Year 2: ≥ 70% Year 3: ≥ 75% Year 10: ≥ 80%	Year 1: ≥ 70% Year 2: ≥ 70% Year 3: ≥ 80% Year 10: ≥ 90%
Transport			
The number of deaths and serious injuries on the road network	Year 1: ≤ 125 Year 2: ≤ 125 Year 3: ≤ 125 Year 10: ≤ 125	Year 1: ≤ 120 Year 2: ≤ 118 Year 3: ≤ 115 Year 10: ≤ 100	Year 1: ≤ 120 Year 2: ≤ 118 Year 3: ≤ 115 Year 10: ≤ 100
The average roughness of the sealed local road network (NAASRA roughness counts)	Year 1: ≤ 125 Year 2: ≤ 125 Year 3: ≤ 127 Year 10: ≤ 130	Year 1: ≤ 125 Year 2: ≤ 124 Year 3: ≤ 123 Year 10: ≤ 123	Year 1: ≤ 124 Year 2: ≤ 123 Year 3: ≤ 122 Year 10: ≤ 120
The average quality of the sealed local road network, measured by smooth travel exposure (STE)	Year 1: ≥ 69% Year 2: ≥ 68% Year 3: ≥ 67% Year 10: ≥ 60%	Year 1: ≥ 69% Year 2: ≥ 70% Year 3: ≥ 71% Year 10: ≥ 75%	Year 1: ≥ 69% Year 2: ≥ 70% Year 3: ≥ 71% Year 10: ≥ 80%
The percentage of the sealed local road network that is resurfaced per year	Year 1: ≥ 1% Year 2: ≥ 1% Year 3: ≥ 1% Year 10: ≥ 1%	Year 1: ≥ 2% Year 2: ≥ 2% Year 3: ≥ 2% Year 10: ≥ 3%	Year 1: ≥ 2% Year 2: ≥ 2% Year 3: ≥ 2% Year 10: ≥ 4%
The percentage of footpaths that are condition rating 1 (excellent) or 2 (good)	Year 1: ≥ 75% Year 2: ≥ 75% Year 3: ≥ 75% Year 10: ≥ 75%	Year 1: ≥ 75% Year 2: ≥ 76% Year 3: ≥ 77% Year 10: ≥ 80%	Year 1: ≥ 75% Year 2: ≥ 76% Year 3: ≥ 77% Year 10: ≥ 85%
Resident satisfaction with road condition	Year 1: ≥ 38% Year 2: ≥ 38% Year 3: ≥ 38% Year 10: ≥ 35%	Year 1: ≥ 38% Year 2: ≥ 39% Year 3: ≥ 40% Year 10: ≥ 50%	Year 1: ≥ 38% Year 2: ≥ 39% Year 3: ≥ 40% Year 10: ≥ 60%

Level of service performance measure	Target level of service		
	Option 2 – Low	**Option 1 – Medium (most likely)**	**Option 3 - High**
Resident satisfaction with footpath condition	Year 1: ≥ 75% Year 2: ≥ 75% Year 3: ≥ 75% Year 10: ≥ 75%	Year 1: ≥ 75% Year 2: ≥ 76% Year 3: ≥ 77% Year 10: ≥ 80%	Year 1: ≥ 75% Year 2: ≥ 76% Year 3: ≥ 77% Year 10: ≥ 85%

8.2 Performance reporting

Each Service Plan details performance measures aligned to particular level of service statements. These measures are benchmarked against other organisations where the data is available and relevant. The Council monitors and reports against the performance measures in its Annual Report.

8.3 Asset management information system

The Council's objective is to manage all assets using a single source of data held within an integrated Asset Management Information System, which will:

- Record geospatial data, component data, capital and maintenance expenditure, asset value and physical condition at asset component level for all the Council's assets
- Store asset data with common key attributes to facilitate consistent data interrogation for reporting and analytics across all asset groups
- Facilitate optimised asset maintenance, rehabilitation and renewal activities across multiple asset portfolios
- Use technologies to create user interfaces which are both intuitive and compatible with a range of devices
- Keep abreast of and use industry best practice.

The Asset Management Information System is divided into two tiers. Each tier refers to software applications in the context of asset management. Tier 1 is the core interlinked system and comprises:

- SAP - core business information system
- Intergraph - GIS system
- Sentient - Capital Programme Management System (CPMS)
- TRIM - document management system.

All Tier 2 systems will be integrated to the Tier 1 system as the primary source of information. This integrated system will enable reporting and analysis to inform operational and strategic decisions in a co-ordinated and consistent fashion.

In general, Council is confident that the geospatial (GIS) and attributed meta data held in SAP is accurate, apart from areas where shallow ground movement has distorted physical property boundaries. At present all survey data captured is in accordance with the current instructions for surveying in the Canterbury region issued by the Office of the Surveyor-General. Where Council assets have not been resurveyed there may be property boundary issues yet to be identified.

9.0 FINANCIAL ESTIMATES

The following sections show graphs of the projected capital expenditure over the next 30 years for each type of infrastructure, by prioritisation category for the low, medium and high options. Pie charts showing the split of total 30 year spend are also shown for Option 1 Medium. Inflation is included in all graphs in this section.

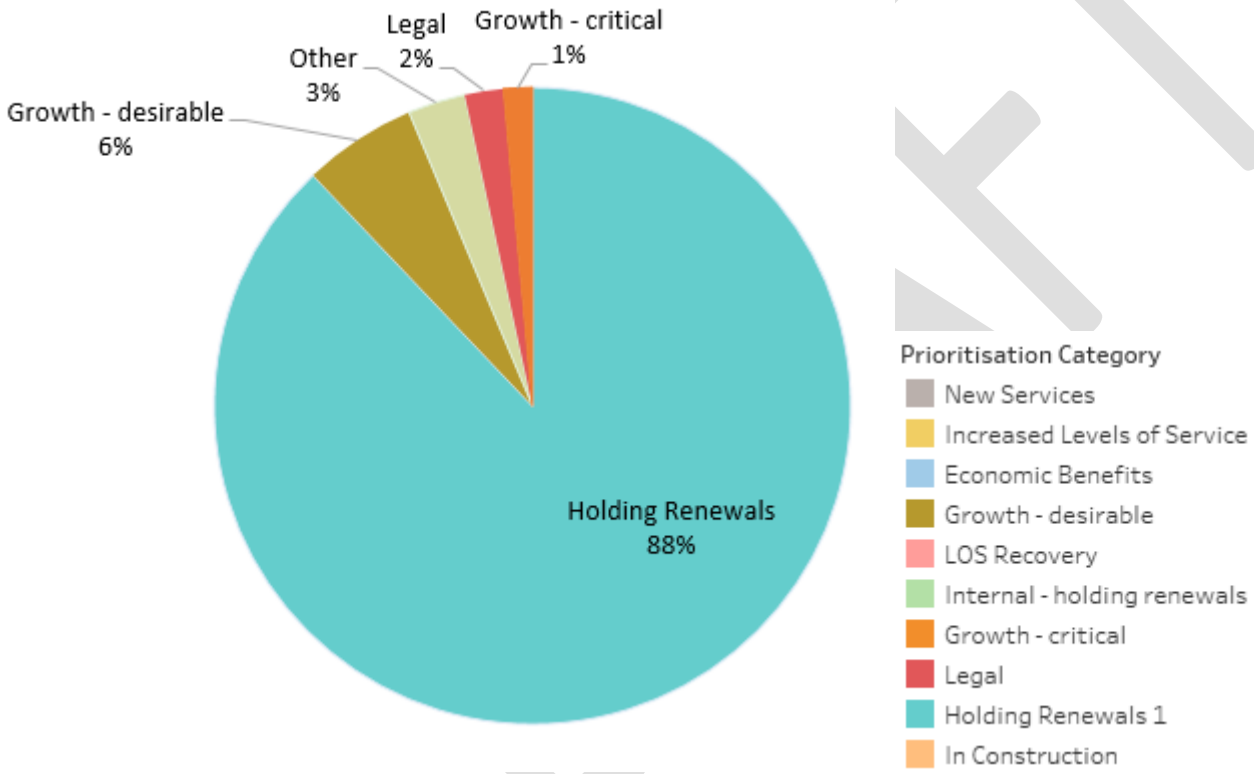


Figure 9.1: Water supply - percentage capital expenditure by prioritisation category – Option 1 Medium

9.1 Water supply

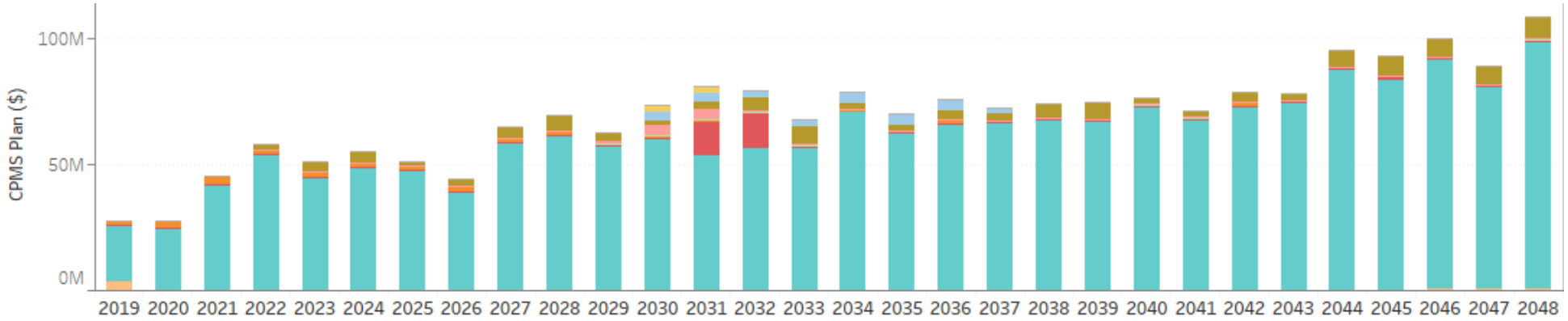


Figure 9.2: Water supply – projected capital expenditure by prioritisation category – Option 1 Medium

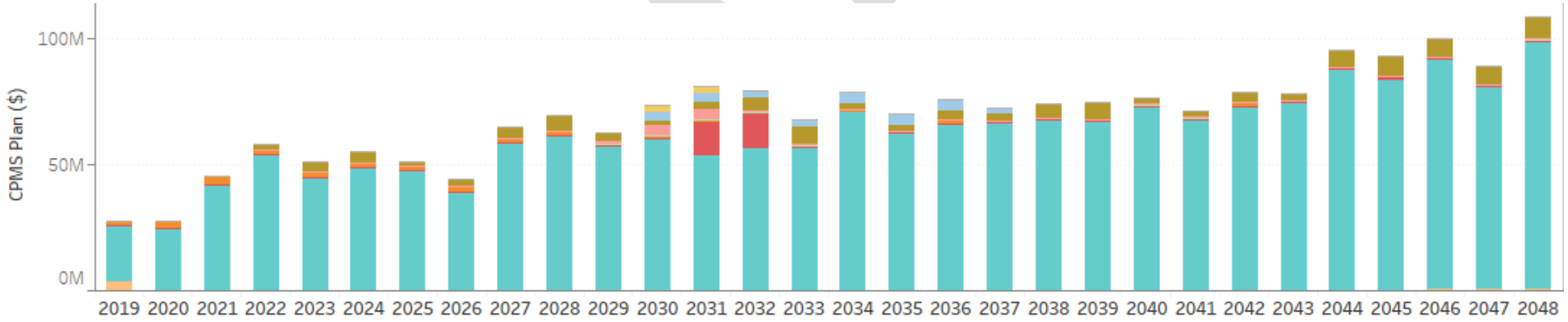


Figure 9.3: Water supply – projected capital expenditure by prioritisation category – Option 2 Low

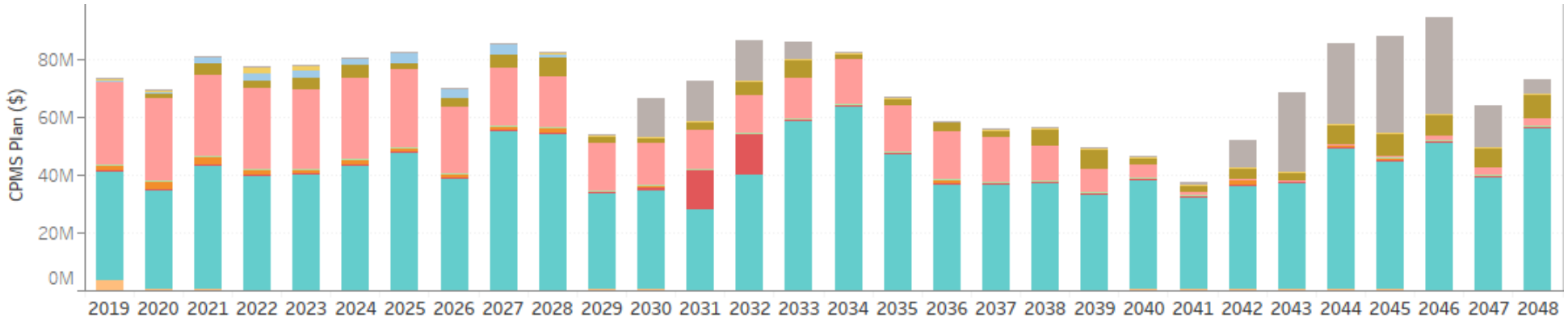


Figure 9.4: Water supply – projected capital expenditure by prioritisation category – Option 3 High

9.2 Wastewater

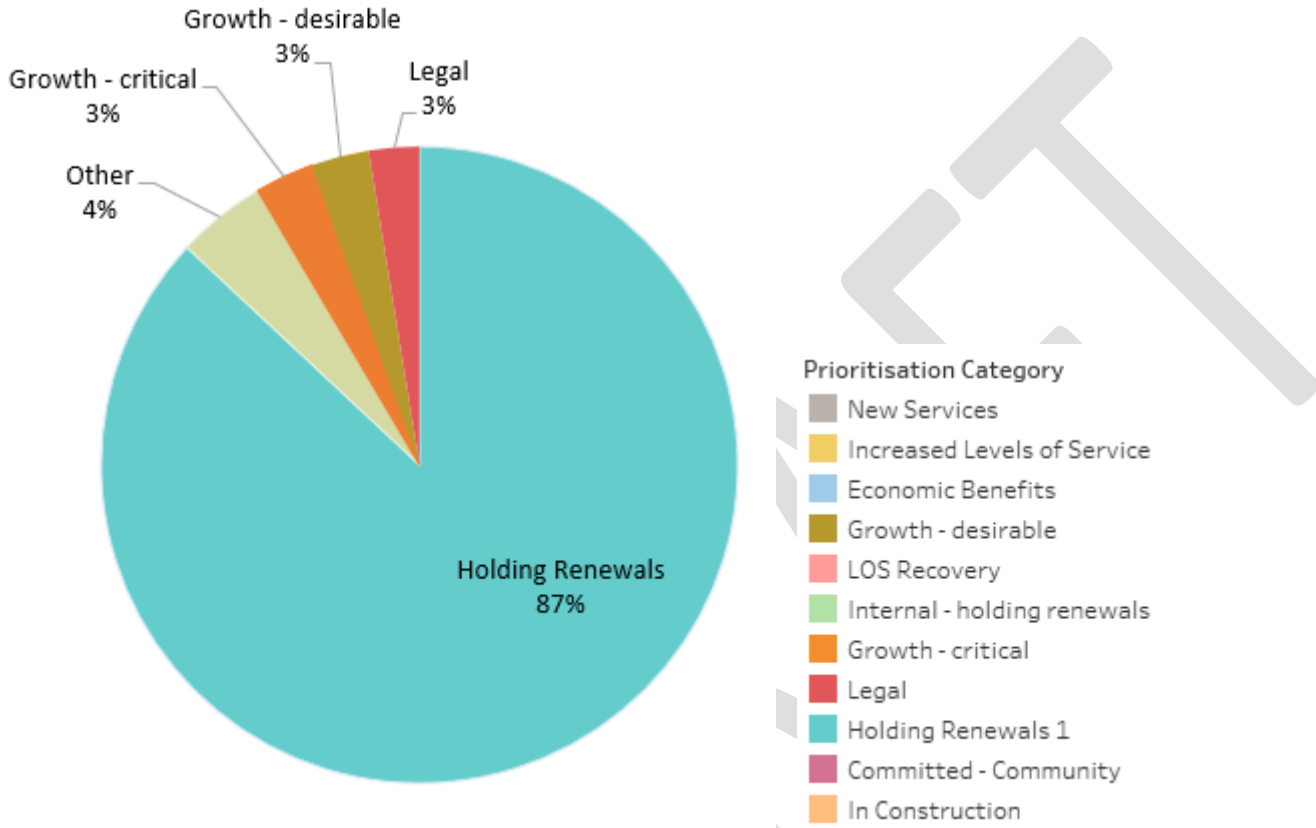


Figure 9.5: Wastewater - percentage capital expenditure by prioritisation category – Option 1 Medium

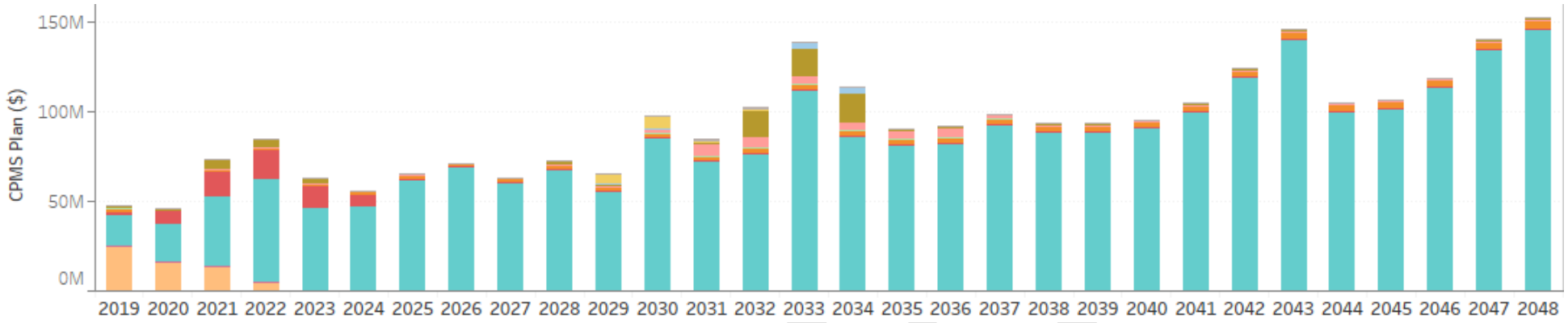


Figure 9.6: Wastewater– projected capital expenditure by prioritisation category – Option 1 Medium

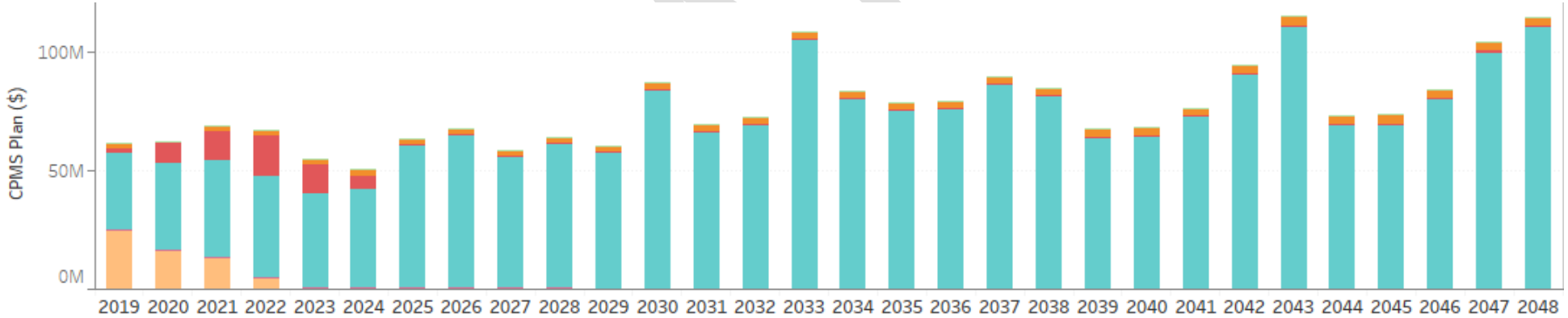


Figure 9.7: Wastewater– projected capital expenditure by prioritisation category – Option 2 Low

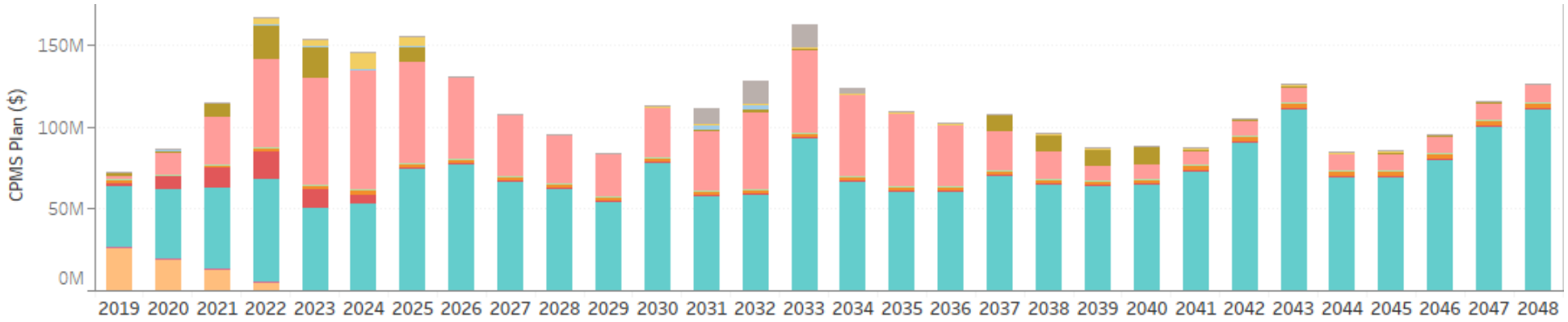


Figure 9.8: Wastewater– projected capital expenditure by prioritisation category – Option 3 High

9.3 Stormwater

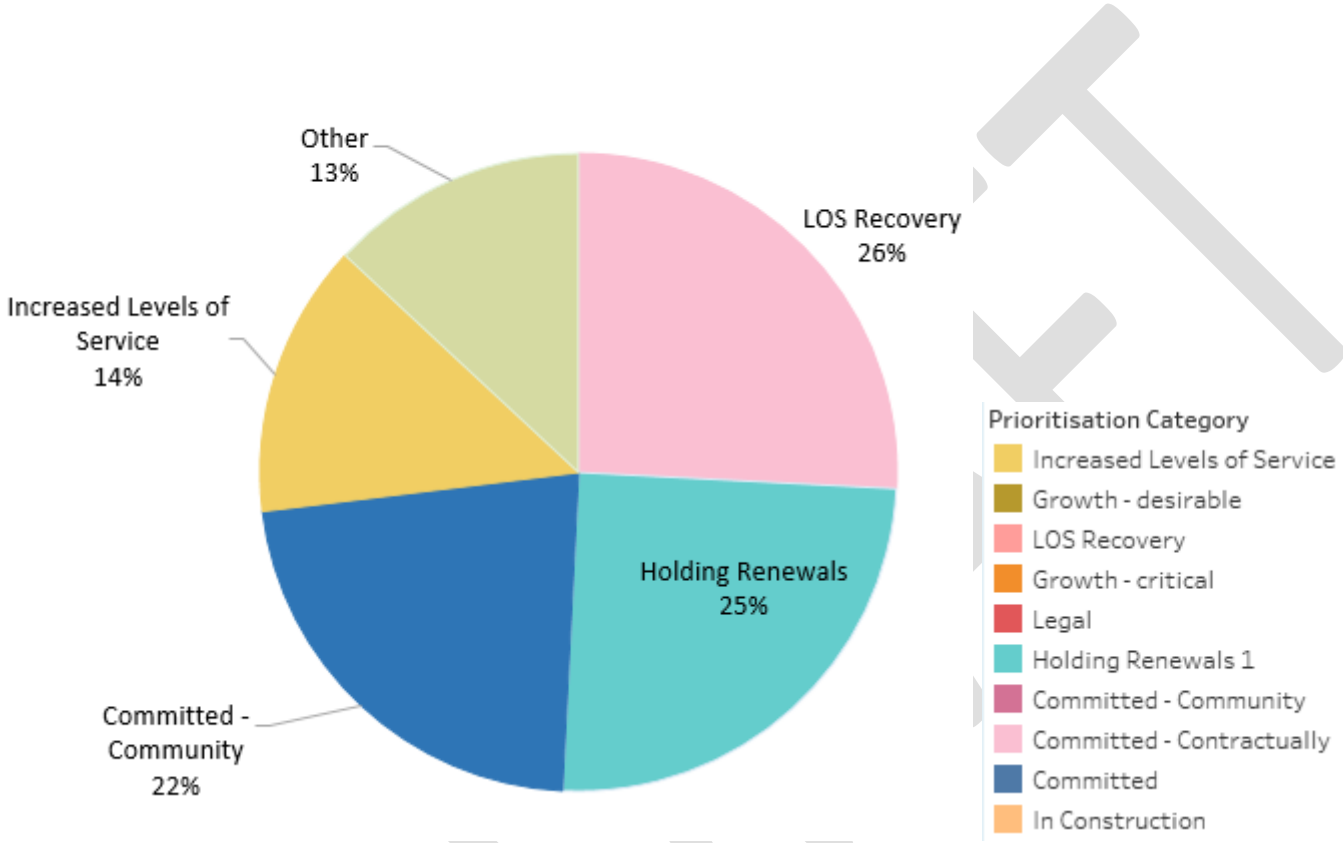


Figure 9.9: Stormwater - percentage capital expenditure by prioritisation category – Option 1 Medium

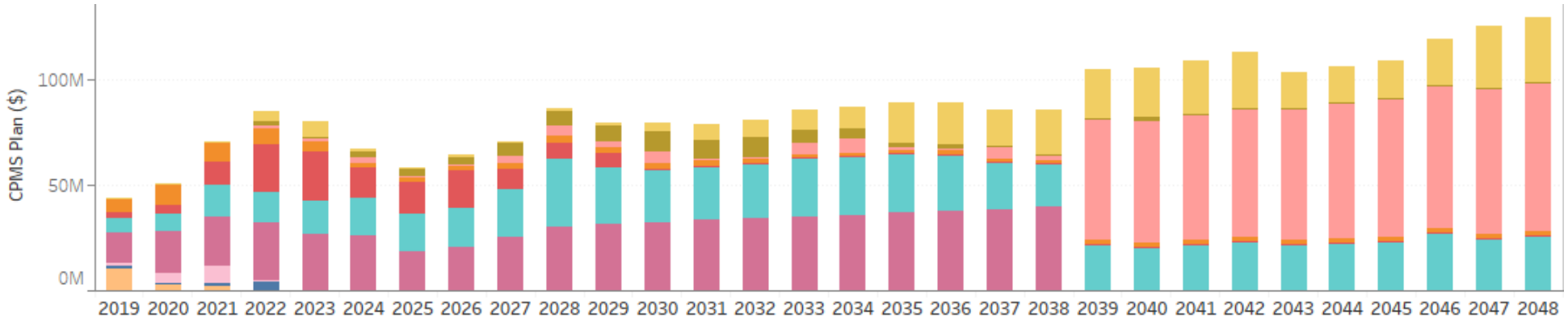


Figure 9.10: Stormwater– projected capital expenditure by prioritisation category – Option 1 Medium

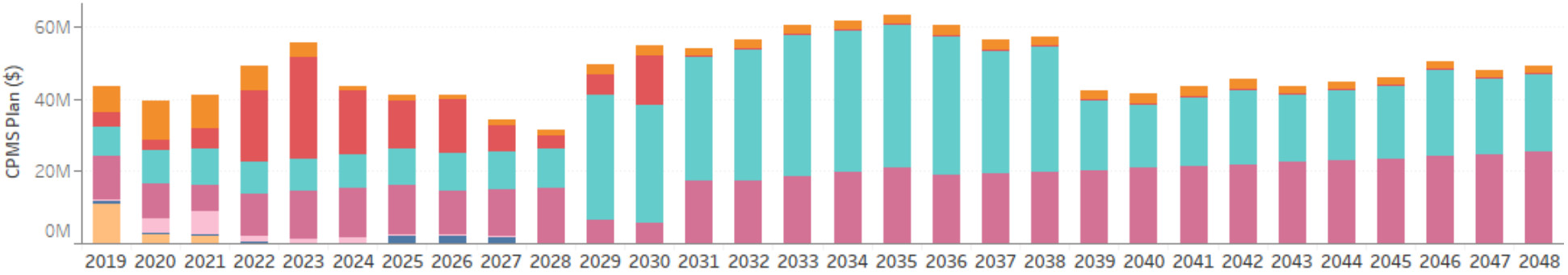


Figure 9.11: Stormwater– projected capital expenditure by prioritisation category – Option 2 Low

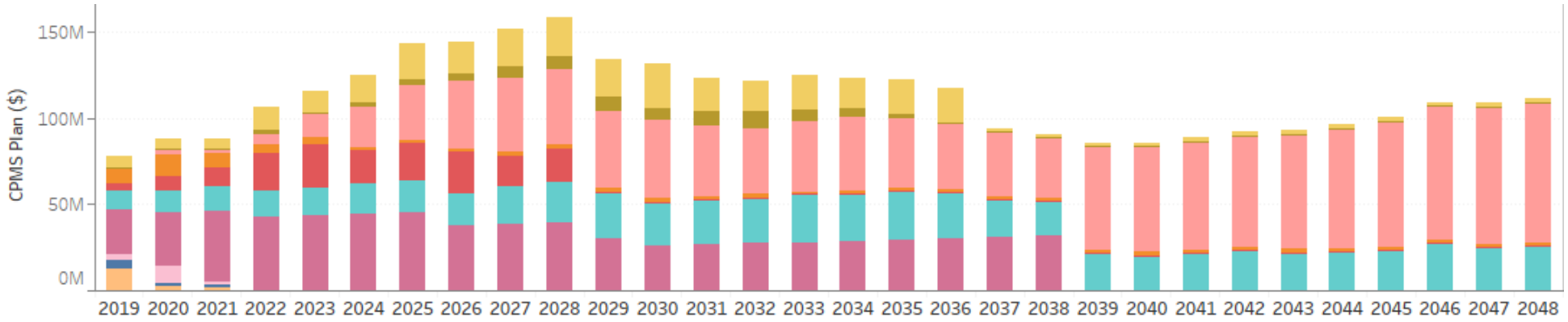


Figure 9.12: Stormwater– projected capital expenditure by prioritisation category – Option 3 High

9.4 Transport

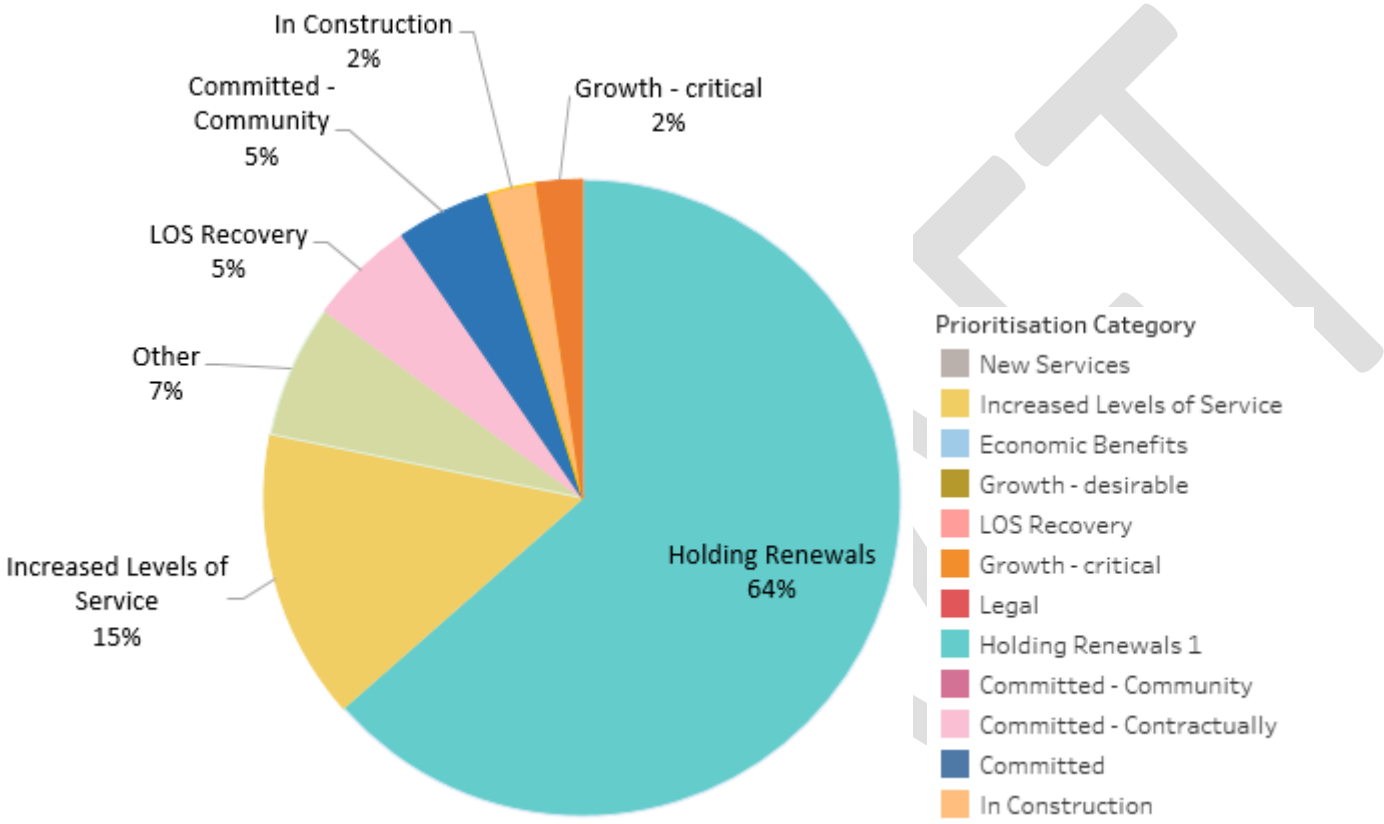


Figure 9.13: Transport - percentage capital expenditure by prioritisation category – Option 1 Medium

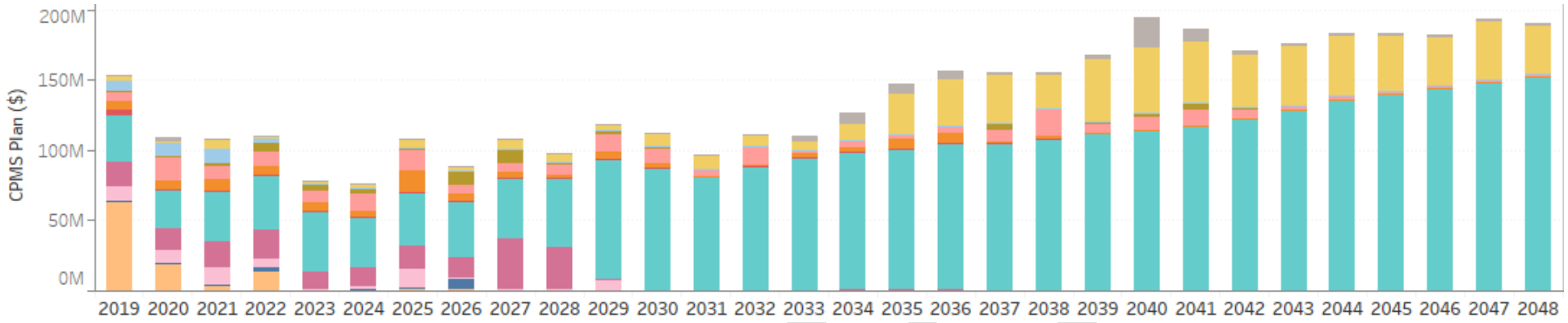


Figure 9.14: Transport – projected capital expenditure by prioritisation category – Option 1 Medium

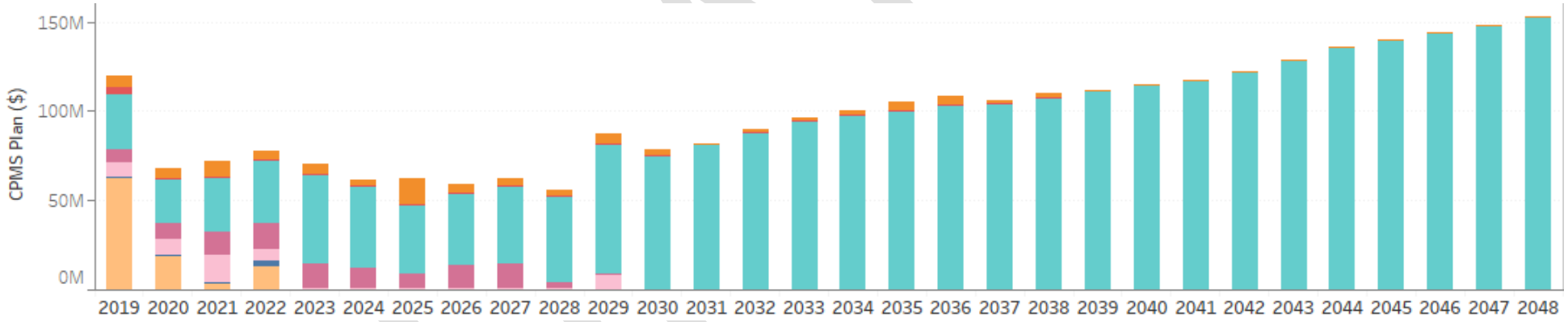


Figure 9.15: Transport – projected capital expenditure by prioritisation category – Option 2 Low

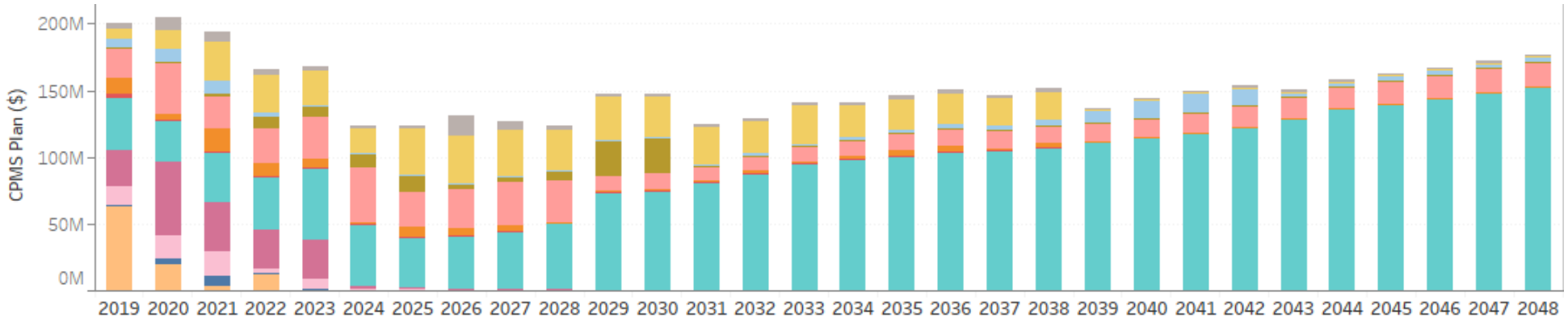


Figure 9.16: Transport – projected capital expenditure by prioritisation category – Option 3 High

9.5 Facilities

Note that so that all capital expenditure is captured in the Infrastructure Strategy, the financial information shown below includes the following group of activities: Communities and Citizens, Corporate Capital, Housing, Regulation and Compliance, Strategic Planning and Policy (other than Information and Communication Technology).

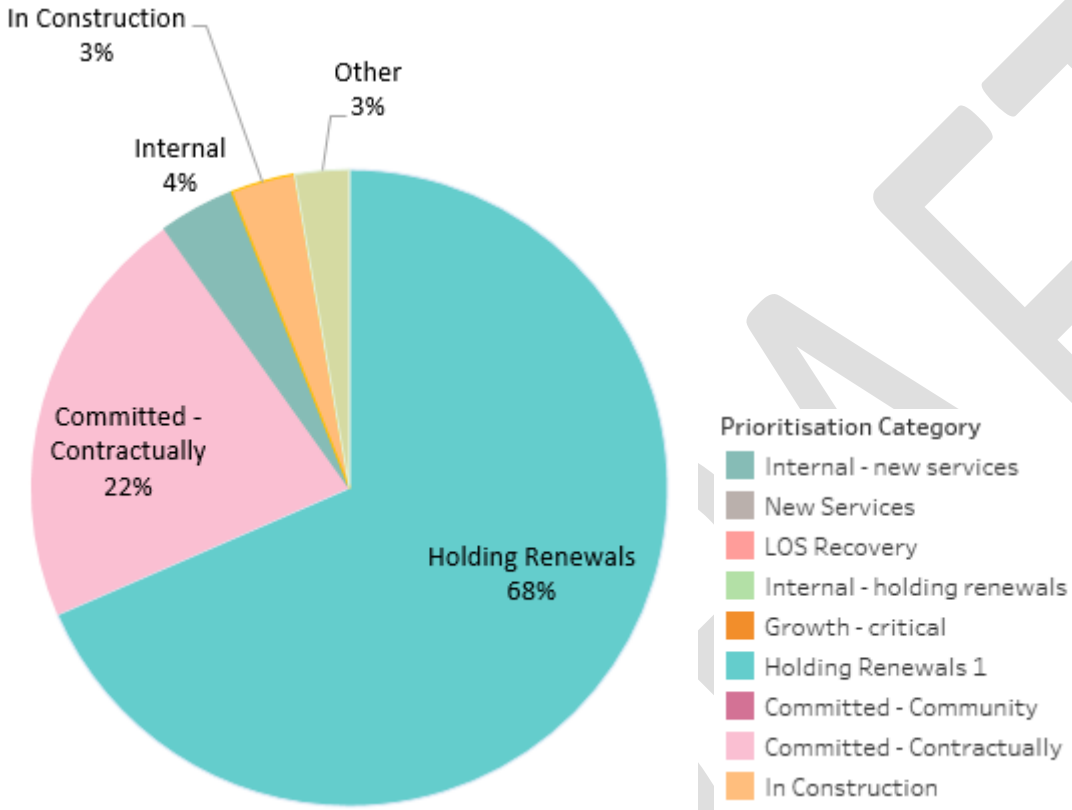


Figure 9.17: Facilities - percentage capital expenditure by prioritisation category – Option 1 Medium

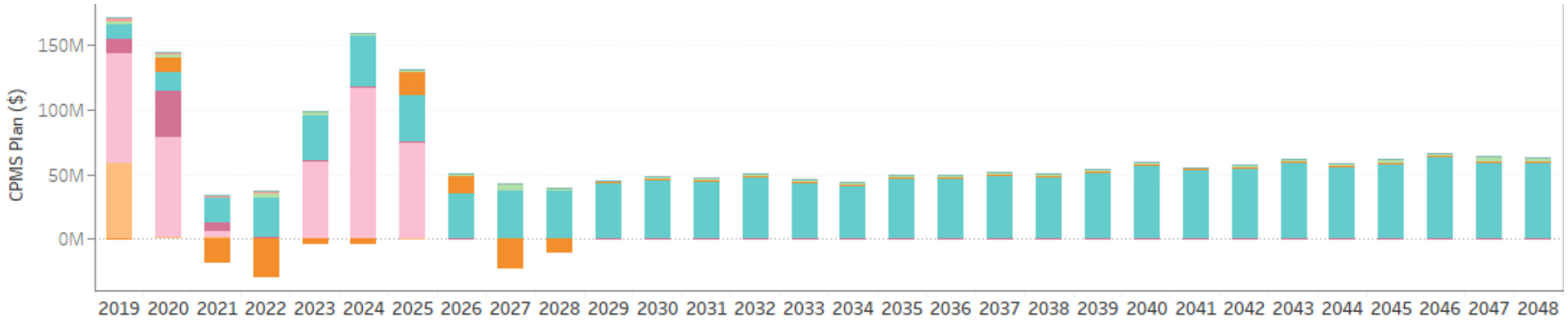


Figure 9.18: Facilities – projected capital expenditure by prioritisation category – Option 1 Medium

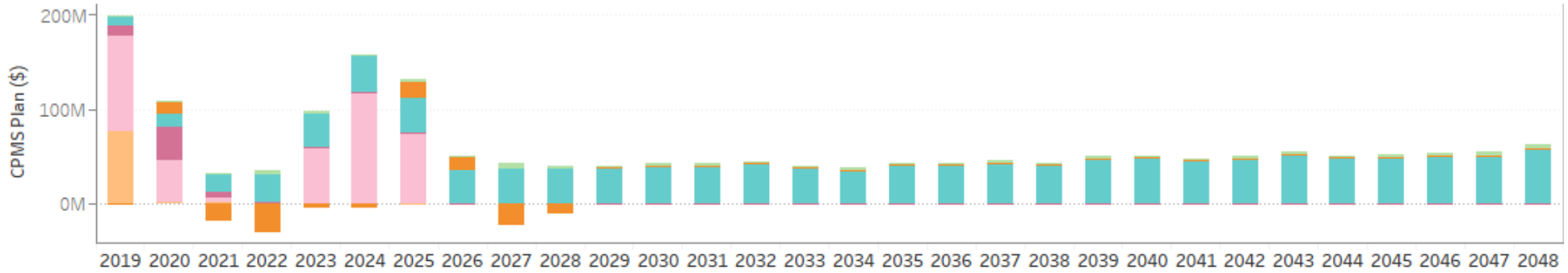


Figure 9.19: Facilities – projected capital expenditure by prioritisation category – Option 2 Low

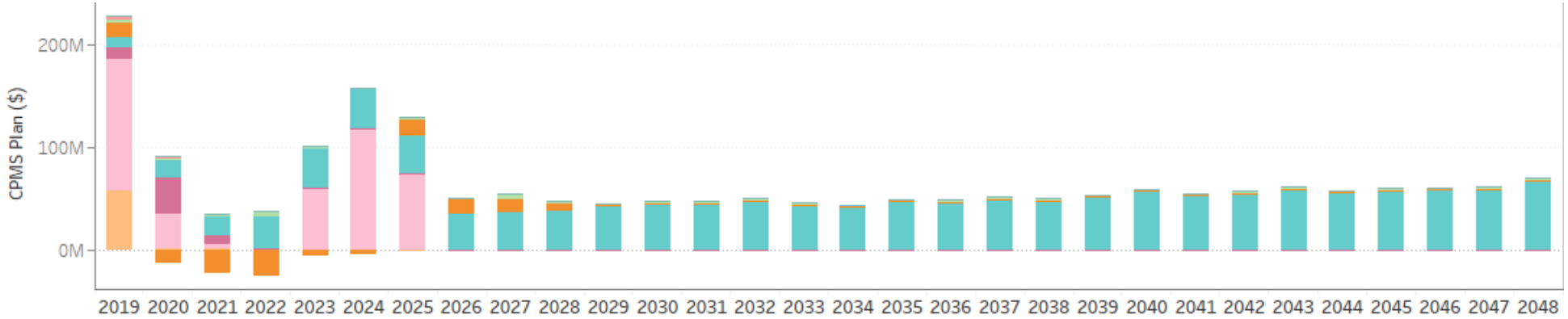


Figure 9.20: Facilities – projected capital expenditure by prioritisation category – Option 3 High

9.6 Parks

The graphs shown below are for the Parks, Heritage and Coastal Environment group of activities.

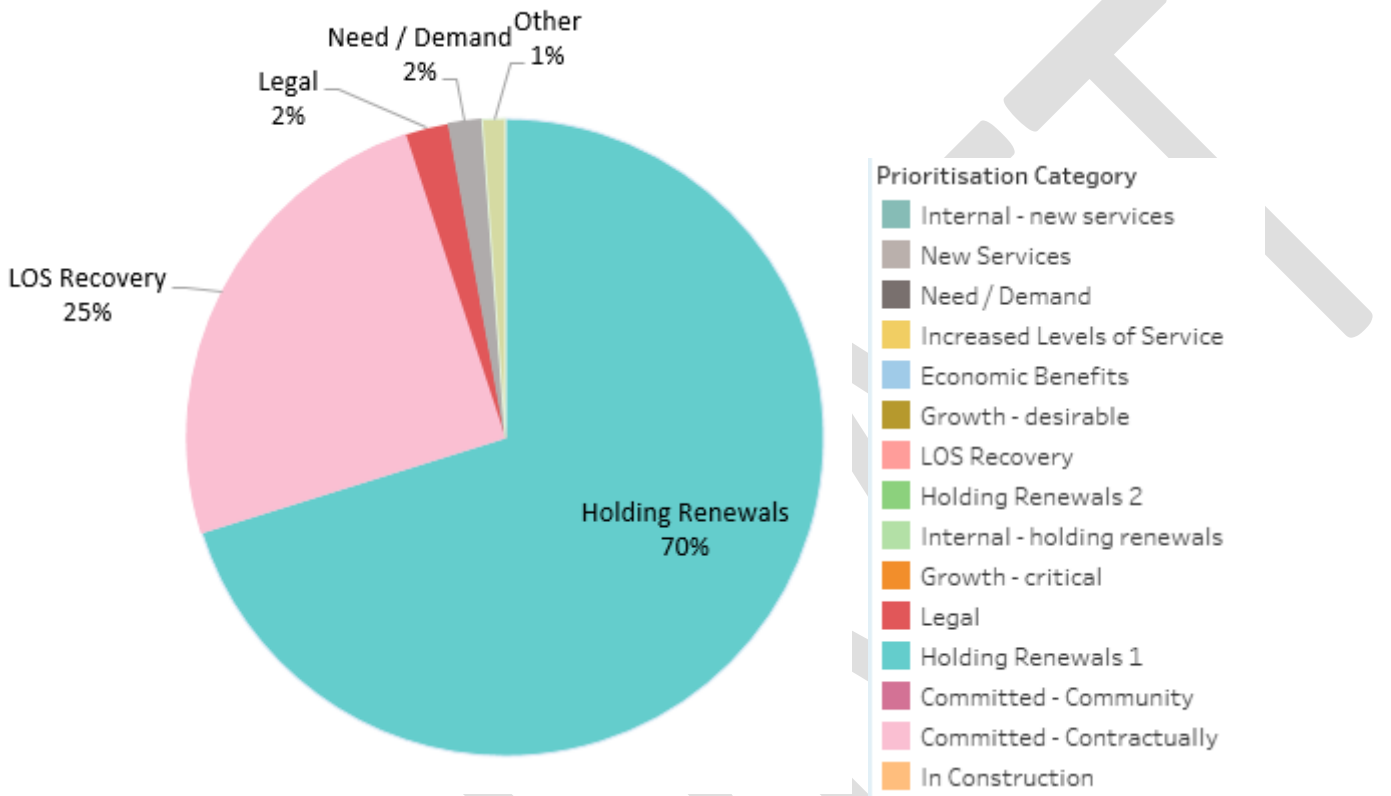


Figure 9.21: Parks - percentage capital expenditure by prioritisation category – Option 1 Medium

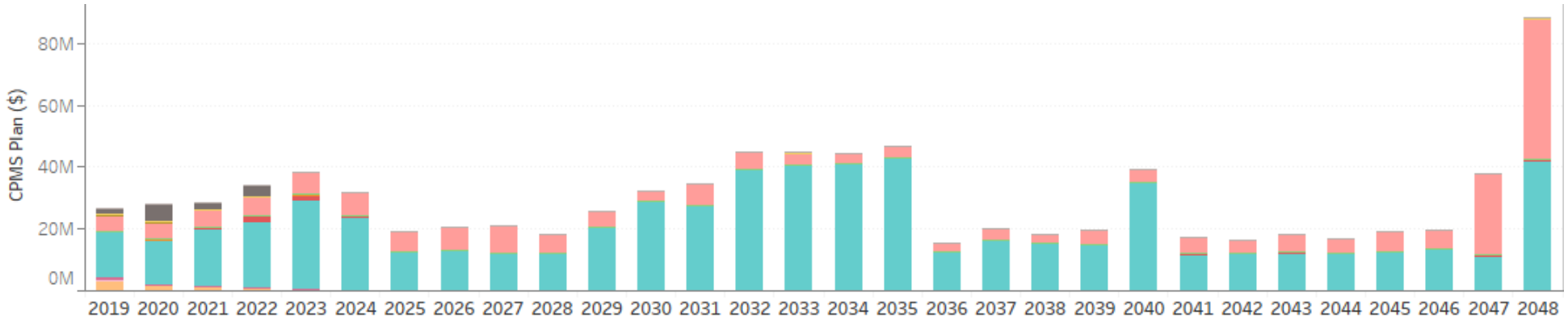


Figure 9.22: Parks – projected capital expenditure by prioritisation category – Option 1 Medium

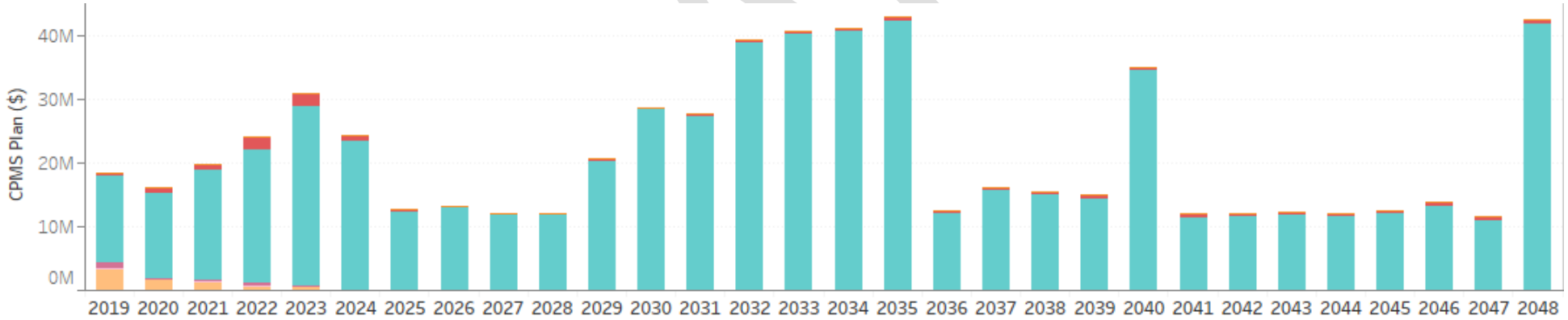


Figure 9.23: Parks – projected capital expenditure by prioritisation category – Option 2 Low

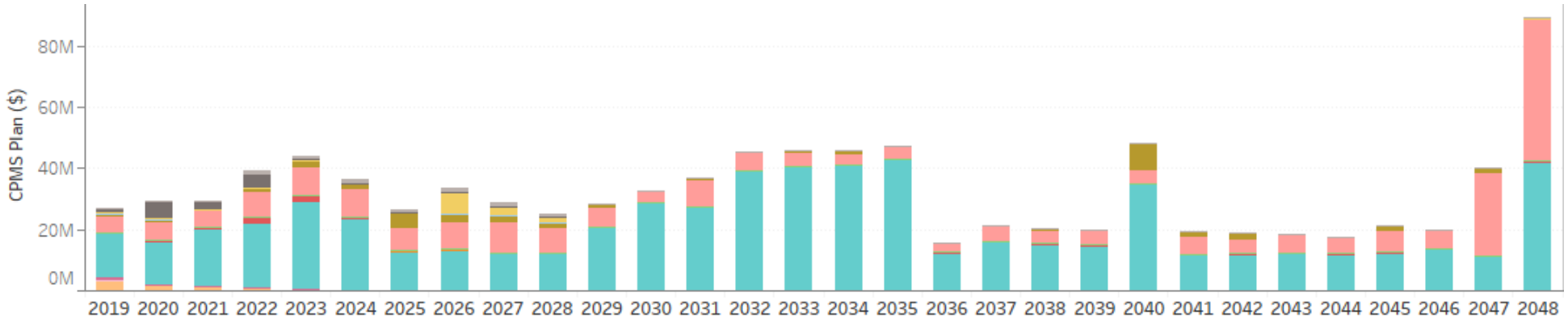


Figure 9.24: Parks – projected capital expenditure by prioritisation category – Option 3 High

9.7 Solid waste

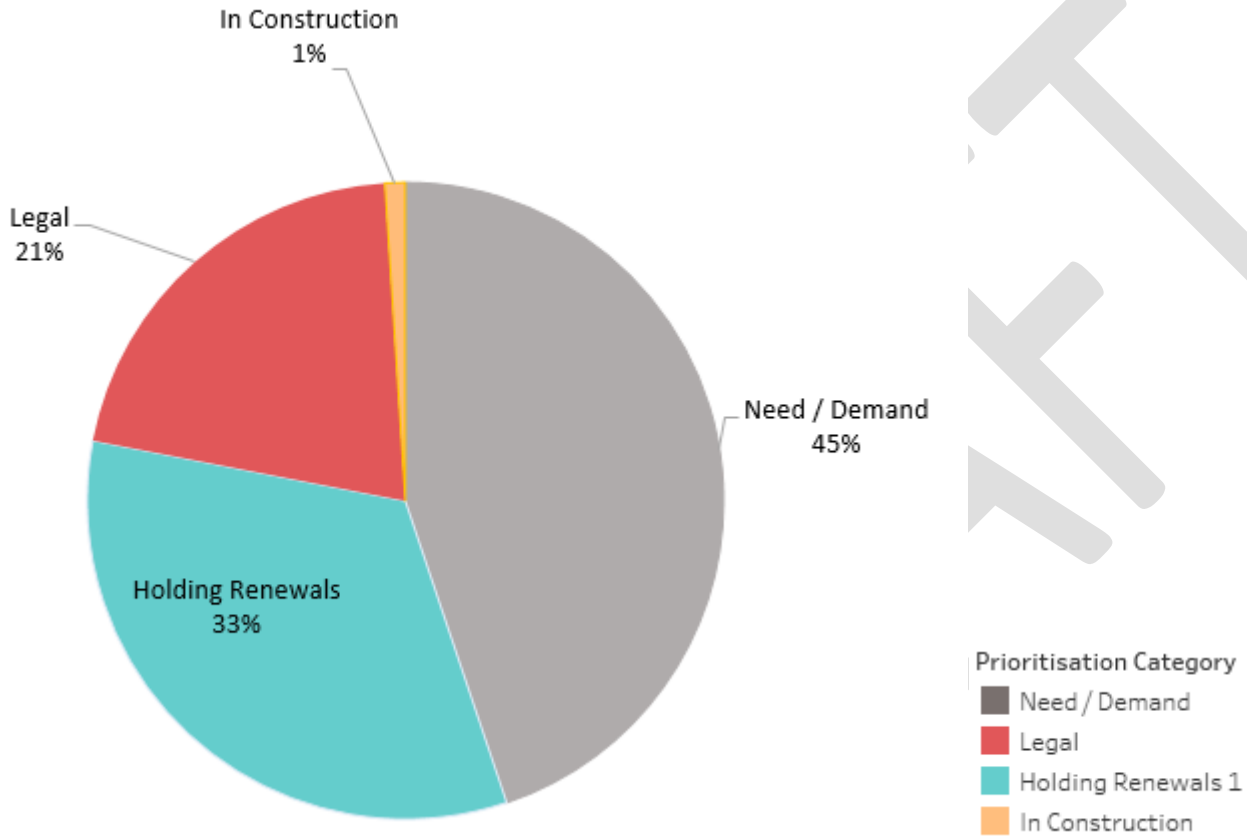


Figure 9.25: Solid waste - percentage capital expenditure by prioritisation category – Option 1 Medium

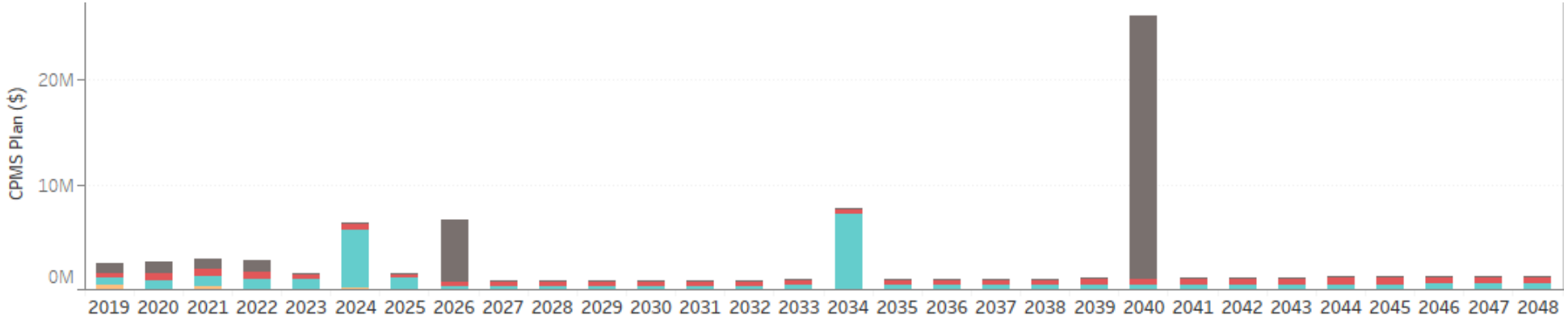


Figure 9.26: Solid waste – projected capital expenditure by prioritisation category – Option 1 Medium

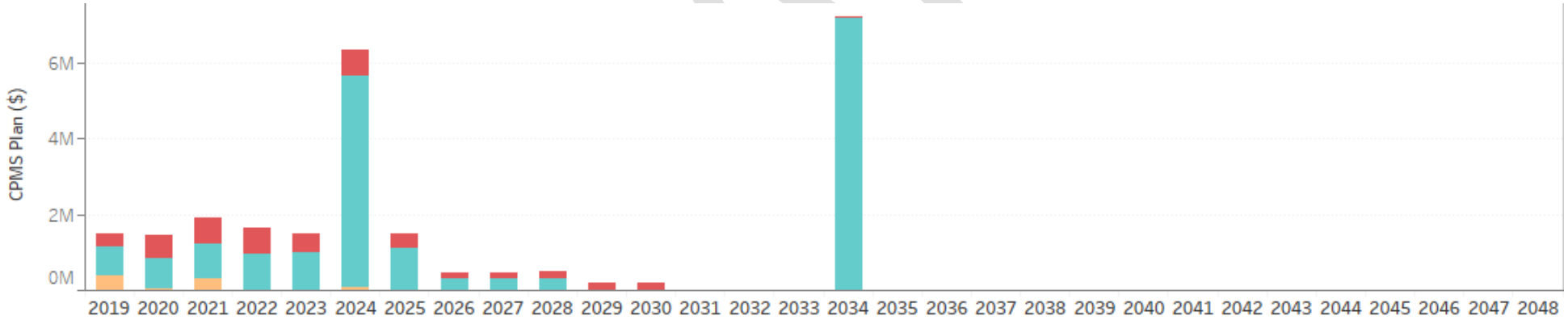


Figure 9.27: Solid waste – projected capital expenditure by prioritisation category – Option 2 Low

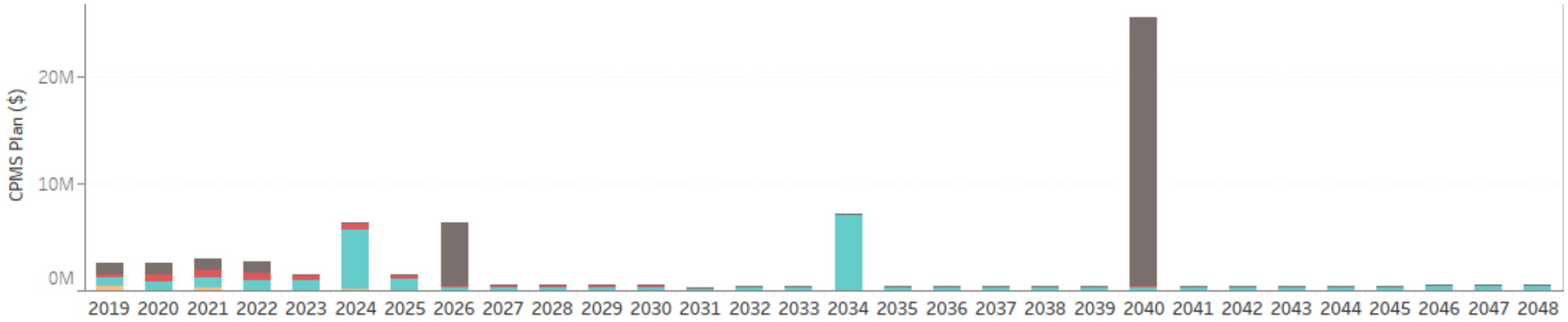
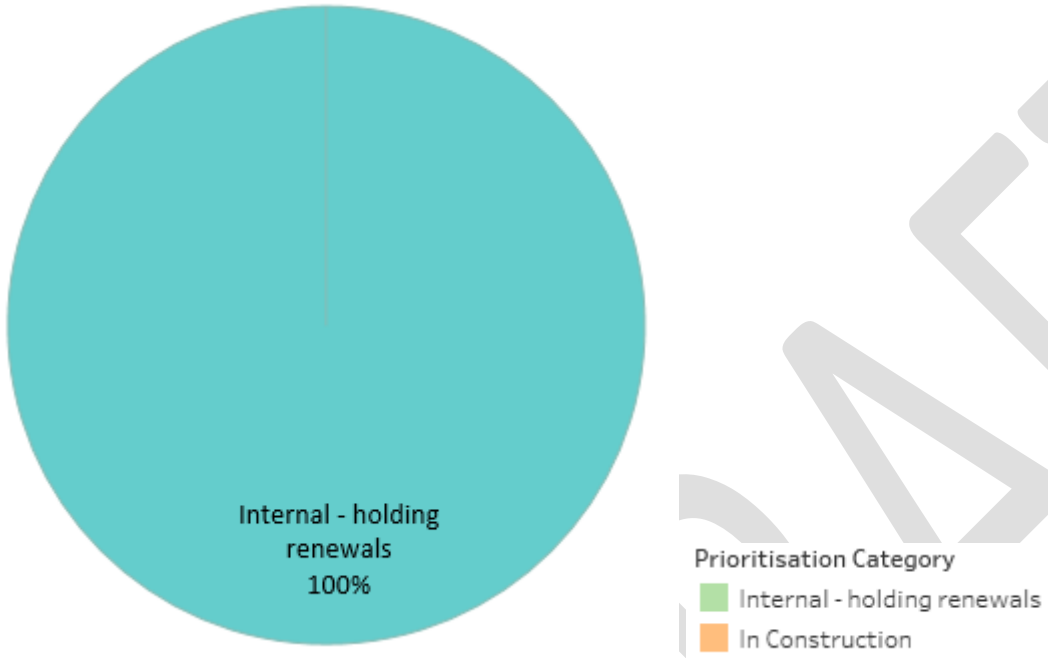


Figure 9.28: Solid waste – projected capital expenditure by prioritisation category – Option 3 High

9.8 Information and communication technology

There is no difference between the medium and high options for information and communication technology, so only one graph is shown for these options.



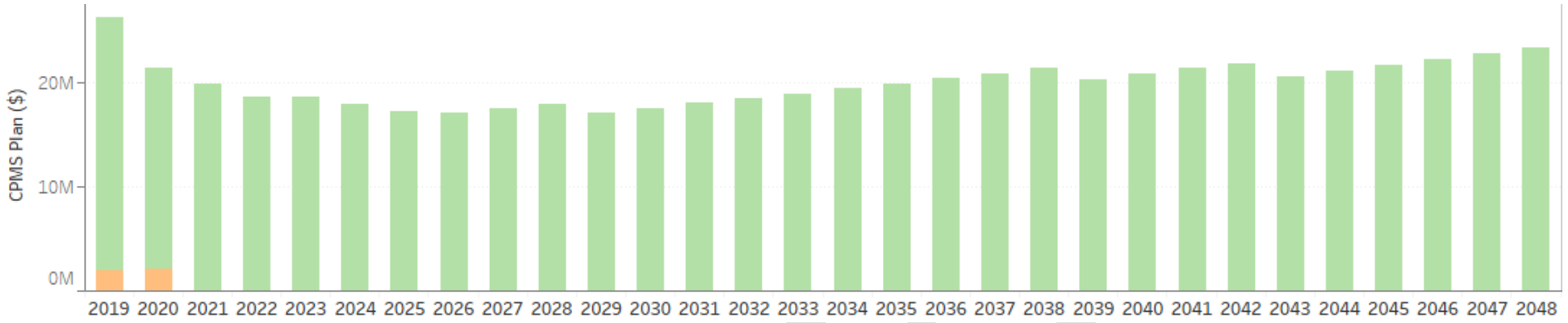


Figure 9.29: Information and communication technology – projected capital expenditure by prioritisation category – Options 1 and 3 (Medium and High)

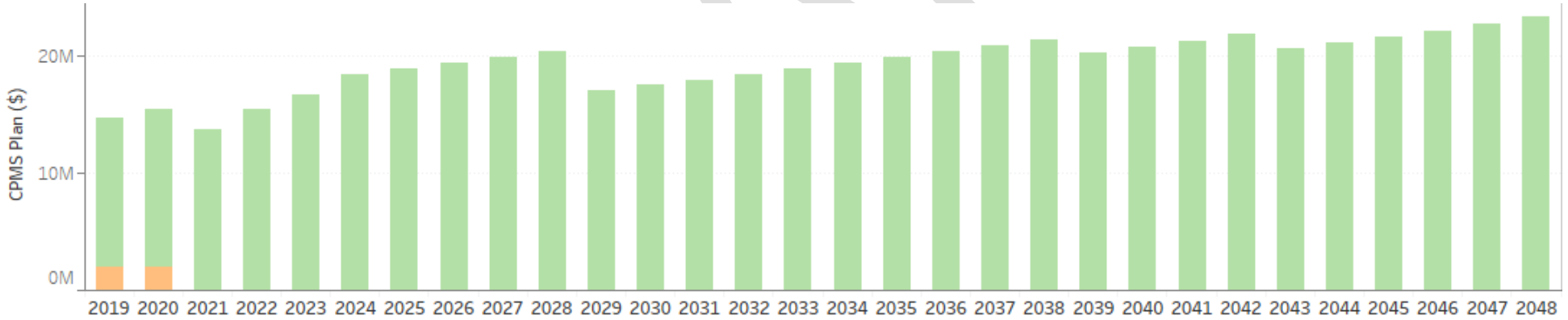


Figure 9.30: Information and communication technology – projected capital expenditure by prioritisation category – Option 2 Low

9.9 Financial impacts of the Infrastructure Strategy

To be completed

9.10 Assumptions and risks

The key assumptions and risks for the Infrastructure Strategy are set out in Table 9.1. The following items have not been included, but could have a significant impact on the capital programme if added:

- Projects to protect infrastructure from the natural hazards arising from climate change (e.g. sea level rise and coastal erosion), noting that climate change is taken into account where possible when designing new projects
- Permanently treating Christchurch's water supply
- Additional contributions to regeneration projects, particularly Ōtākaro-Avon River corridor and Cathedral Square, other than $9 million for Cathedral Square, $118 million for Avon flood plain management and stormwater treatment and $26 million for New Brighton regeneration projects
- Alpine Fault earthquake (AF8) readiness, in addition to the civil defence preparedness already undertaken by the Council
- Variations to cost-share agreements (e.g. Multi Use Arena)
- Changes resulting from Government review of 3 Waters, other legislative changes
- Moving to dispose treated wastewater to land, other than for Duvauchelle.

Table 9.1: Key assumptions and risks

Significant assumptions	Uncertainty	Impact	Mitigation measures
Population growth will be in line with the medium option	Medium	An underestimated level would lead to insufficient capacity to meet demand. An overestimated level would lead to an oversupply of capacity and the costs will become unsustainable.	Monitoring trends, using Statistics NZ growth projections, frequent review and adjustment where necessary
The condition grades for water supply, wastewater, stormwater and roads are correct	Low	If the condition grades were too conservative, assets would be renewed earlier than required. If they were too optimistic, assets would fail before they were renewed and reactive maintenance and operational costs would increase.	Continue with asset condition assessment programmes
The current asset data is correct and up-to-date	Low	Incomplete or inaccurate asset data could lead to inaccurate renewal forecast expenditure	Quality assurance processes for asset data

Significant assumptions	Uncertainty	Impact	Mitigation measures
Effective lives used in asset renewal models are correct	Moderate	If the effective lives were too conservative, assets would be renewed earlier than required. If they were too optimistic, assets would fail before they were renewed and reactive maintenance and operational costs would increase.	Continue to improve the modelling of effective lives of assets
Cost estimates used to develop the capital programme are accurate to ±30%	Medium	If cost estimates are too low, the planned spend would be insufficient to undertake the planned work. If they are too high, the Council will underspend its budget.	Refine cost estimates at every stage of the project
The growth-related capital programme is based on rate of growth and growth areas as shown in the Christchurch District Plan, with a focus on the north and south-west areas of the city	Low	If growth occurred in other areas, additional infrastructure would need to be built and additional budget would be required.	Careful consideration of the infrastructure impacts of any additional land rezoning
Climate change projections for changes in rainfall and sea level rise are from the Ministry for Environment, based on the information provided by the International Panel on Climate Change	Medium	Where projects have been designed to include the impacts of climate change (e.g. increased pipe capacity), if climate change effects occur more slowly than expected then investment may have been too conservative. If climate change effects occur more quickly than expected, changes to infrastructure may need to be made earlier than expected.	Continue to keep abreast of the latest climate change predictions
Specific projects to address the impacts of climate change are not included	High	If the Council chooses to undertake projects to address the effects of climate change (e.g. sea walls), additional budget would be required.	Council to prepare a strategy for climate change and associated natural hazards
Water supply, wastewater and stormwater hydraulic computer models are accurate	Medium	Projects may be oversized or undersized if the models are inaccurate, and expenditure would be too low or too high as a result.	Maintain and calibrate the network models on a regular basis

Significant assumptions	Uncertainty	Impact	Mitigation measures
The modelled numbers of properties with increased flood risk as a result of the earthquakes is accurate	Medium	Land Drainage Recovery Programme projects may not deliver on the goal of returning flood risk to pre-earthquake levels. Additional or fewer houses may be flooded if the model is inaccurate.	Complete and calibrate the city wide stormwater model, update it regularly
Land can be purchased where needed	Medium	If land cannot be purchased, projects would need to be relocated or deferred until land could be acquired	Use best endeavours to acquire the land needed in a suitable location. Use the Public Works Act to compulsorily acquire land where this is needed to deliver essential projects.
Traffic growth is in line with Greater Christchurch population growth projections	Medium	An underestimated level would lead to insufficient capacity to meet demand. An overestimated level would lead to an oversupply of capacity and the costs will become unsustainable.	Monitoring trends, using Statistics NZ growth projections, frequent review and adjustment where necessary
The Council is not required to treat Christchurch's water supply to provide an additional barrier for bacteria and protozoa	High	The cost of treating the city's water supply would be significant	Report promptly to Council on the outcomes of Stage 2 of the Havelock North Drinking Water Inquiry expected in December 2018, including the options and cost implications, so that the Long Term Plan can be amended accordingly
The Council does not make a financial contribution to the regeneration of the residential red zone	High	If the Council did contribute to the regeneration of the red zone, this could exceed $100 million	Update the Long Term Plan once a decision has been made about the Council's contribution to the regeneration of the residential red zone
There are no variations to cost share agreements (e.g. multi use arena)	Medium	If changes are made to cost share agreements, additional budget would be required	Careful consideration by Council of any variations to cost share agreements
Resource consents can be obtained	Low	If resource consents cannot be obtained, projects would be delayed and may need to be redesigned, and this is likely to result in increased costs.	Prepare a consenting strategy for each project which identifies the risks and required engagement with key stakeholders

Significant assumptions	Uncertainty	Impact	Mitigation measures
Traffic models are accurate	Low	Projects may be oversized or undersized if the models are inaccurate, and expenditure would be too low or too high as a result.	Maintain and calibrate the network models on a regular basis

The inflation figures that were assumed for capital and operating expenditure are shown in Table 9.2. These are consistent with the assumed inflation in the Finance Strategy.

Table 9.1: Assumed Inflation Rates

Inflation (%)	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29-FY48
Capital expenditure	-	2.00%	2.10%	2.10%	2.10%	2.20%	2.30%	2.40%	2.40%	2.50%	2.40%
Operating expenditure	-	2.10%	2.30%	2.30%	2.30%	2.40%	2.50%	2.50%	2.60%	2.70%	2.50%

10.0 APPENDIX 1 - CONTEXT

10.1.1 Christchurch district

The Christchurch territorial authority area is located on the central east coast of the South Island and includes the metropolitan area of Christchurch city, Banks Peninsula and surrounding rural areas.

10.1.2 Population

Christchurch is the largest city in the South Island of New Zealand and is home to 387,200[2] residents. Christchurch's population is forecast to be 467,000 by 2048, an increase of 80,000[3]. This will be driven population drift to larger cities, and new residents coming to pursue career and lifestyle opportunities. New migrants are essential to the ongoing success of Christchurch, bringing skills and aspirations essential for a modern city economy.

This means Christchurch will need around 32,000 new homes, based on the current average household size. The Council's planning approach is for approximately 20% of future residential growth to be located in new greenfield developments and 80% in infill areas within the current urban limits. This requires extending infrastructure networks to the new greenfield developments and, where necessary, increasing the capacity of existing infrastructure to cater for both infill and greenfield development. A significant component of the planned residential intensification is for the number of homes in the central city area (within the four avenues) to increase from the current 3,000 to 8,000 by 2048.

The demographic profile of the district is also set to change significantly over the next 30 years. Christchurch's population is ageing and the number of residents aged over 65 will nearly double by 2048, rising from 58,880 in 2018 to 91,630. Christchurch will also become more multicultural and diverse.

Population growth, ageing and increasing cultural diversity will result in changes in demand for housing, commercial facilities and services, and infrastructure, as well as changing the demand for some community facilities and services. The Council's infrastructure planning and delivery must anticipate and respond to the demands these changes will bring while remaining affordable for residents.

10.1.3 Geography

Christchurch district covers 1493 square kilometres, of which 194 square kilometres is urban, almost all being the metropolitan Christchurch area. Banks Peninsula covers 70% of the land area of Christchurch district.

Christchurch is in a seismically active area with the Alpine Fault 100 kilometres west and the Porters Pass Fault zone 50 kilometres west. The Greendale Fault, cause of the major earthquake on 4 September 2010, extends within 18 kilometres of Christchurch. There are at least two faults within Christchurch running from Heathcote towards New Brighton, which caused the major earthquakes of 2011. All these faults are active and capable of generating major earthquakes.

[2] Statistics NZ Medium projections for Christchurch

[3] Statistics NZ Medium projections for Christchurch

Much of the city and some of the urban settlements on Banks Peninsula are built on low lying land and are vulnerable to flooding and/or coastal hazards. These risks are expected to be exacerbated by sea level rise.

Neighbouring towns of Kaiapoi, Rangiora, Lincoln and Rolleston all have a large proportion of residents who commute to work in Christchurch. This has infrastructure implications for Christchurch, particularly with respect to the transport networks.

10.1.4 Economy

The Christchurch economy has outperformed New Zealand as a whole over the past 6 years, driven by the post-earthquake rebuild. The local economy is expected to return to normal activity and growth levels may underperform relative to New Zealand as a whole over the next 2 – 5 years.

At the macroeconomic level New Zealand is forecasting continued economic growth. Interest and inflation have been at historic lows. While both are forecast to rise the increase will still see them at very low levels (around 3%). This means the interest cost of providing infrastructure should remain relatively low, which provides the Council with more choices with respect how it invests community funding.

Christchurch is likely to see economic growth from internal and external migration creating additional demand for local goods and services and from the shift in economic drivers from manufacturing to service and technology sectors.

10.1.5 Environment

Like most cities in the world Christchurch's environmental indicators point to there being significant work to do to mitigate past and present negative impacts on the environment and to change to environmentally sustainable approaches. The planning, delivery and management of the Council's infrastructure presents challenges and opportunities to reduce the city's environmental footprint and show leadership in protecting and valuing Christchurch's environment.

Christchurch has chosen to be a leader in climate change and the Mayor is considering signing the Global Covenant of Mayors. One of the immediate requirements is to understand how this impacts on infrastructure over the next 30 years so that climate change imperatives can be understood and factored into infrastructure planning and delivery.

10.1.6 History of Christchurch City Council

Christchurch was founded in 1850 on the arrival of about 800 settlers from the United Kingdom, and became New Zealand's first city, by Royal Charter, in 1856. Responsible local government began when the first meeting of the Christchurch Municipal Council, established under a provincial ordinance, was held on 3 March 1862.

The original boundaries of the city were the North, East and South Town Belts and to the west, Antigua Street (which then included Rolleston Avenue) and the Avon River parallel to Park Terrace. In 1863 the boundaries were extended to the south-west to bring the wedge between Antigua Street, the South Belt and Hagley Avenue into the city. These remained the limits of the city until 1903.

In 1903 the St Albans, Sydenham and Linwood boroughs were absorbed by Christchurch City. Woolston and Spreydon became part of the city in 1921. In the 1940s the city absorbed the New Brighton borough and the Sumner borough. The city also gained more area from the Heathcote and Waimari counties.

As a result of the 1989 local government reforms on 1 November 1989 Christchurch City Council took over the functions of the former Heathcote County Council, Riccarton Borough Council, Waimairi District Council, part of Paparua County Council, and the Christchurch Drainage Board. On 6 March 2006, Banks Peninsula District Council merged with Christchurch City Council.

10.1.7 Canterbury earthquakes and Christchurch regeneration

The earthquakes of 2010 – 2011 resulted in the death of 185 people, many serious injuries and widespread damage to thousands of homes and businesses, including most of the central city. There was considerable damage to public infrastructure, including roads, bridges and underground services. Many of the district's community facilities were lost or damaged. The district lost many of its heritage features, and considerable damage was caused to natural and cultural values, particularly associated with waterways.

The pattern of damage was uneven, with the central city and eastern suburbs being hardest hit. The east continues to have the most residual infrastructure issues.

The cost of the earthquake rebuild was estimated at $40 billion including between $2 billion and $3.4 billion to repair infrastructure. The SCIRT alliance, established to repair the Council's horizontal infrastructure, delivered more than 700 individual projects costing $2.22 billion. However, not all damage was repaired and this now forms part of the Council's renewal programme.

The effects of the earthquakes will be felt for many years and urban Christchurch will continue to change during the recovery period, particularly over the next 10 to 15 years. As the rebuild proceeds, businesses and residents will relocate, with many likely to move back to the Central City.

The city's infrastructure must support the regeneration of the city. The Council's strategic infrastructure decisions will play an important role in shaping where, when and how development will occur.

The post-earthquake rebuild and regeneration has seen the Council partner with the Crown and private sector to repair and replace damaged infrastructure and to plan for and service new growth areas. The replacement Christchurch District Plan has introduced objectives and policies for natural hazards to improve the resilience of the rebuild and regeneration of the city.

The following agencies will continue to influence Council decision-making on delivering community benefit through service and infrastructure provision:

1. **Ōtākaro Limited.** Ōtākaro is delivering Crown-led Anchor Projects in Central Christchurch. The purpose of Ōtākaro is to add value to anchor projects and Crown land, balancing commercial outcomes with regeneration (social) outcomes, and to support the Crown's exit over time on favourable terms. The Council is partnering with Ōtākaro to plan, design, fund and build Anchor Projects (e.g. the Metro Sports facility and the Convention Centre).

2. **Regenerate Christchurch.** Established in April 2016 to lead the regeneration planning for Christchurch and, in particular, to consider the future use of the residential red zone land. A body corporate, governed by legislation through the Greater Christchurch Regeneration Act 2016 (Act), it will cease to exist on 30 June 2021. Regenerate Christchurch has an initial focus on the following areas:
    - Central City
    - Ōtākaro-Avon River corridor
    - New Brighton

10.1.8 Papatipu Rūnanga

Six Ngāi Tahu Papatipu Rūnanga have manawhenua over areas within the Christchurch City Council territorial boundaries. The Rūnanga hold their role as kaitiaki (guardian) as fundamental to their relationship with the environment. This includes the protection of natural resources, such as water and biodiversity, and access to and protection of sites and areas of historic and cultural significance.

The six Rūnanga are:

- Te Rūnanga o Wairewa
- Te Ngāi Tūāhuriri Rūnanga
- Te Rūnanga o Koukourārata
- Te Taumutu Rūnanga
- Te Hapū o Ngāti Wheke
- Ōnuku Rūnanga

10.1.9 Linkage with other documents

Finance Strategy

The 30 year Finance Strategy and 30 year Infrastructure Strategy are aligned. The Finance Strategy ensures that the Infrastructure Strategy is affordable, and can be delivered within financial limits and generally accepted accounting principles.

The Finance Strategy includes financial limits set by the Council that effectively provide a limited funding envelope for each financial year.

Long Term Plan

The Council's Long Term Plan details its planned work programme and budget for a 10 year period. The Long Term Plan is the primary implementation document to carry through the direction set in the Infrastructure Strategy. After community consultation and hearings the Council the Long Term Plan is adopted, including the Infrastructure Strategy and Finance Strategy.

Christchurch City Council's Long Term Plan typically contains over 1200 programmes and projects to be implemented over the 10 year period covered. The majority of projects are infrastructure related. This planning process allows the Council to take a long-term view of its responsibilities while enabling it to adjust for changing service demand and financial priorities.

The planning horizon for the Infrastructure Strategy is at least 30 years and it therefore extends well beyond the more detailed planning included in the Long Term Plan. This helps the Council and the community to see the longer term approaches planned and knows what it can expect to come into future Long Term Plans at the appropriate time.

Together the Infrastructure Strategy, the Finance Strategy and the Service Plans form the pillars of the Long Term Plan.

National Policy Statements

A National Policy Statement enables central government to prescribe objectives and policies for resource management matters of national significance. The following Statements are relevant to the Infrastructure Strategy:

1. **National Policy Statement on Urban Development Capacity 2016**. This directs that in the short term (3 years) development capacity[4]must be serviced with development infrastructure, in the medium term (3-10 years) development capacity must be serviced with development infrastructure or the funding for the development infrastructure required to service that development capacity must be identified in a Long Term Plan; and in the long term (10-30 years) development capacity must have the required development infrastructure identified in the Infrastructure Strategy. It further directs that local authorities of high growth areas (including Christchurch) produce a future development strategy. The future development strategy must demonstrate that there will be sufficient, feasible development capacity in the medium and long term and identify the broad location, timing and sequencing of future development capacity. The future development strategy shall be informed by the Long Term Plan and Infrastructure Strategy, and it is imperative that the directions of this Infrastructure Strategy takes account of these requirements.

2. **National Policy Statement for Freshwater Management 2014**. The discharge of stormwater and treated needs to meet the values set by the community. The Infrastructure Strategy needs to ensure there are adequate programmes to achieve these value requirements.

Greater Christchurch Urban Development Strategy (UDS)

The urban development strategy was prepared in collaboration with Selwyn, Waimakariri, New Zealand Transport Agency (NZTA) and Environment Canterbury (ECan). Its fundamental purpose is to manage the growth of Greater Christchurch. It is given effect through the Canterbury Regional Policy Statement and District Plans for Christchurch City, Waimakariri and Selwyn. A key element of the Urban Development Strategy is to identify future infrastructure demand patterns so partner Councils can examine the most cost-effective and efficient service delivery options.

Canterbury Regional Policy Statement (CRPS)

The Canterbury Regional Policy Statement gives an overview of the significant resource management issues facing the region, including issues of resource management significance to Ngāi Tahu. The purpose of the CRPS is to set out objectives, policies and methods to resolve those resource management issues and to achieve the integrated management of the natural and physical resources of Canterbury. Chapter 5 and 6 of the CRPS provide the overarching framework for land use and infrastructure planning in Christchurch, promotes urban consolidation and integration of land use development and infrastructure.

The CRPS highlights that infrastructure should be designed, located, developed and used so adverse effects on significant natural and physical resources are avoided or mitigated and other adverse effects on the environment are appropriately controlled.

Canterbury Water Management Strategy (CWMS)

The Canterbury Water Management Strategy establishes a framework for addressing Canterbury's water resources to enable present and future generations to gain the greatest social, economic, recreational and cultural benefits from the water resources within an environmentally sustainable framework.

[4] Development capacity is defined under the National Policy Statement on Urban Development Capacity to mean "…in relation to housing and business land, the capacity of land intended for urban development based on: a) the zoning, objectives, policies, rules and overlays that apply to the land, in the relevant proposed and operative regional policy statements, regional plans and district plans; and b) the provision of adequate development infrastructure to support the development of land."

Ten water management zones across Canterbury are empowered to make local decisions about local issues while reflecting the regional goals and principles of the CWMS. They do this through a Zone Implementation Programme (ZIP) that identifies priorities and actions for their zone. Christchurch City Council has the Christchurch-West Melton, Banks Peninsula and Selwyn-Waihora zones in its district. Some actions in the ZIPs for these zones include issues that impact on the provision of infrastructure.

Iwi Management Plan

The Mahaanui is the Iwi Management Plan is the manawhenua planning document of the six Ngāi Tahu Papatipu Rūnanga who hold manawhenua rights over lands and waters within the takiwā from the Hurunui River to the Hakatere River and inland to Kā Tiritiri o Te Moana. The plan provides a values-based, plain language policy framework for the protection and enhancement of Ngāi Tahu values, and for achieving outcomes that provide for the relationship of Ngāi Tahu with natural resources across Ngā Pākihi Whakatekateka o Waitaha and Te Pātaka o Rākaihautū.

Ngāi Tahu value freshwater as a life sustaining taonga and through their role as kaitaiaki work to protect and maintain the mauri (life force) and cultural values of freshwater within their takiwa. The development of iwi management plans is an expression of kaitiakitanga and rangatiratanga and the aspirations that tangata whenua have for their future. The Infrastructure Strategy recognises the importance of these intergenerational aspirations and seeks to ensure infrastructure developed over the next 30 years restores previously degraded ecosystems.

Christchurch District Plan

The Christchurch District Plan sets a framework for development and the management of resources in the district in a manner that meets the goal of sustainable management of those resources. It includes objectives, policies and rules to manage the environmental effects of land use activities. It defines the various zones and the rules for what activities are permitted to occur in each zone. In this way a district plan has a very strong influence over all activities that occur in the district.

The District Plan gives effect to the Land Use Recovery Plan which identified changes in land development areas post the Canterbury earthquakes and set targets for household growth. The plan picks up the changes in new greenfield areas, intensification in some existing areas, new housing provisions, mixed use developments, inner city redevelopment and red zone areas. The infrastructure strategy highlights issues relating to servicing the district plan requirements. Of specific relevance is the infrastructure needed to service the new greenfield developments and ensuring that infill development areas have services that can meet the development needs.

Healthy Environment Strategies

Council has a suite of Healthy Environment Strategies:

1. ***Water Supply Strategy 2009 – 2039*** – provides direction to ensure water supplies meet legislative requirements and community needs and expectations. Includes improvement paths for all supplies to meet relevant Health (Drinking Water) Act requirements.
2. ***Surface Water Strategy 2009 – 2039*** – provides direction on how we can protect and enhance surface water quality.
3. ***Wastewater Strategy 2013 -*** Ensures adequate protection of public health, and that the wastewater infrastructure is resilient and meets the community needs for environmental, social and cultural sustainability.
4. ***Biodiversity Strategy 2008 – 2035*** - Ensures the city develops in a sustainable manner that restores degraded biodiversity.
5. ***Public Open Space Strategy 2010-2040 -*** provides aspirational levels of service based on area of parks per resident. Details what the Council needs to do to maintain greenspace and where applicable develop it to meet community requirements.
6. ***Climate Smart Strategy 2010-2025*** - Ensures development proactively mitigates the effects of climate change.

The Water Supply, Surface Water and Wastewater Strategies are currently in a consolidation process to create an Integrated Waters Strategy that will also address floodplain management. These strategies facilitate the sustainable management of the city's water resources. Significant issues relating to the infrastructure strategy include the provision of programmes to improve secure water supplies, ensuring core reticulation services are in a good condition, there is adequate treatment of wastewater to meet the discharges consents, and that the delivery of infrastructure is done in a sustainable and restorative manner.

Transport Strategies

1. ***Regional Land Transport Strategy 2012-2042*** – aims to improve land use and transport integration, increase travel choices, improve mobility of disadvantaged, increase use of active and public transport.
2. ***Christchurch Transport Strategic Plan 2012 - 2042*** – has the key goals of promoting improved access and choice of modes; creating safe, healthy and liveable communities; supporting economic vitality and creating opportunities for environmental enhancement. It has a focus on enhanced network demand management through improving travel choices, with more support for active and public transport options, while maintaining easy movement of freight and services.
3. ***Canterbury Regional Land Transport Plan*** - ensures effective, efficient and safe transport at a regional level.
4. ***Greater Christchurch Transport Statement 2012*** – seeks to integrate land use activities with transport solutions and identify some of the key measures needed to enhance the transport system for greater Christchurch over the next 30 years. It promotes safe, efficient and resilient links to connect people and places, ensuring efficient and predictable travel times between key places. It provides more options for active and public transport
5. ***Transport Strategic Business Case –*** identifies the key problems facing Christchurch's transport system, relating to transport safety, network performance and capability, transport and the environment and health
6. ***An Accessible City*** (the transport chapter of the Christchurch Central Recovery Plan) – ensures the rebuilt city centre has a multimodal transport system catering for future land use and activity needs, with enhanced choices of alternative modes to the single occupant car and offering more people friendly transport and street environment.

These strategies individually and in combination, promote a re-shaped functional transport network for the region and the city of Christchurch, supporting regeneration, economic and population growth over the next 30 years in a sustainable, resilient fashion. They are used to support long term planning for transport services with business cases to inform optimum investment decisions. They prioritise and promote multimodal transport infrastructure investments, ensuring transport upgrades across the multi-modal networks are timely to improve their safety, efficiency, convenience and attractiveness. This Infrastructure Strategy highlights the most pressing transport issues highlighted by these strategies and requiring action, noting that there will most likely be significant disruption to what the community traditionally has viewed as transport infrastructure and services over the next 30 years as a result of worldwide technology changes and the uptake of major developments such autonomous electric vehicles and the growing phenomenon of "mobiity as a service" which is demand responsive transport (e.g. Uber, calling cars in on apps, shared electric hire cars).

Waste Management and Minimisation Plan 2013

The Waste Management and Minimisation plan is required by the New Zealand Waste Minimisation Act 2008, with guidance from the New Zealand Waste Strategy 2010. The vision of the plan is "A prosperous city, in a clean, healthy and sustainable environment, where each person, business and organisation takes responsibility for waste minimisation and actively works toward zero waste to landfill". The Infrastructure Strategy looks to help decrease waste to landfill.

Christchurch Economic Development Strategy

The Christchurch Economic Development Strategy was prepared by Christchurch NZ and endorsed by the Council. It sets out projects in the region that return economic development outcomes to the city. It includes new projects being scoped, projects under way, and identifies lead agencies for the projects. The strategy has identified five large-scale opportunities which have the potential to step-change Christchurch's economy:

- Create an attractive city for residents, business, Investment and visitors. Christchurch attracts and retains residents, business, investment and visitors, and residents are proud of its amenity and profile.
- Realise the potential of Canterbury's rural economy. The region and city work together to realise Canterbury's economic opportunities while maintaining the natural environment for current and future generations.
- Maximise the commercial value of innovation. Greater economic benefits will be generated from ideas and research by improving the rate of commercialisation and ability for businesses to scale up.
- A connected, engaging and thriving central city. Central business districts are a window into cities. Christchurch must complete the regeneration of its central business district so that it plays an integral part in attracting people, visitors and new businesses to the city.
- Connect internationally for commercialisation and growth. Improve exports, commercialisation and the flow of people, ideas, investment and intellect into Christchurch. Be the gateway for Canterbury and the South Island.

Significance and Engagement Policy

The Council's Significance and Engagement Policy lists the Council's strategic assets. These are assets the Council believes are essential to its ability promote outcomes that it believes are important to the current or future wellbeing of the community.

A decision to transfer the ownership or control of a strategic asset cannot be made unless it is explicitly provided for in the Council's Long Term Plan and the public is consulted through the Special Consultative Procedure (SCP).

The Council-owned assets listed as strategic are:

- the stormwater collection and disposal system
- the wastewater collection, treatment and disposal system
- the water collection, storage, treatment and distribution system
- the waste management system
- the roading network
- all public transport infrastructure owned or operated by the Council
- Christchurch Town Hall
- Christchurch Art Gallery and its permanent collection
- all land and buildings comprising the Council's social housing portfolio
- all public library facilities
- all parks and reserves owned by or administered by the Council
- all public swimming pools
- all waterfront land and facilities owned or operated by the Council, including wharves, jetties, slipways, breakwaters and seawalls
- cemeteries and listed heritage buildings and structures.

11.0 APPENDIX 2 – ASSET DESCRIPTION

11.1.1 Replacement value of assets

The core infrastructure assets and their replacement values are shown in Table 11.1. The replacement value shown is the optimised renewal cost, which is the cost of renewing an asset in a way that meets current standards.

Table 11.1: Value of infrastructure assets

Asset	Description	Replacement value ($ million)	% of total
Water	Water extraction, treatment and distribution	$2,496	19.9
Wastewater and solid waste	Wastewater collection, treatment and discharge Kate Valley landfill, transfer stations, composting facility, recycling facility	$3,550	28.1
Stormwater and flood protection	Stormwater collection and discharge	$1,154	9.2
Transport	Roads (arterial, collectors, local; curbs and gutters), bridges, footpaths, cycleways, bus priority lanes and stops and ancillary infrastructure such as lighting, signals, signs.	$3,578	28.5
Community facilities and parks	Christchurch Art Gallery, Akaroa Museum, libraries, recreation and leisure centres, outdoor aquatic centres, paddling pools, stadia, camp grounds, golf course, community halls and facilities, volunteer libraries, early learning centres, social housing, community parks, regional parks, Botanic Garden, Hagley Park, cemeteries	$1,698	13.5
Information and communication technology	Information, software, integration services, equipment, servers, storage, network and telecommunications	$95	0.8
TOTAL		**12,476**	**100%**

Council has insurance of $2.5 billion for all its assets, including $500 million for underground assets. This is significantly less than the replacement cost of $12.5 billion for all assets. It is assumed that the government would contribute 60% of the cost of repair of the depreciated value of the assets in the event of another natural disaster, as was the case after the 2010/11 earthquakes.

The following sections describe the different types of assets, including the completeness and reliability of asset attribute data for each asset group (see Tables 11.2 and 11.3 for the key).

Condition data for water supply, wastewater and stormwater assets used to build the renewals program is based on most up to date data held in InfoNet our condition database and supporting spreadsheets which is why data confidence is high. However, the confidence rating of data in this section is taken from recent valuations that are based on extracts from SAP which does not hold condition data and therefore rated lower.

Table 11.2: Key to asset data confidence rating tables

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

Table 11.3: Key to asset data completeness rating tables

Completeness Rating	Description
0 - 20%	The asset register contains minimal information about the assets with the majority of assets not listed at all
20 – 40%	About a third of the assets are listed and/or about a third of the attribute information is listed
40 – 60%	About half of the assets are included in the asset register and/or of the assets included, only half the asset attribute data is included
60 – 80%	Most assets are included on the asset register with most of the relevant asset attributes
80 – 100%	The asset register contains a complete set of data for every known asset

11.1.2 Water supply

Christchurch City and Lyttelton Harbour settlements are supplied untreated drinking water from deep aquifers via secure deep well water bores (water wells). There are 137 water supply bores in Christchurch, the majority of which source water from secure, deep aquifers; however a small number in the northwest of the city tap into shallow, unsecure aquifers. A programme is underway to replace bores in shallow aquifers with secure bores into deep aquifers by June 2019. In the meantime, use of the shallow bores has ceased and these would only be used in an emergency (e.g. fire fighting).

Banks Peninsula water supplies are unable to access the secure aquifers under Canterbury Plains. Council water supplies servicing Akaroa, Takamatua, Duvauchelle, Birdlings Flat, Little River, and Pigeon Bay source water from streams, springs and unsecure bores. This water must be treated to remove contaminants and minimise public health risk. Wainui water supply is the exception, having a secure groundwater source and requiring no treatment.

The Council owns $2.5 billion of water assets and supplies drinking water supplied to approximately 159,000 properties throughout the district, with 150.6 million litres of water supplied each day.

Table 11.4: Summary of water supply assets

Asset type	Details
Water pipes	3,400 km
Water treatment plants	6 - Akaroa, Little River, Birdlings Flat, Duvauchelle, Wainui and Pigeon Bay
Reservoir sites	35
Water pump stations	129

Following the earthquakes over 90km of water supply pipes and 26 pump stations have been repaired or replaced over the last 5 years.

245km of water supply pipework is currently past its design life with an additional 1,104km of pipework due to reach its design life over the next 30 years. This is a total of 1,349km of water pipes requiring renewal over the next 30 years.

Asset condition data is based on asset age, material and expected useful life. Pipe samples are collected from throughout the reticulation network and their condition assessed by experts; this testing includes chemical tests, CT scans, detailed measurements, microscopic inspections, evaluation of coatings and comparison with manufacturing standards. Condition assessment results are used to refine expected useful lives.

Table 11.5: Data confidence and completeness for water supply assets

Asset Group	Asset Type	Quantity	Size	Age	Condition/ performance	Data completeness	Proportion of total asset value
Reticulation	Submain					95%	21%
	Crossover					95%	2%
	Mains ≤150 mm diameter					95%	28%
	Mains (200 – 300 mm diameter)					95%	17%
	Trunk main					95%	4%

Asset Group	Asset Type	Quantity	Size	Age	Condition/ performance	Data completeness	Proportion of total asset value
	Lateral					90%	3%
	Meters					95%	3%
	Connections					50%	2%
	Valves					95%	3%
	Hydrants					95%	3%
Pump stations	Pipework					60%	<1%
	Valves					80%	<1%
	Pump set					75%	<1%
	Standby plant					80%	<1%
	Plant and equipment					90%	<1%
	Electrics					70%	<1%
	Instrumentation and control					85%	<1%
	Buildings					90%	2%
	Wells and wellheads					85%	4%
Reservoirs and tanks	Reservoirs and tanks					80%	6%
Treatment plants	Pipework					60%	<1%
	Valves					80%	<1%
	Pump set					75%	<1%
	Standby plant					80%	<1%
	Plant and equipment					90%	<1%

Asset Group	Asset Type	Quantity	Size	Age	Condition/ performance	Data completeness	Proportion of total asset value
	Electrics					70%	<1%
	Instrumentation and control					85%	<1%
	Buildings					90%	<1%
	Wells and wellheads					85%	<1%
	Reservoirs and tanks					85%	<1%

11.1.3 Wastewater

The Christchurch Wastewater Treatment Plant at Bromley is the largest and treats wastewater from the entire urban area of Christchurch before treated wastewater is discharged via a three kilometre outfall into Pegasus Bay.

There are wastewater treatment plants in Lyttelton, Diamond Harbour and Governors Bay, which discharge treated wastewater to Lyttelton Harbour. A project is underway to pump wastewater from these settlements to the Christchurch Wastewater Treatment Plant. This project will eliminate all treated wastewater discharges to Lyttelton Harbour.

The Akaroa and Duvauchelle Wastewater Treatment Plants discharge to Akaroa Harbour. Construction of a new plant for Akaroa is planned but the method of disposal is yet to be determined. Treated wastewater from the Wainui and Tikao Bay Wastewater Treatment Plants is discharged to land to irrigate pine forests.

Table 11.6: Summary of wastewater assets

Asset type	Details
Wastewater treatment plants	8
Wastewater pipes	1,826 km
Wastewater pump stations	149
Wastewater lift stations	84

Asset type	Details
Radio repeaters	10

The Council owns $3.5 billion of wastewater assets which collect wastewater from approximately 159,000 properties and pipes on to treatment and disposal facilities. On average 153 million litres of wastewater is treated each day.

Following the earthquakes, over 500 km of wastewater pipework was replaced or relined, approximately 10 pump stations repaired and 84 new lift stations built.

20% (366 km) of wastewater pipes have been assessed as being in poor or very poor condition. 93% of condition results for these pipes are based on physical inspections giving a high level of confidence in the data. In total 763 km of pipework is past its design life or will reach its design life and require renewal over the next 30 years.

Asset condition data for gravity wastewater pipes is based mainly on CCTV inspection. Where CCTV inspections have not been carried out asset age, material, expected life, location and studies into earthquake effects are applied. To maximise value from the CCTV inspections only pipes exhibiting operational problems or expected to be nearing the end of their lives are inspected. 55% of the wastewater network has up-to-date CCTV inspections. Wastewater pressure pipes go through similar condition assessments to water mains.

Table 11.7: Data confidence and completeness for wastewater assets

Asset Group	Asset Types	Quantity	Size	Age	Condition / Performance	Data completeness	Proportion of total Asset Value
Reticulation	Gravity pipes					95%	56%
	Pressure pipes					95%	8%
	Vacuum pipes					100%	<1%
	Overflow pipes					95%	<1%
	Syphon					95%	<1%
	Laterals					95%	8%

Asset Group	Asset Types	Quantity	Size	Age	Condition / Performance	Data completeness	Proportion of total Asset Value
	Biogas pipes					95%	<1%
	Built structures					95%	<1%
	Vents					90%	<1%
	Valves					90%	<1%
	Air gaps					95%	<1%
	Flush tanks					95%	<1%
	Manholes					95%	5%
	Pressure sewer systems					95%	<1%
	Vacuum sewer systems					95%	<1%
	Pipe protection					95%	<1%
	Biogas valves					95%	<1%
Odour Control Stations	Buildings and structures					95%	<1%
	Electrical					95%	<1%
	Pipework					95%	<1%
	Odour filter					95%	<1%
Lift Stations	Buildings and structures					100%	<1%

Asset Group	Asset Types	Quantity	Size	Age	Condition / Performance	Data completeness	Proportion of total Asset Value
	Electrical					100%	<1%
	Mechanical					100%	<1%
	Pipework					100%	<1%
Pumping Stations	Buildings and structures					90%	1%
	Control system					95%	<1%
	Electrical					95%	<1%
	Gantry crane					95%	<1%
	Mechanical					95%	<1%
	Pipework					90%	4%
	Standby equipment					95%	<1%
Vacuum Stations	Buildings and structures					100%	<1%
	Control system					100%	<1%
	Electrical					100%	<1%
	Gantry crane					100%	<1%
	Mechanical					100%	<1%
	Pipework					100%	<1%

Asset Group	Asset Types	Quantity	Size	Age	Condition / Performance	Data completeness	Proportion of total Asset Value
	Standby equipment					100%	<1%
Treatment Plants	Buildings and structures					90%	6%
	Civil earthworks					80%	<1%
	Pipework						1%
	Filter media (CWTP)						<1%
	Electrical					95%	<1%
	Control						1%
	Mechanical					95%	2%
	Other						<1%
	Standby and generation					95%	<1%

11.1.4 Stormwater

Effective management of stormwater runoff reduces the risk of flooding, and reduces the impact of stormwater on the receiving environment. A well performing stormwater drainage network contributes to multiple values such as ecology, recreation, culture, heritage, and landscape. It also an important part of developing resilience to hazards and climate change stresses. The stormwater drainage network is provided and maintained to collect and remove stormwater, protecting the community from surface flooding during storm events. Council aims to protect the community from surface flooding during storm events of up to a 1 in 5 year return period for most of the city, and from a 1 in 50 year return period in new subdivisions or where a site is being redeveloped.

The primary stormwater drainage network includes pipes, waterway channels, waterway lining and structures.

Table 11.8: Summary of stormwater assets

Asset type	Details
Waterways	158 km
Retaining walls	11.3 km
Bank stabilisation	9.4 km
Control structures	11
Earth channels	112 km
Timber lined waterways	33.9 km
Rock lined waterways	2 km
Concrete lined waterways	22.9 km
Stormwater pipes	914 km
Manholes	15,192
Sumps	32,676

Open waterways form an important part of the stormwater network and while the channels themselves have an indefinite life, the structures within the waterways (including lining) do require renewal. Urban activities have had a detrimental impact on the ecology of waterways and waterway margins and can result in significant restoration costs to return to their natural state.

Dredging of waterways was common practice until the 1990s, but only restarted after the earthquakes deposited liquefaction into waterways and stormwater systems. The degree of siltation across the network has been exacerbated by liquefaction material filling open channels.

Extensive lining of waterways has been undertaken in the past and timber lining in particular. Almost all of the timber lining was installed between 1974 and 1989 by lining gangs employed by the Drainage Board prior to amalgamation with the Council. The expected useful life for timber lining is 40 years and much of the lining has reached or is reaching this point.

The majority of the piped stormwater network has been constructed since 1955, however, there are a large number of brick barrels installed in the late 1800s and early 1900s as well as concrete and earthenware pipes installed in the early to mid-1900s that are now reaching the end of their useful life. The issue has been compounded by the reduction in expected useful lives due to the earthquakes.

The earthquakes also resulted in land settlement which exposed new areas to flood risk and adversely affected the natural drainage of some areas of the city. It also resulted in physical damage to the stormwater network.

SCIRT generally only repaired or replaced damaged stormwater pipes on a like-for-like basis where the damage was assessed as being earthquake related, so capacity and non-earthquake related deterioration was not addressed.

A full condition assessment was undertaken in 2016/17 and SCIRT surveyed a large proportion of the stormwater pipe network. With the improvements in asset data quality brought about through these assessments, knowledge of the network condition is better than ever before and this has been used to develop more robust renewals programmes than has previously been possible. Approximately 10% of waterway lining and stormwater pipes were assessed as being in poor or very poor condition and in need of renewal.

The district has always been exposed to flood risk from both the sea and the river network. The stormwater network (pipes and secondary flow paths) functions well enough to deal with average flood events (10 year average recurrence interval). Predicted climate change and sea level rise options will see flood risk increase, exposing more people and properties to flood events.

A city wide hydraulic model identifies capacity issues and future needs. The capacity of the stormwater network is under pressure as a result of urban development and the earthquakes. The rate of infill housing has increased without a forward programme to upgrade stormwater mains. Flood risk has worsened since the earthquakes due to land settlement, loss of natural gravity drainage, loss of capacity and damaged assets.

As flood risk has increased following the earthquakes, due to pipe damage, land settlement and liquefaction/sediment in waterways, Council is implementing the Land Drainage Recovery Programme (LDRP) to repair, renew and upgrade the stormwater network to restore the city to pre-quake flood risk or better.

11.1.5 Flood protection and control

Flood protection and control works deliver floodplain and stormwater management plan objectives to reduce the harm from flooding to the community and to improve the quality of ground and surface water.

Christchurch has always been exposed to flood risk from the sea, the river network and significant rainfall events. Flood risk has worsened since the earthquakes due to land settlement, loss of natural gravity drainage, loss of capacity and damaged assets. Where the Avon River discharges into the estuary, the land has subsided by 0.2 – 0.5 metres, increasing the risk of flooding and coastal erosion. Conversely the lower reaches of the Heathcote River and estuary have risen 0.3 – 0.5 metres, which has flattened the gradient, increasing siltation and reducing channel capacity.

The primary flood protection and control network includes pump stations, stop banks, basins and monitoring equipment. In addition to flood protection, the network also provides treatment to improve water quality.

Predicted climate change and sea level rise options will see flood risk increase, exposing more people and properties to more frequent and more severe flood events. This will have a far greater impact on flood risk than the earthquakes.

The Land Drainage Recovery Programme plays a significant role in implementing post-earthquake flood protection and control projects with works to date including construction of stop banks, plus repair, upgrade or construction of new pump stations and basins.

The majority of stormwater treatment assets are co-located with flood protection assets. For example, basins and wetlands serve a dual purpose of providing stormwater detention for reducing flood risk as well as providing water quality treatment. Healthy waterways are an important part of a healthy environment. Growth and land use intensification can negatively impact on the water quality and the ecological health of natural waterways. To assist water quality in waterways, wetlands

and estuaries to improve over time Council is developing and implementing stormwater management plans across Christchurch City and Banks Peninsula where the Council has stormwater infrastructure. The stormwater management plans aim to maintain and improve the six values for waterways. Without investment in stormwater treatment then water quality will continue to degrade as further land use intensification takes place. This not only requires investment in greenfield areas, but also retrofit in existing developed areas.

Table 11.9: Summary of flood protection assets

Asset type	Details
Pump stations	47
Detention and treatment structures/ features	427
Project rainfall monitoring sites	2
Permanent water level sites	16
Project water level sites	6
Permanent groundwater monitoring sites	17
Project groundwater monitoring sites	14
Sea level monitoring site	1
Stop banks	12.1 km

The Council owns flood control assets valued at $500 million. The capital renewal programme needs to consider the likely impacts of climate change, with sea level rise of up to 0.8 metre by 2090 plus 10 mm per year after that, and possible increases in rainfall intensity of 16%.

Table 11.10: Data confidence and completeness for stormwater and flood protection assets

Asset Group	Asset Types	Quantity	Size	Age	Condition / Performance	Data completeness	Proportion of total Asset Value
Reticulation	Pipe					95%	82%

Asset Group	Asset Types	Quantity	Size	Age	Condition / Performance	Data completeness	Proportion of total Asset Value
	Access					90%	4%
	Inlet (excluding soakpits)					95%	<1%
	Outlet (excluding valves and soakpits)					95%	<1%
	Junction					90%	<1%
	Restriction (weir)					75%	<1%
	Structure					70%	<1%
Waterway Lining	Bank lining					75%	7%
	Bed lining					70%	<1%
	Earthworks					65%	<1%
	Bank stabilisation					60%	<1%
	Retaining walls					60%	<1%
Open Waterways	Plants					60%	<1%
	Beds					60%	<1%
	Protection					60%	<1%
	Walkways					60%	<1%
	Earthworks					60%	<1%
	Earth channels					65%	<1%
Open Waterway Structures (excl lining)	Weirs					60%	<1%
	Boat ramps					60%	<1%
	Flumes					60%	<1%

Asset Group	Asset Types	Quantity	Size	Age	Condition / Performance	Data completeness	Proportion of total Asset Value
	Other					60%	<1%
Pump stations	Pump					65%	<1%
	Building					70%	<1%
	Well					65%	<1%
	Electrical					65%	<1%
	Pipework					65%	<1%
	Tank					75%	<1%
	Instrument and control					70%	<1%
	Fittings					95%	<1%
	Standby plant					90%	<1%
Flood protection structures	Stop banks					60%	<1%
	Valves (reticulation outlet)					95%	<1%
	Valves (reticulation flow control)					95%	<1%
	Horseshoe Lake tide gates					60%	<1%
	Woolston tidal barrage					60%	<1%
Treatment and Storage Facilities	Earthworks					55%	<1%
	Lining					60%	<1%
	Soakpits (reticulation outlet)					95%	<1%

Asset Group	Asset Types	Quantity	Size	Age	Condition / Performance	Data completeness	Proportion of total Asset Value
	Soakpits (retic inlet)					95%	<1%
Monitoring Equipment / Hydrometric	Instruments					95%	<1%
	Structures					95%	<1%
	Other equipment					95%	<1%

11.1.6 Transport

The Council is the road controlling authority for the public roads that service the district with the exception of the State Highway network managed by the New Zealand Transport Agency (NZTA). The transport network includes the central city bus interchange, suburban bus passenger hub facilities and an expanding network of cycle facilities and bus priority infrastructure. Public transport services are provided by Environment Canterbury, in partnership with the Council, which provides and maintains the supporting public transport infrastructure.

The Council is responsible for planning, designing and building the transport infrastructure, often in partnership with key agencies, such as New Zealand Transport Agency (NZTA), Environment Canterbury, Ōtākaro Limited (in the central city), Regenerate Christchurch, Lyttelton Port of Christchurch (LPC), Christchurch International Airport Limited (CIAL), Kiwirail, and neighbouring local governments.

Table 11.11: Summary of transport assets

Asset type	Details
Carriageways	1,985 km sealed and 360 km unsealed
Road drainage	3,226.5 km kerb and channel 29,469 sumps and associated pipes
Structures	353 roads bridges 116 foot bridges 1412 retaining walls 103 culverts 1 ford 2 underpasses

Asset type	Details
Footpaths	2,585 km
Amenity areas	60,000 m2 and various furniture
Road lighting	37,738 lights 20,327 poles
Traffic systems	225 signalised intersections, CCTV and school speed zone sites
Road landscaping	65,720 trees 9,592 landscaped sites
Cycleways	225 km of on-road lanes 115 km of shared paths
Public transport	420 bus shelters signs and furniture
Parking	1,200 on street metered spaces 396 parking meters Lichfield St off-street car park

Transport infrastructure was severely damaged in the earthquakes. It is estimated it will take over 20 years before the condition of the overall road and footpath network matches the expected level of service for equivalent networks nationwide.

The condition of the transport network and its corresponding levels of service have been severely impacted by the earthquakes. Approximately 1,000 km (45%) of Christchurch's street network sustained significant damage in the earthquakes, requiring some 50,000 repairs. Earthquake road repairs focussed on creating a functional network.

Table 11.12: Data confidence and completeness for transport assets

Asset Type	Quantity	Age	Condition	Performance	Data completeness	Proportion of total asset value
Road formation					90%	11%
Pavements (sub-base, base, surface)					80%	31%
Footpaths					70%	12%
Structures (bridges, major culverts)					85%	7%
Structures (retaining walls)					60%	6%
Drainage (culverts, sumps, soak-pits, kerb and channel)					80%	12%
Drainage (pipes)					60%	5%
Pavement markings					80%	<1%
Signs					70%	<1%
Berms					75%	4%
Traffic signals					90%	1%
Street landscaping assets					60%	1%
Lighting					90%	3%
Litter bins					80%	<1%
Other street furniture					70%	<1%
Other transportation amenities					60%	<1%
Parking meters					90%	<1%
Tram assets					95%	<1%

Asset Type	Quantity	Age	Condition	Performance	Data completeness	Proportion of total asset value
Street trees					60%	4%
Crime cameras, traffic management cameras and real-time bus passenger information					60%	<1%

11.1.7 Facilities

Many of the Council's activities rely on built and property assets to support their delivery. These facilities are outlined in Table 11.13.

Table 11.13: Summary of facilities assets

Facility	Details
Libraries	20 Libraries (open or under construction) 2 libraries not built but planned
Social Housing	2,478 Social Houses (2,307 currently open)
Recreation and Sport	8 Paddling Pools 17 Aquatic Facilities 4 Recreation and Leisure Centres 5 Camp Grounds 1 Golf Course 1 Stadia
Community Facilities	64 Community Facilities 14 Volunteer Libraries 8 Early Learning Centres
Corporate Assets	Corporate Accommodation Service Centres

Facility	Details
	Miscellaneous including Storage and works yards. Fleet and Plant
Art Galleries	City Art Gallery Akaroa Museum and Gallery

The earthquakes of 2010/11 disrupted a number of facilities. Repairs have been completed across a number of facilities on a prioritised basis. Many facilities are advanced in terms of asset life. Repair and renewal programmes have been developed to ensure fit for purpose assets are provided in an efficient manner that achieves levels of service. These programmes will create a legacy spike for renewals recurring cyclically in the future, which presents practical and financial pressure.

Data systems are currently under review in order to modernise and better articulate condition data. There are also issues around provision of facilities in light of population shifts. Asset management processes are focusing on articulating facility condition and renewal and supply plans that best meet Levels of Service requirements. Repairs and renewals have occurred on a reactive basis in particular following the Canterbury earthquakes. A more optimised approach is desirable in future years to improve cost effectiveness.

Libraries

The planned 30 year capital expenditure for library built assets is $90 million. Scheduling, lack of timely maintenance and optimisation of renewal cycles are identified as risks for the libraries assets that affect cost effectiveness across works programmes.

Social housing

The housing portfolio consists of 2,478 social housing units of which 2,307 are currently open. The portfolio had a current market value of $307 million in 2015. The housing portfolio is self-funded from revenue, it is not rates funded. The planned capital expenditure for the upcoming 10 years is $68 million with the 30 year projection being $202 million. A large proportion of the portfolio is in need of a midlife refurbishment in order for the units to be fit for purpose for the expected life of 90 years. No new assets are planned to be added to the portfolio as this would mean the housing fund would be financially unsustainable in both the short and long term.

Recreation and sport

The age profiling of recreation and sport assets sees the average asset age approaching 35 years with the majority of assets exceeding 20 years and over 40% of assets exceeding 40 years of age.

Although 50 years is the base life of buildings prescribed by the Building Act the specialised nature of aquatic and recreational assets would suggest the physical, economic and functional obsolescence of these assets is somewhat less.

Many recreation and sport assets have had incremental upgrade work completed on them since original construction – where a portion of the asset remains in original condition and other areas have been revitalised.

In terms of new assets planned but not yet built at Linwood and Hornby, consideration needs to be given to the risk that service provision will exceed demand. The initial capital costs and ongoing operational costs are high for these projects are high.

Community facilities

The age variance of the community facilities assets spans from newly constructed facilities to assets that have heritage significance due to their age.

The facilities on average were constructed in the 1960s and approximately 60% of the buildings are over 50 years of age being the base design life of buildings prescribed by the Building Act.

Issues around how fit for purpose many of these facilities now are is a pertinent issue and requires further analysis.

Through necessity, due to the damage caused by the Canterbury earthquake events; there have been a number of new facilities recently constructed or on the planning board awaiting construction.

Once these facilities are completed the volume of assets will be in line with pre-earthquake provision.

Corporate assets

The Council provides corporate accommodation for councillors, community board members and Council staff. Corporate accommodation buildings are held for various reasons such as office space, board meeting rooms and storage facilities.

The Facilities, Property and Planning Service Plan includes for the provision and efficient management of shared fleet and plant items (e.g. tractors, sports ground equipment, trailers).

Art galleries

The Christchurch Art Gallery is a single facility, located in the central city on the corner of Worcester Street and Montreal Street.

A capital plan has been prepared for the next 30 years. The planning for replacement and renewals has been done through a mix of predicted asset life and also deterioration /degradation of assets using the results of a recent condition assessment project along with detailed knowledge of the assets in most cases.

The art gallery was closed from the time Civil Defence established their Emergency Operations Centre on 22 February 2011 until it was evacuated by CERA in June 2011. A comprehensive structural assessment was carried out at this time when it was found that the building had sustained more extensive earthquake damage than previously thought. A repair and strengthening project was initiated which focused on the retrofitting of base isolation to provide a high level of protection and resilience against significant earthquakes in the future. This project was completed in phases from late 2015 and the art gallery reopened to the public on 15 December 2015.

11.1.8 Parks

The Council maintains and manages 1,125 parks and reserves covering nearly 9,000 hectares in Christchurch City and Banks Peninsula, with an approximate value of $800 million. This includes the Christchurch Botanic Gardens, Hagley Park, other significant heritage gardens, sports, neighbourhood, and regional parks as well as open and closed cemeteries.

Table 11.14: Summary of parks assets

Asset group	Details
Park furniture	20,500
Park structures	16,800
Carparks and tracks	5,500
Gardens and hedges	18,600
Play equipment	3,300
Sport areas and recreational equipment	990
Water supply and irrigation	1,000
Park trees	47,000
Park buildings	952
Marine structures	101

A large proportion of assets are in need of renewal (replace/refurbishment) to maintain a fit for purpose state for the expected life of assets. A number of new assets are to be added to the portfolio to satisfy growth and demand, and also accommodate for environmental and social changes in a regenerating city.

Asset condition data has been collected over the past three years for 58% of targeted parks asset types (excluding buildings, public monuments and art). 29% of parks assets are in good or very good condition, 12% in moderate condition, 7% in poor or very poor condition and 52% have not been assessed yet.

The Council has a number of buildings, artworks, memorials, monuments, fountains and objects with heritage values. These are distributed throughout the district.

These heritage assets include 60 buildings which are listed and protected in the District Plan. All are strategic assets and some have legislative and further restrictions as a result of being gifted. There are a number of national and internationally important buildings such as the Canterbury Provincial Buildings and the Former Municipal Chambers. The Canterbury Provincial Council Buildings are the only purpose-built provincial government buildings still in existence in New Zealand. The Former Municipal Chambers (Our City O-Tautahi) is a beautiful and historic Queen Anne building on the corner of Worcester Boulevard and Oxford Terrace. Both listed as Group 1, High Significance in the District Plan and are NZ Historic Places Category 1 buildings.

Heritage assets also include artworks, monuments, memorials, clocks, fountains and objects are located throughout the City and Banks Peninsula. There are 59 heritage assets in this group that are listed and protected in the District Plan. The earthquake repair programme for this group of heritage assets will be completed by the end of FY19.

Table 11.15: Data confidence and completeness for parks assets

Asset Group	Asset Types	Assets captured in register	Spatial data captured	Completeness of asset attribute information	Accuracy of recorded attribute data	Age	Condition/performance	Overall data confidence
Buildings	Aviary							60%
	Barn							60%
	Building – commercial							60%
	Building – heritage							70%
	Changing room							60%
	Clock tower							70%
	Club building							60%
	Community building							60%
	Display house							60%
	Garage							60%
	Hall							60%
	House							60%
	Office							60%
	Pavilion							60%
	Pump shed							60%
	Shed							60%
	Shelter							60%

Asset Group	Asset Types	Assets captured in register	Spatial data captured	Completeness of asset attribute information	Accuracy of recorded attribute data	Age	Condition/performance	Overall data confidence
	To be defined - buildings assorted							0%
	Toilet							60%
	Visitor centre							60%
	Workshop							60%
Structures	Boat ramp							70%
	Bridge							70%
	Cattle stop							80%
	Culvert							70%
	Fence							70%
	Jetty							80%
	Retaining wall							60%
	Safety barrier							80%
	Shelter							80%
	Stairs							80%
	Stock yard							70%
	Viewing platform							80%
	Water tower							70%
	Water trough							80%

Asset Group	Asset Types	Assets captured in register	Spatial data captured	Completeness of asset attribute information	Accuracy of recorded attribute data	Age	Condition/performance	Overall data confidence
Furniture	BBQ							80%
	Bin							80%
	Bollard							90%
	Cycle equipment							80%
	Flag pole							80%
	Fountain							80%
	Gate							80%
	Light							70%
	Light pole							70%
	Picnic table							80%
	Plaque							40%
	Pool							60%
	Seat							80%
	Shower							80%
	Sign							80%
	Stile							80%
	Tree cage							70%
	Tree grate							70%

Asset Group	Asset Types	Assets captured in register	Spatial data captured	Completeness of asset attribute information	Accuracy of recorded attribute data	Age	Condition/performance	Overall data confidence
	Tree planter							70%
	Water feature – drinking							80%
Hard surfaces	Board walk							70%
	Car park							70%
	Judder bar							80%
	Ramp							80%
	Track							70%
Green assets	Garden							90%
	Hedge							80%
	Stand of trees							50%
	Turf							60%
	Park trees							50%
Play	Dog exercise equipment							80%
	Play equipment							65%
	Play modular unit							65%
	Play surface							75%
Sport	Sports area							70%
	Sports equipment							70%

Asset Group	Asset Types	Assets captured in register	Spatial data captured	Completeness of asset attribute information	Accuracy of recorded attribute data	Age	Condition/performance	Overall data confidence
Water supply	Backflow preventor							85%
	Irrigation system							50%
	Pump unit							50%
Wastewater	Tank							50%
Electrical	Tank							50%
Mechanical	Various		n/a					40%

Table 11.16: Data confidence and completeness for foreshore assets

Asset Group	Asset Types	Assets captured in register	Spatial data captured	Completeness of asset attribute information	Accuracy of recorded attribute data	Age	Condition/performance	Overall data confidence
Foreshore assets	Pier, wharf and jetty							70%
	Marine slipway							70%
	Pontoon – recreational raft							70%
	Mooring							70%
	Seawall - breakwater							40%

Table 11.17: Data confidence and completeness for heritage assets

Asset Group	Asset Types	Assets captured in register	Spatial data captured	Completeness of asset attribute information	Accuracy of recorded attribute data	Age	Condition/performance	Overall data confidence
Heritage buildings	Building							70%
	Clocks – tower							70%
Public monuments, sculptures and artworks	Public monuments							50%
	Sculptures							50%
	Artworks							50%

11.1.9 Solid waste

The Council's duty to provide solid waste management services to the community in terms of the Waste Minimisation Act 2008 and Council's statutory Waste Management and Minimisation Plan 2013 is achieved by with the following assets:

Table 11.18: Summary of solid waste assets

Asset type	Details
Transfer stations (Christchurch)	3
Transfer stations (Banks Peninsula)	2
Community collection points and other service points (Banks Peninsula)	12
Materials recovery facility	1
Organics processing plant	1
Landfill gas collection, treatment plant, reticulation and infrastructure	1
Closed landfills	18

The assets support the following community outcomes: healthy environment (sustainable use of resources) and prosperous economy (modern and robust infrastructure and community facilities).

Insufficient data exists at present to provide data confidence and completeness for solid waste assets. This will be added in the next Infrastructure Strategy.

11.1.10 Information and communication technology

Council maintains a diverse portfolio of information and communication technology (ICT) assets (owned and managed hardware, network, software and data) that support all of the Council's activities and services. ICT assets are directly and indirectly consumed by residents, business partners and other agencies and organisations as well as supporting Council staff in delivering these services.

Council has not historically recognised information and data as an asset, despite this asset being fundamental to the entire operation of the organisation and residents' engagement with the Council. This position has recently changed and so Council must improve how it manage information assets through their full asset lifecycle.

Council success requires information and communication technology to deliver services that are:

- Modern: Amazing digital experience for all customer interactions
- Mobile: Interactive services with real-time information from anywhere, at anytime
- Resilient: Accessible technology that caters for all

- Innovative: Clever use of technology and data to create a smart city.

The proportion of asset total asset value for each ICT asset type is not available, but will be included in the next Infrastructure Strategy.

Table 11.19: Summary of information and communication technology assets

Asset type	Details
Software	511
Desktops	1,241
Laptops	1,421
Virtual desktop client devices	867
Tablets	408
Mobile phones	935
Projectors	37
Large Display	83

Table 11.4: Data confidence and completeness for information and communication technology assets

Asset Group	Asset Type	Quantity	Age	Condition/ performance	Data completeness
Desktop Fleet	Desktops				90%
	Laptops				90%
	Workstations				90%
	Virtual desktop client devices				90%
	Tablets				85%

Large Displays	Projectors				65%
	Smartboards				65%
	Public Displays				50%
	Meeting Rooms				50%
Printers	Receipt				50%
	Card				100%
	Plotter				100%
Mobile phones	Cell phones				50%
	Smart phones				75%
Network	Firewall				85%
	Access Point				85%
	Load Balancer				85%
	PABX				85%
	Router				85%
	Switch				85%
	VPN				85%
	Voice gateway				85%
	Wireless Controllers				85%
Server	Physical				85%
	Virtual				90%
	Appliance				90%
Software	Documented				90%

12.0 APPENDIX 3 – PROJECT PRIORITISATION FRAMEWORK

Category Grouping	Included in prioritisation category
In Construction	
Medium	Holding renewals (condition) 1 Legal Committed Growth – critical Growth – desirable Internal – holding renewals
Low	As for medium, but with reduced renewals and some projects delayed
High	Holding renewals (condition) 2 Level of service recovery – 30 year period (earthquake and backlog) Economic benefits Internal – increase level of service Need/demand Increase level of service New services Special projects Internal – new services

Prioritisation Category Definitions –

- **Holding renewals 1 –** *For Infrastructure* – renewals that hold the asset network at its current overall condition.

- **Holding renewals 1 –** *For Customer / Community* – renewals that are essential because there is a significant increase in opex or capex cost later if not renewed, needed to maintain LOS, or there is a demonstrated critical need in that locality to ensure equitable provision and spatial distribution. Asset may have reached end of life and requires replacement as no alternative asset can be used.
- **Legal –** a project that Council is required to undertake to meet legal obligations (e.g. resource consents, drinking water standards, landfill after care, signs for the road network, IT upgrades to meet legal obligations).
- **Committed** – Cost share payments, signed infrastructure provision agreements. Committed and signed agreements/contracts where the cost to break the contract is disproportionate to the benefit. Projects which the Council has already made a political commitment to undertake (e.g. through the previous Long Term Plan or Annual Plan).
- **Growth – critical –** projects that are needed for new developments and subdivisions that are either proceeding or have high probability of proceeding in 1 to 3 years.
- **Growth – desirable –** projects that are needed for developments and subdivisions where probability/timing of increased demand is less certain. The project is primarily required to meet the agreed levels of service for the incoming community.
- **Internal – holding renewals –** internal service capital renewal projects that hold the asset/service at its current overall planned condition.
- **Need/Demand –** For *Customer / Community* there is a demonstrated critical need for a new asset in that locality to ensure equitable provision and spatial distribution.
- **Holding Renewals 2** – For *Customer/ Community* renewals that are not essential i.e. deemed end of life so recommending are not renewed, or there is no critical need in that locality.
- **Level of service recovery –** projects that bring the delivered level of service up to the current agreed level of service (backlog) and/or restore damage or loss of capacity created by the earthquake sequence.
- **Economic benefits** – projects that primarily reflect opportunities to reduce total cost of ownership through capital contributions and or reduced operating costs (e.g. streetlight conversions).
- **Internal – Increase level of service –** internal service projects that increase the current agreed levels of service.
- **Increase level of service –** Projects that result in an increase above the current agreed level of service provided (e.g. new libraries, bus priority lanes and water supply upgrades).
- **New services** – where a project adds a new service to Council.
- **Special projects –** special one-off projects such as contributions to third-party capital programs or projects (e.g. museum, Court Theatre, heritage projects).
  Internal – new services – internal service projects that add a new service to Council.

Christchurch
City Council