Infrastructure Strategy
2015 – 2045

March 2016

Christchurch City Council

Quality Assurance Statement

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1.1 Introduction

Purpose

The purpose of Council's Infrastructure Strategy is to identify significant infrastructure issues for the local authority over the next 30 years and to identify the principal options for managing those issues and the implications of those options.

Local Government Act Amendment

The Local Government Act 2002 was amended on 8 August 2014 to include a new Section 101B which requires local authorities to prepare an Infrastructure Strategy as part of its Long Term Plan.

Scope

The scope of this Infrastructure Strategy is to outline the most likely scenario for managing the following infrastructure assets:

- Water supply
- Wastewater
- Stormwater
- Flood protection and control works
- Roads and footpaths.

The strategy describes how these assets will be managed, taking into account growth, renewals, changes in levels of service and resilience in terms of natural hazards. For each of these assets, the strategy:

- Provides capital and operational expenditure forecasts, every year for the first 12 years and every three years between 2028 – 2045, to match the Long Term Plan periods
- Identifies significant decisions the Council will have to make about its assets, when those decisions will be required, the scale of costs and the likely options to be considered
- Provides costs and options for significant capital expenditure decisions
- Describes assumptions on lifecycle, growth or decline in demand for services, and increases or decreases in level of service. Where there is a high level of uncertainty about these assumptions, this is identified and the potential effects described.

Term

This Infrastructure Strategy covers the 30 year period from 2015 to 2045.

Version

This version of the Infrastructure Strategy differs slightly from that adopted by Council on 26 February 2015. The changes made are to include inflation (so that inflation is treated consistently across the various Long Term Plan documents), address auditor's comments, remove reference to the cost sharing agreement, and a few minor wording changes.

1.2 Geographic Context

The City of Christchurch covers an area of 149,345 hectares, of which 19,365 hectares is urban and this is mostly located on the Plains. Banks Peninsula makes up 70% of the land area of Christchurch.

Christchurch comprises two distinct geological areas. Banks Peninsula is formed from a series of large eroded volcanoes that originally formed an island, and the vents of these volcanoes now form Akaroa and Lyttelton Harbours. The main rock type of Banks Peninsula is basalt, covered by a layer of loess (wind blown dust) originating from the Southern Alps and plains.

The Canterbury Plains were formed by outwash gravels deposited by rivers rising in the Southern Alps. The majority of the Christchurch urban area is located on the coalescing shingle fans of the Waimakariri River. The shingle is at deeper levels for two-thirds of the urban area and most of the City has been built on a subgrade of silts and clays. Bordering the plains to the north east are the sand dunes and coastal sandflats. A low lying peaty area occurs between the dunes and flats and the plains themselves.

Some 20,000 years ago, the plains met the volcanic island and linked it to the South Island. The out-washing of eroded gravels and sands from the erosion of the Alps also enclosed and formed the two lakes of the district, Waihora/Ellesmere and Wairewa/Forsyth. The long and intricate coastline is a legacy of the geological processes of uplift, erosion and deposition which have shaped the Peninsula. Rocky cliffs and headlands punctuated by intimate sheltered, sandy bays and the dramatic harbours of Akaroa and Lyttelton form a spectacular link between the land and the sea and contribute to the scenic value of the District.

The Alpine Fault lies approximately 100 kilometres west of the City and the Porters Pass Fault zone is 50 kilometres to the west. There is also the Greendale Fault which caused the major earthquake on 4 September 2010, and extends within 18 kilometres of Christchurch. There are at least two buried faults within Christchurch running from Heathcote towards New Brighton, which caused the subsequent major earthquakes in 2011, which have had a major impact on Christchurch's infrastructure. All of these fault zones are active and capable of generating major earthquakes.

The varying geography over the city requires different approaches to infrastructure. Banks Peninsula, with its small communities in often hilly areas, is often serviced differently compared to the largely flat Christchurch urban area. For example, most Banks Peninsula settlements have their own gravity wastewater network with a small number of pump stations pumping to a wastewater treatment plant, whereas Christchurch has many wastewater pump stations pumping to a large centralised wastewater treatment plant. In terms of water supply, the aquifers beneath the Christchurch urban area provide high quality water which does not require treatment to the Christchurch urban area and Lyttelton Harbour settlements, whereas a combination of small streams and groundwater sources are used to provide water to other settlements on Banks Peninsula.

1.3 Population and Demographic Context

The effects of the earthquakes will be felt for some time and the shape of urban Christchurch will continue to change during the recovery period, particularly over the next 10 to 15 years. Christchurch City's population is expected to grow by around 23,000 between 2015 and 2025, and by 63,000 people between 2015 and 2046, as shown in Figure 1.1.

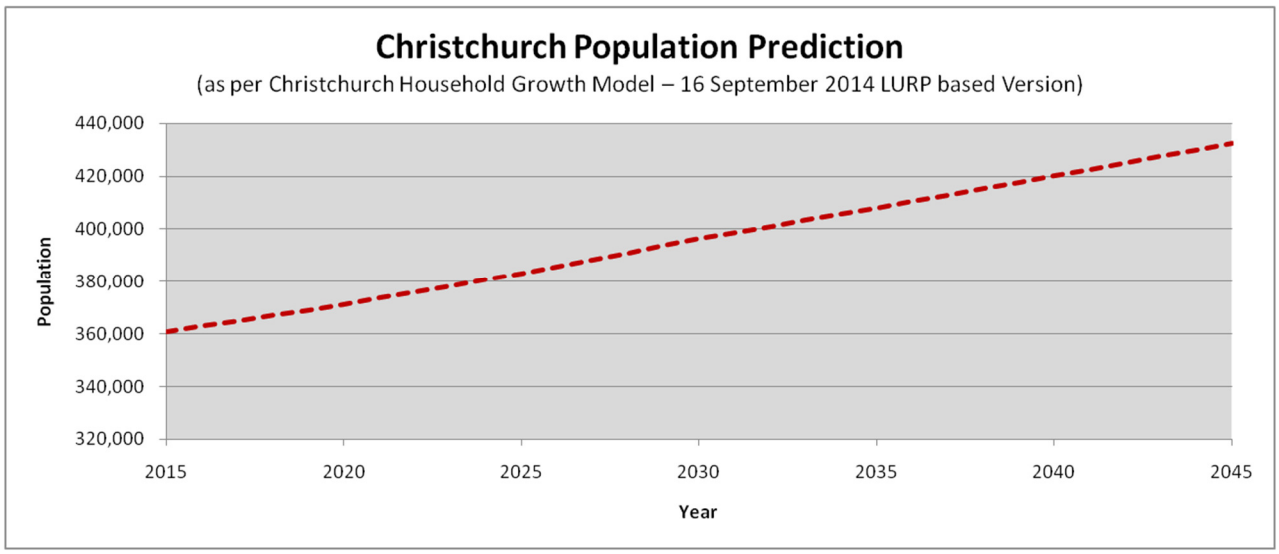


Figure 1-1: Predicted Population – Christchurch City

Between 2015 and 2046 there is expected to be a growth of around 54,000 households, proportionally faster than population growth due to the decline in household size from an ageing of the population, taking the total number of households in the City to around 189,000 in 2046. Most of the growth in households and families is expected to be in families without children and one person families, reflecting the ageing of the population. Population growth and an ageing population will have implications for infrastructure and its delivery.

Generally the areas with the greatest losses of population are those associated with the Avon River residential red zone in Christchurch. In Christchurch City, the area units with the greatest loss of population were Avondale, Burwood, Dallington, Bexley and Avonside. Many of the established suburban areas are expected to show long term static or small declines in population levels due to the effects of the earthquakes and an ageing population.

The newer greenfield areas in northern and south-western Christchurch are expected to show strong long term growth. Belfast South, Aidenfield, Travis and Wigram have had high levels of growth in Christchurch City, reflecting development of greenfield areas. Halswell, Harewood, Redwood and Prestons will also grow strongly in the future. Other areas that are planned for growth are the recently enlarged higher residential density areas around large suburban centres, as signalled in the proposed Christchurch Replacement District Plan.

Land Use Recovery Plan

The Land Use Recovery Plan (LURP) was required to address the planning issues that faced Canterbury after the 2010/11 earthquakes. Significant areas of Christchurch City were deemed to be unsuitable for residential housing and given a classification of "Red Zone". This zoning allowed the government to compensate the owners of that land. In parallel with that work, the government enacted the LURP under the special powers of the Canterbury Earthquake Recovery Act 2011 to fast track land use planning for the future and make new areas available for development. The impact of the LURP on infrastructure has been to require new and upgraded assets in many areas to provide for the demographic shift.

Greater Christchurch Urban Development Strategy

The Greater Christchurch Urban Development Strategy was prepared in collaboration with the Urban Development Strategy partners and is being given effect through the LURP. Integration of land use with strategic infrastructure is a key part of the strategy.

Christchurch Replacement District Plan

The Council is reviewing its current operative district plan. It must complete this process by March 2016, given directions in the Government's Land Use Recovery Plan and Order in Council. The short timeframe reflects the need to provide a solid foundation for Christchurch's immediate rebuilding needs, as well as the longer-term future. The Replacement District Plan will give effect to the directions in the LURP relating to new housing provision, intensification of some existing areas, mixed use developments and supporting rebuilding activities.

2 This Infrastructure Strategy

2.1 Strategy Layout

This strategy is divided into six sections:

- Section 1 gives the background, and describes the geographic and demographic contexts.
- Section 2 describes the core infrastructure that Council manages and emerging issues to be taken into account over the 30 year term of the strategy.
- Section 3 provides the linkages to other Council documents, in particular Activity Management Plans, Asset Management Plans, the Financial Strategy, the Long Term Plan and Strategic Plans.
- Section 4 covers Council's strategic direction, infrastructure priorities, how the assets will be managed and resilience to natural hazards.
- Section 5 outlines significant infrastructure issues and options for each of the five infrastructure categories.
- Section 6 sets out the financial estimates, including operations and maintenance, renewals, capital improvements and disposals, as well as the assumptions underlying these financial estimates.

2.2 Core Infrastructure

The core infrastructure types that this strategy covers are water supply, wastewater, stormwater, flood protection and control works, and roads and footpaths.

Water Supply

Groundwater aquifers are the main source of drinking water for the Christchurch urban area and Lyttelton Harbour. This water is of very high quality and no treatment is needed before use.

Streams are generally used to supply other settlements, although some groundwater is also used to supply drinking water to Akaroa, Little River, Wainui and Birdlings Flat. Council has eight water treatment plants, which treat the water for Akaroa (Alymers Valley and L'Aube Hill Water Treatment Plants), Takamatua, Little River, Birdlings Flat, Duvauchelle, Wainui and Pigeon Bay. This will reduce to six treatment plants in 2015 when the new Akaroa Water Treatment Plant is commissioned, which will replace the Alymers Valley, L'Aube Hill and Takamatua Water Treatment Plants.

Council also owns, operates and maintains 1,740 kilometres of water pipes, 83 reservoirs and 109 water pump stations, with water supplied to 135,078 properties (2013/14 Local Government New Zealand 3 Waters Survey).

Wastewater

Council has eight wastewater treatment plants, all of which provide primary, secondary and tertiary treatment. The Christchurch Wastewater Treatment Plant at Bromley is the largest and treats wastewater from the entire urban area of Christchurch before the treated wastewater is discharged via a three kilometre long outfall into Pegasus Bay. There are also wastewater treatment plants in Lyttelton, Diamond Harbour and Governors Bay, all of which discharge treated wastewater to Lyttelton Harbour. Akaroa and Duvauchelle Wastewater Treatment Plants discharge to Akaroa Harbour, and treated wastewater from the Wainui and Tikao Bay Wastewater Treatment Plants is irrigated into pine forests.

Council also owns, operates and maintains 3,213 kilometres of wastewater pipes and 166 wastewater pump stations, with wastewater collected from 150,758 properties (2013/14 Local Government New Zealand 3 waters Survey).

Stormwater

The stormwater drainage network is provided and maintained to collect and remove stormwater whilst 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 waterways, drains, pipes, pumping stations, and increasing numbers of basins, artificial wetlands and low impact design infrastructure that improve stormwater quality before it is discharged into waterways.

Council owns, operates and maintains 1,579 kilometres of stormwater pipes, with stormwater collected from 156,868 properties (2013/14 Local Government New Zealand 3 Waters Survey).

Flood Protection and Control Works

Flood protection and control works are carried out to protect the community from and to respond to significant flooding events, and involves the management of waterways and associated structures and systems such as stopbanks, flood control structures, and monitoring rainfall depth and water levels. This infrastructure needs to be renewed from time to time, with consideration for the impact of climate change, and sea level rise by up to 1 metre by the year 2115, and possible increases in rainfall intensity of 16%. The 2010/11 earthquakes have provided Christchurch with an opportunity to re-consider its flood protection strategy and implement a range of defence or retreat options and this strategy will need to be finalised before major investment in flood protection infrastructure in the tidal areas is undertaken. Included in this strategy review is the need for dredging maintenance particularly in the lower river tidal areas where silt accumulates.

Roads and Footpaths

The Council is the road controlling authority for the network of public roads that service both the rural and urban communities of the District with the exception of the State Highway network that is managed by the New Zealand Transport Agency (NZTA). This network is classified into a hierarchy that represents the demand, use and function of each road ranging from Local Street to Regional Road. The level of service provided on each road and its physical characteristics align to this hierarchy. Footpaths are generally only provided in urban areas to standards that align to the level of demand. As well as the traditional provision of vehicle carriageways and footpaths, the road network also includes an expanding network of bicycle facilities and bus priority infrastructure.

The total length of roads in Christchurch is 2,342 kilometres, and of this 359 kilometres is unsealed. Associated with the road network are 2,546 kilometres of formed footpaths.

2.3 Emerging Issues

Earthquake Legacy

The earthquake series in 2010 and 2011 caused a significant level of damage to Christchurch's infrastructure, with the majority of earthquake damage in Lyttelton and the eastern suburbs of the urban area of Christchurch.

The Infrastructure Rebuild Management Office (IRMO) and Stronger Christchurch Infrastructure Rebuild Team (SCIRT) were created for repair and rebuild of horizontal infrastructure (water, wastewater, stormwater and roads). At present Council does not know how much earthquake recovery work will be required when SCIRT ends in 2016, but it is expected that infrastructure renewals will need to significantly increase over the next 20 years to return the City's infrastructure to its former level of service.

The rebuild standards have gone through several changes as investigations and design have been completed, and understanding of the damage has developed.

The three stages to date have been:

1. Repair of all earthquake damage, originally estimated at $2.9 billion; this was a high level estimate early in the programme. This level of expense would have provided a much newer network and reduced capital and operational expenditure requirements over the 30 year period.

2. However, the funding partners agreed that this was an unreasonable level of expense and so the scope was reduced to provide Council with infrastructure which had the same capital and operational expenditure needs as pre-earthquake levels by accepting damage on the network in less affected areas (central and western suburbs), and repairing the damage to newer infrastructure in the east where it was beyond economic repair and unserviceable. This was estimated at $2.5 billion.

3. Recent decisions by the funding partners have capped the cost of the SCIRT rebuild to $2.1 billion (i.e. a funding reduction of $400 million) meaning that infrastructure will be in a worse condition that pre-earthquake with a reduced remaining life and increasing capital and operational expenditure needs within the 30 year timeframe. This level of rebuild funding has been used to develop the 30 year infrastructure plan.

To assist SCIRT with meeting the financial constraints presented by Stage 3 above, an optimisation process was developed to prioritise work across the roading and three waters assets. The intent of this process was to identify critical assets and ensure that these were funded ahead of assets that are of a lesser priority. This resulted in a number of design guidelines being developed to formalise the process. However, rebuild standards and levels of funding are still under review by the funding partners and are therefore subject to change. There is therefore a large amount of uncertainty about the amount of damaged infrastructure that will be returned to Council, and this could have a major impact on capital and operational expenditure for the duration of this strategy. If more unrepaired infrastructure returned to Council than expected, the renewals programme will be reprioritised, and additional funding may be required. Council is exploring options which could potentially reduce this expenditure, including innovations and new technologies.

In addition, areas of residential land within Christchurch City were red-zoned by the Canterbury Earthquake Recovery Authority (CERA) and are being acquired by the Crown. The future of this land and infrastructure passing through the land is uncertain. Although currently being acquired by the Crown, non-residential buildings could be located in the residential red zone, and it is possible that infrastructure must be retained to serve future developments. Due to the uncertainty at this stage

the assets within the residential red zone remain on Council's books, however they are not included in renewal programmes or in depreciation calculations.

SCIRT has done extensive condition assessments of infrastructure which may have been damaged by earthquakes, but not all of this information has been provided to Council yet. Once all asset information has been provided, Council will have a much clearer understanding about the condition of its assets.

Climate Change

The most likely scenario relating to climate change is that Christchurch will experience more frequent intense rain storms resulting in a greater number of flood events, and it may also result in the Canterbury Plains experiencing drier than normal conditions. The IPCC Fifth Assessment Report, New Zealand Findings predicts the following to occur by 2080-2100 if there is no decrease in global greenhouse emissions:

- Sea level rises of 0.3-1.0 metres
- 0.8ºC average temperature increase
- 0-5% decrease in summer precipitation for Christchurch City
- 0-5% increase in summer precipitation for Banks Peninsula
- 10-15% decrease in winter precipitation for Christchurch City and Banks Peninsula
- Increased precipitation to the east of the Southern Alps, especially in winter
- An increase in the frequency and intensity of significant rainfall events
- Time spent in drought conditions to double or triple.

Changes to precipitation and sea levels will affect the recharge of Christchurch's aquifers and expose larger areas to the risk of coastal and tidal flooding.

Urban Development

A significant amount of urban development is proposed for Christchurch. This includes accelerated greenfield development (previously undeveloped) and intensification around existing commercial centres in the short term. In many cases, infrastructure will need to be upgraded or expanded to support this growth. The Land Use Recovery Plan outlines this expected development, however Council needs to be agile to address the changing needs as the recovery of the City occurs at accelerated or decelerated levels. Council also needs to provide infrastructure to support this growth, and it is generally more expensive to provide infrastructure for greenfield areas than for intensification within the city.

Ageing Infrastructure

Population and building booms in the 1950s and 1960s resulted in the construction of many Christchurch suburbs and associated infrastructure. This means that the rate of renewals will increase as these assets reach the end of their useful life. In addition, earthquake-damaged infrastructure that has a remaining life of at least 15 years is being patch-repaired rather than replaced by SCIRT. This means that there may be another renewals peak starting in 15 years' time. Timing, duration, costs and effects of this second renewals peak are currently unknown and cannot be confirmed until all renewals and repair information is received from SCIRT. Due to its unknown nature this peak is not allowed for in the forecasts.

Risk Management

Like much of Aotearoa/New Zealand, the district is vulnerable to natural and man-made hazards. Natural hazards include flooding, tsunami, earthquakes, slope instability, severe winds, snow, droughts and wildfire. Man-made hazards relevant to infrastructure include terrorism, hazardous substance incidents, transport accidents and infectious human disease outbreaks. Climate change is also expected to increase the frequency and severity of storms, resulting in more intense rainfall and flooding, which will be exacerbated by sea level rise.
A key issue for the district is to understand the nature and possible consequences of the risks posed by hazards and ensure these risks are managed to acceptable levels. In addition to threats to infrastructure, infrastructure failure can also occur as a result of internal causes such as a lack of maintenance or planning. Council must address and manage the risks of all hazards, including the management of low probability but high consequence events.

Regulatory Direction

It is likely that there will be change in the regulatory environment over the term of this document.

Given the recent reforms to the Local Government Act 2002, a consideration of **local government boundaries** is highly likely to be an issue within the next ten years. For Christchurch the questions that arise relate to the most appropriate organisation in the largest region in New Zealand, where Christchurch city dominates an otherwise largely rural/semi-rural environment, and the implications for infrastructure provision.

In a context of functional reforms regarding infrastructure provision and regulatory planning, the case for the reform of political structures may become stronger. Central government has stated that a review of Environment Canterbury will not include amalgamation with other local authorities.

The government has signalled changes to the **Resource Management Act 1991** (RMA) that have the potential to significantly impact on the environmental standards required of Councils in the treatment and disposal of wastewater and stormwater.

The next phase of the RMA reforms will make further changes to the RMA, and resource management more broadly, including how fresh water is managed and used, and an independent review of Sections 6 and 7 of the Resource Management Act 1991. Key elements of the proposals include:

- Clearer national direction and tools
- Single, local resource management plans that address future environmental and development priorities and cover all local, regional and national issues, replacing the current range of planning documents
- Simpler, faster and fewer resource consents.

Most, if not all, of the reforms will directly or indirectly affect infrastructure planning and consents. The proposed amendment that will potentially impact on infrastructure the most is the addition of the efficient provision of infrastructure to the list of matters of national importance in Section 6. The practical implications of this amendment are unclear but it will certainly mean that decisions on applications for consent or proposed plan changes that concern infrastructure will need to give more weight, or recognise and provide for the efficient use of infrastructure.

The RMA reform proposal included an option for regional freshwater-related plans to be developed through a collaborative process. This is already occurring in Canterbury through the implementation of the **Canterbury Water Management Strategy**, via the formation of the water management committees, the development of zone implementation programmes and the incremental incorporation of Zone Implementation Programme recommendations into the Land and Water Regional Plan. As a result, there is likely to be increasing pressure for the Council to further improve surface water quality, by reducing wastewater overflows and improving stormwater quality.

Affordability and Level of Service

Council's constrained financial position has reduced its ability to deliver pre-earthquake levels of service, and this is likely to be the case for many years. Council needs to establish an appropriate balance between expenditure required to accommodate growth and the asset renewal costs to restore levels of service.

Sustainability

Increased awareness of sustainability practices, especially regarding social, cultural and environmental issues, has resulted in different requirements; both in terms of legislation and in community expectations, as well as Council's Sustainability Policy.

Resilience

Resilience of infrastructure and its associated networks to the effects of future events, both natural and non-natural, is a critical issue for Councils particularly in the delivery of essential services. This exposure has been highlighted by the ongoing impacts of the 2010/11 series of earthquakes.

Natural events that could threaten the Canterbury region are:

- Earthquake
- Tsunami
- Extreme weather.

Non-natural events that should be considered are:

- Accident (e.g. accident causing loss of a pump station)
- Criminal acts (e.g. theft of control equipment)
- Sabotage (e.g. deliberate disabling of assets)
- Terrorism (e.g. contamination of the water supply).

Whilst it is possible to provide high levels of resilience this is usually accompanied by a higher cost for control systems, stronger materials and construction methodology. Upgrades for resilience can also result in the loss of remaining useful life in existing assets if they are replaced before they have been fully utilised. Therefore, decisions around resilience need to be balanced against affordability, risk and consequence.

The earthquake rebuild programme considered resilience in the design of all repair and replacement projects. This process led to a number of standard design details that improved the resilience of particular parts of Council's utility systems. These have been incorporated into Council's design standards for all future works. Examples include resilient pipe connection details to pump stations and use of polyethylene (PE) pipe for critical pipelines in liquefaction prone ground.

As part of the process for determining resilience need, all assets will be assessed for criticality in their provision of a network function. A critical asset will be one that performs a vital function for the delivery of an essential service to a significant part of the community. This may be a pump station on a trunk water main serving a whole suburb or a bridge on a key transport route. Typically, there will be no viable alternatives for delivery of the service.

However, the scope of work now included limits repairs to critical defects/assets only, which in some areas will provide a network which is much less resilient to future earthquake events.

Resilience options will be considered as part of the design process for creation and replacement of critical assets.

All essential networks have been assessed for exposure to non-natural threats through a risk management process. Where appropriate, security and/or protection arrangements are in place to reduce the likelihood of an event. Council is preparing a Resilience Strategy.

Insurance

Council has very limited insurance for its infrastructure assets, with only fire and earthquake cover for above ground assets which can be used. There is limited cover for below ground assets. Council's roads are not insured, as emergency works are subsidised by NZTA. More extensive insurance cover is being sought.

Normally Council's infrastructure would be insured for material damage (e.g. fire, flood, earthquakes), with business interruption insurance for some facilities. Contractors are required to have public liability and contract works insurance when working on Council assets. Please refer to Council's Financial Strategy for further information about insurance.

Economic and Social Environment

Whilst the short term economic activity in Christchurch is driven by the earthquake rebuild, along with benefits from strong dairying activity in the surrounding districts, there will likely come a time when both of these plateau. As well as the central city focus, the newer, enlarged commercial hubs such as Addington will stabilise, and require long term infrastructure support. Energy and transport costs could result in people moving to more concentrated urban environments. Timing and delivery of infrastructure will need to take account of these trends.

Relevant social issues include a more stratified society, with persistent levels of inequality underpinned by long term drivers of falling rates of home ownership, and diversifying patterns of employment and income. It is likely that there will be a greater segment of the older population who are both asset poor and cash poor. This will pose challenges around people's ability to contribute directly or indirectly, to Council rates as a key funder of infrastructure projects.

Technology Change

Demand changes as a result of technological improvements are difficult to anticipate both because technology is constantly changing and because there is no certainty on the size and rate of technology uptake. This uncertainty means that technological improvements are reacted to, rather than planned for.

New technology that may impact on the demand for services is typically developed with the following aims:

- Improved efficiency and convenience
- Alternative construction methods and treatment processes.

Council is actively considering new technologies that achieve these aims.

3 Linkage with Other Documents

Many other Council documents were drawn on to prepare this Infrastructure Strategy. The Infrastructure Strategy was used as an input to the Long Term Plan, and to inform updates to the other documents. The documents that this strategy has linkages to are:

Asset Management Plans outline and recommend management requirements for the Council's infrastructure assets to meet agreed levels of service and optimise whole of life costs, such that Council can meet the requirements of present and future customers and ratepayers. Asset Management Plans consider the condition of assets and demands upon them along with growth predictions to develop medium to long term capital programmes that will deliver the defined Level of Service.

Activity Management Plans are the building blocks for the Long Term Plan and Annual Plans. They set out the services and levels of service Council intends to provide the community for the next 3 to 10 years. The Activity Management Plans have strong links to, and are informed by the relevant Asset Management Plan. The recommended Asset Management Plan capital programme for renewals, replacements and new assets are aligned and phased to support delivery of the levels of service, while budgets are set according to the resources required to deliver the agreed activities, levels of service and projects.

The 30 year strategy for management of each activity's assets will be described in its Activity Management Plan. The strategies for Water Supply, Wastewater, Land Drainage, Flood Protection and Control Works, and Roads and Footpaths are summarised from the Activity Management Plans into this document.

The **Long Term Plan** sets out all the work and services the Council plans to undertake over the next 10 years. It explains why the Council will provide these services and projects, how it will achieve its objectives and how they will be funded. The Long Term Plan is renewed every three years to take account of changing city issues and projects. This planning process allows Council to take a long-term view of its responsibilities while enabling it to adjust for changing financial factors and keep budgets up to date.

The **Financial Strategy** sets out how the Council plans to manage its share of the costs of the earthquake rebuild (consisting of operating deficits, response costs, infrastructure rebuild and anchor projects) as well as continue to provide agreed levels of service to the community.

Council has developed **30 year strategic plans** for the infrastructure assets covered by this strategy as follows:

- Water Supply Strategy 2009-2039
- Wastewater Strategy 2013-2043
- Surface Water Strategy 2009-2039 (this includes stormwater and flood protection)
- Christchurch Transport Strategic Plan 2012-2042.

These strategies have been used to inform the plans above and in that way contribute to this document. The water supply, wastewater and surface water strategies will be reviewed next financial year and will form the basis of a Three Waters Strategy.

Additional 30 year strategic plans that indirectly affect management of infrastructure assets include the Biodiversity Strategy 2008, Christchurch Economic Development Strategy, Climate Smart Strategy and Sustainable Energy Strategy 2008-18.

4 Thirty Year Strategy

4.1 Council's Strategic Direction

Community Outcomes, Goals and Objectives

The community outcomes describe what the Council aims to achieve to promote the social, economic, environmental and cultural interest of the district, in the present and the future. They focus on those areas that the Council has the ability to, and can afford to, influence and describe what the City aspires to be.

The community outcomes have been sourced from and align with the Council's key planning documents, e.g. Water Supply Strategy (2009). They are important as they set the direction for long term plans. All activities that the Council plans to undertake as part of its Long Term Plan contribute towards achieving these outcomes. All capital and operating expenditure that the Council undertakes is directed towards a level of service that moves the community towards these outcomes now or at some future point.

The relevant community outcomes, their context and related strategic directions are noted in the table below. Infrastructure planning takes these community outcomes into account.

Community Outcome	Context	Strategic Direction – Key Strategies/Plans and Goals
The transport system provides people with access to economic, social and cultural activities	The purpose of the transport system is to provide options for the movement of people and goods. Key activities are the provision of roads, footpaths, cycling and walking networks and associated street lighting and traffic systems.	*Regional Land Transport Strategy 2012 – 2042* • Improved land use and transport integration • Increased travel choices for households to access key activity centres *Greater Christchurch Transport Statement 2012* • Integrate land-use activities with transport solutions • Provide safe, efficient and resilient links to connect people and places • Ensure efficient and predictable travel time between key places *Christchurch Transport Strategic Plan 2012 – 2042* • Easy movement of and access to goods and services *Land Use Recovery Plan* • Developing a transport system that meets the changed needs of people and businesses, enabling accessible, sustainable, affordable and safe travel choices

Community Outcome	Context	Strategic Direction – Key Strategies/Plans and Goals
There is a range of travel options that meet the needs of the community	Having a city with a range of travel options provides for an inclusive society. This allows for the transport needs and wants of the entire community to be provided for.	*Regional Land Transport Strategy 2012 – 2042* • Increased travel choices for households to access key activity centres • Improved mobility for the transport disadvantaged *Greater Christchurch Transport Statement 2012* • Provide more options for people to walk, cycle and use public transport *Christchurch Transport Strategic Plan 2012 – 2042* • Managing the demand network by encouraging people to use a wider range of travel options *Land Use Recovery Plan* • An attractive and financially viable public transport network supports significantly increased use • More people walk and cycle in and between centres of activity and for local trips.
An increased proportion of journeys is made by active travel and public transport	Increasing the number of trips made by active and public transport will help ease congestion levels in the City. Increasing active and public transport journeys will also help make the city less reliant on fossil fuels.	*Regional Land Transport Strategy 2012 – 2042* • Increased proportion of the population travelling by active means *Greater Christchurch Transport Statement 2012* • Provide more options for people to walk, cycle and use public transport *Christchurch Transport Strategic Plan 2012 – 2042* • Managing the demand network by encouraging people to use a wider range of travel options *Land Use Recovery Plan* • Developing a transport system that meets the changed needs of people and businesses, enabling accessible, sustainable, affordable and safe travel choices
The Council's water supplies meet the public's reasonable needs	Public water supplies for Christchurch largely rely on groundwater sources. A key activity is the supply of water to properties, including provision of infrastructure and leak detection measures.	*Water Supply Strategy 2009-2039* • The Council's water supplies meet the public's reasonable needs.
Christchurch has clean, safe drinking water	Public water supplies must meet the Drinking-water Standards for New Zealand. Supply of water to properties and associated infrastructure are key activities.	*Water Supply Strategy 2009-2039* • We have clean, safe water • The sources of our water are protected from harm *Surface Water Strategy 2009-2039* • Improve the water quality of our surface water resources.

Community Outcome	Context	Strategic Direction – Key Strategies/Plans and Goals
Water quality in rivers, streams, lakes and wetlands is improved	Surface water quality is essential for supporting ecosystems, recreation, cultural values and the health of residents. Stormwater management and wastewater collection, treatment and disposal are key activities for Council.	*Surface Water Strategy 2009-2039* • Improve the water quality of our surface water resources • Manage stormwater in an efficient manner that supports the other goals of the Strategy *Wastewater Strategy 2013* • The wastewater system protects public health effectively. • The wastewater system is resilient and meets community needs for environmental, social and cultural sustainability. *Water Supply Strategy 2009-2039* • The sources of our water are protected from harm.
Water is used efficiently and sustainably	As the population of Christchurch continues to grow, the current rate of consumption will place greater pressure on drinking water sources and the supply network. This is exacerbated by changing climatic conditions and seasons.	*Water Supply Strategy 2009-2039* • Water is used efficiently and sustainably *Sustainability Policy* • Products and services use less resources to achieve their benefits
Risks from natural hazards, including earthquakes, flooding, tsunami and rock fall, are minimised	Christchurch is vulnerable to a range of natural hazards, with the potential for significant harm to people and property. In relation to flooding, key activities are stormwater management, and flood protection and control works.	*Surface Water Strategy 2009-2039* • Reduce the adverse effects of flooding *Wastewater Strategy 2013* • The wastewater system is resilient and meets community needs for environmental, social and cultural sustainability.
Injuries and risks to public health are minimised	Water quality can have an effect on public health. The Council will remain proactive in minimising the risks to public health from our drinking water supply by employing a risk management programme to deliver targeted improvements where necessary.	*Wastewater Strategy 2013* • The wastewater system protects public health effectively *Water Supply Strategy 2009-2039* • We have clean, safe water *Surface Water Strategy 2009-2039* • Improve the water quality of our surface water resources.

4.2 Infrastructure Priorities

General

The Council process for considering which projects take priority over others takes into account the following factors:

- The drivers for the project (renewing assets, infrastructure to meet backlog demand, infrastructure to provide an improved level of service, infrastructure for growth or a new service)
- The prioritisation category for the project (already committed to a project (i.e. contract awarded), legal requirement (e.g. to meet resource consent conditions), providing for growth, renewals, increased level of service or new services)
- The overall project score (calculated from the contribution the project makes to achieving the community outcomes above, any savings resulting from the project, and how much of the community benefits from the project)
- The cost of the project
- The risks associated with the project.

The general priority areas for infrastructure are repairing and replacing earthquake damaged assets, and renewing assets as they reach the end of their useful lives. The timing and sequence of some of this work will need to be integrated with the Greater Christchurch Urban Development Strategy. The priorities for each of the infrastructure groups are described below.

Water Supply

The priorities for water supply are:

- Repairing earthquake damaged assets
- Renewing failed or failing assets
- Meeting the requirements of the Drinking-water Standards for New Zealand
- Providing water infrastructure for growth areas.

Wastewater

The priorities for wastewater are:

- Repairing earthquake damaged assets
- Renewing failed or failing assets
- Providing infrastructure for growth areas
- Reducing the effect of overflows, by reducing the frequency and volume of overflows and improving the quality of the discharge to environment.

Stormwater

The priorities for stormwater are:

- Repairing earthquake damaged assets
- New stormwater infrastructure in growth and rebuild areas for stormwater detention and treatment
- Managing Cranford Basin and Hendersons Basin as natural detention and treatment areas
- Ongoing improvements in stormwater modelling and monitoring.

Flood Protection and Control Works

The priorities for flood protection and control works are:

- Repairing earthquake damaged assets
- A new flood protection scheme for the Flockton area
- Additional flood protection works for areas made more flood prone by earthquakes
- Investigations into long term tidal flood protection system for Christchurch
- Delivering the projects recommended by the Mayoral Flood Taskforce.

Roads and Footpaths

The priorities for roads and footpaths are:

- Repairing earthquake damaged assets
- Maintenance and renewal of existing assets
- Improving the safety of the network
- Support the redevelopment, recovery and growth of the city.
- Encouraging mode change, to support increased walking, cycling and use of public transport.

4.3 Asset and Service Management

Options for Asset Renewals

For planning for renewal of assets, three options were developed within the Asset Management Plans:

- **Option 1 – Low Risk Programme:** This option is based upon predictive modelling or historical data that assumes replacement of an asset when it reaches 100% of its expected useful life or a condition grading of 5 (based on a 1 to 5 scale with 1 being brand new and 5 being at the end of its life). This is normal practice for local authorities.
- **Option 2 – Reduced Level of Service Programme:** This option is based upon predictive modelling detailed in Option 1 but with reduced funding requirements achieved through the reduction of the customer levels of service delivered to the community. While this reduces capital expenditure on renewals, maintenance costs increase due to asset deterioration.
- **Option 3 – High Risk Programme:** This option is based upon predictive modelling that assumes replacement of a non-critical asset when it reaches 105% – 120% of its expected useful life or a condition grading of 5. While this reduces capital expenditure on renewals, maintenance costs increase due to asset deterioration.

Council proposes adopt Option 1 for carriageways, traffic lights, cycleways, water supply assets, wastewater pumping and wastewater treatment plant assets.

However, due to Council's financial constraints, Option 1 is not affordable in all instances and Council has opted to defer renewals where possible, to reduce the overall infrastructure renewals budget. Option 3 is therefore proposed for wastewater pipes, roading assets not listed above (e.g. bridges, lighting, landscaping), stormwater and flood protection works. While this will result in increased costs and disruption to maintain assets as they get older, the overall costs are lower.

This asset renewal programme will result in the majority of earthquake damage being repaired in the next 20 years.

Levels of Service

Council has established a suite of levels of service for each activity that link to the Community Outcomes described in Section 4.1. These levels of service are detailed in each Activity Management Plan for that particular activity.

Many services have been significantly affected by the 2010/11 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. The SCIRT rebuild programme is planned to continue until 2016 at which point seriously and critically damaged infrastructure will have been repaired.

Beyond 2016 it is going to take many years to address minor damage and service impairment as part of the routine maintenance programmes and renewals.

SCIRT's scope was to originally restore pre-earthquake levels of service. However, due to the budget reductions outlined above, the SCIRT scope is now focused on repairing earthquake damage.

This is subtly different from the original scope and means that in situations where a repair is warranted rather than renewal, only the earthquake damage will be repaired, not the level of service deficiency. Where full renewal is required it will be delivered to meet the current design and construction standards.

Performance Measurement

Each Activity Management 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. Council monitors and reports against the performance measures and benchmarks in its Annual Report.

Again the earthquakes have disrupted the ability to analyse and assess historical data and trends in Council's performance and enable it to set targets from a researched base. It is planned to build up this dataset over the coming three years as the District returns to a more stable environment, to enable improved analysis for the 2018 Long Term Plan.

Infrastructure Assessments

One benefit of the earthquakes was the extensive condition assessment of Council's assets to determine the rebuild programme. This data has been captured by SCIRT and is progressively being transferred into Council's Asset Management Information System, where it is used to populate the asset registers with current information.

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 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.

SCIRT As Built Information

Council has implemented in conjunction with SCIRT a robust data transfer system which includes stringent quality assurance protocols for the passing of "As built" data and documentation between both organisations. All transferred metadata is stored in Council's Asset Management Information System. Council also receives information from SCIRT about proposed projects, which are shown in Council's GIS system.

4.4 Improving Resilience

As part of the SCIRT rebuild programme, investigations into better construction details and methodologies have been undertaken and implemented to improve the resilience of Council's infrastructure, particularly in areas prone to liquefaction (e.g. flexible pipe connections to pump stations, resilient well heads, pressure and vacuum sewer systems). These learnings and standard details are being incorporated into Council's Infrastructure Design Standard and Construction Standard Specifications.

Following the earthquakes, Council's financial planning has included the rebuild proposal at current funding levels and assessment of the criticality of each of its assets at a network level, and this has been used in prioritising Council's capital programme. It is planned to continue to update the Asset Management Information System to keep it up to date, and to continuously improve it, especially regarding criticality for the different groups of assets, to make sure that an integrated approach is taken (e.g. the same criticality should be assigned to a bridge and the pipes that it carries). Council liaises with Lifelines groups to make sure that a consistent approach is applied for infrastructure which serves a lifeline role. Council is also developing a Resilience Strategy.

5 Significant Infrastructure Issues

5.1 Water Supply

Residential Red Zone

Approximately 10.16 kilometres of water supply pipes are within the Avon River residential red zone. There is also infrastructure in rock-fall residential red zones.

Exact figures on the length of red zone pipes to be retained or abandoned are not yet available. For long term planning purposes, it has been assumed that all rock-fall red zone pipes will remain and all Avon River residential red zone pipes will be decommissioned, except for trunk mains where required to convey water across the red zone. Once SCIRT projects are complete, exact figures will become available.

A number of water supply pump stations, reservoirs and associated access tracks are on land red-zoned due to the risk of rock-fall. Currently the risk to staff is low as very little time is spent on site and therefore it is planned to retain these assets. Should health and safety or resilience issues require changes to these plans, then a funding increase will be required.

Earthquake Legacy

SCIRT has completed works to return service to all customers and renewed a number of water mains. Approximately 50% of the water mains that meet the pre-earthquake renewals criteria will not be renewed by SCIRT and remain for Council to renew.

Long term effects on the water supply network resulting from the earthquake are not well understood. Ground settlement is continuing following the earthquakes and further water supply failures are possible from this settlement. Movement during the earthquakes may have caused microscopic cracks in water mains. Microscopic cracks in asbestos cement water mains decrease the pipe life leading to premature failure. The extent of this issue and potential outcome to the water supply network are not currently known.

Earthquake damaged wastewater and stormwater networks pose a hazard to the water supply network, especially on hillsides. During storm events, wastewater or stormwater escaping their respective damaged networks can scour material surrounding water pipes, leading to a failure.

Ageing Network

The first public water supplies serving the Christchurch Area were Akaroa and Lyttelton in 1890, Sydenham in 1903 and then Christchurch Central Business District and Southern Christchurch in 1908. Initially cast iron pipes with an expected life of 120 years were used. Between World War II and the mid 1980's, asbestos cement (60 year life) became the material of choice until health concerns led to a move to plastic pipes. The post-war "baby boom" period was a significant time of expansion for Christchurch with approximately half of the water supply reticulation network consisting of asbestos cement pipes installed at this time.

Both the asbestos cement and early cast iron pipes are approaching the end of their effective lives and require renewal. Increased renewals are expected for the next 45 years. 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. Demand models and the network model should be fully developed, updated and calibrated to provide tools for correct sizing of infrastructure; however this cannot proceed until all rebuild and repair data is received from SCIRT.

Figure 5-1 shows the remaining life of water mains and therefore the estimated renewals requirements. Approximately 100 kilometres of water mains have been deferred for renewal due to individual mains outperforming their expected asset lives. The condition of these deferred mains remains adequate; however some mains are undersized and others partially blocked by mineral build-up, therefore it is unlikely they will meet fire flow requirements. The proposed renewals programme aims to complete all deferred renewals over the next ten years.

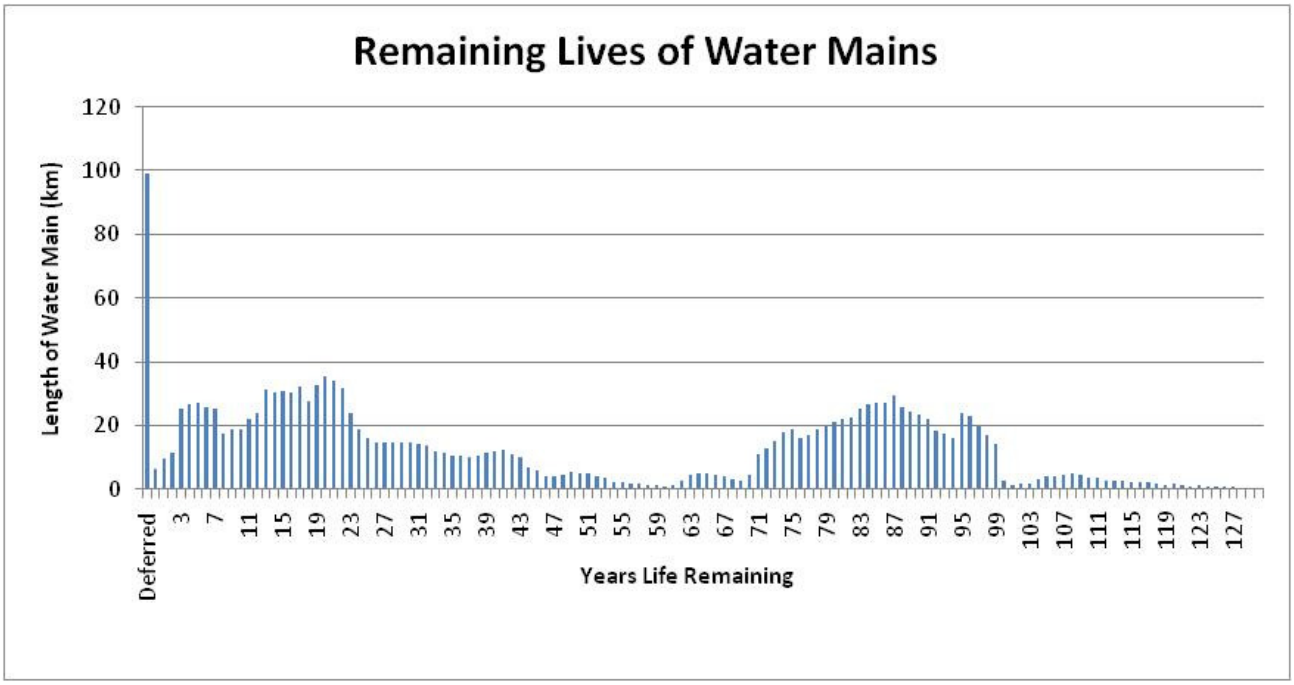


Figure 5-1: Remaining Life of Water Mains

Leaks from the water network are likely increase due to increased pipe failures in the ageing network. Leakage not only increases water demand and pumping costs but can cause damage to roads and other assets.

Climate Change

Climate change has the potential to affect both supply of, and demand for water. Warmer drier conditions are likely to result in increased water demand for irrigation and recreational use. However, as an increase in land use intensity is expected to occur at the same time, which will reduce the area of irrigated land.

The Christchurch urban area, Lyttelton, Governors Bay and Diamond Harbour are fed from groundwater sources beneath Christchurch. An increase in rainfall in the aquifer recharge areas means the Christchurch urban area and Lyttelton Harbour water supplies should not experience adverse changes to water quantity or quality. Local water quality issues may arise if sea levels rise causing the fresh water/salt water interface to move inland, contaminating the groundwater. This could be remedied through replacing coastal water supply wells and with wells further inland.

Wainui also uses groundwater as its water source. Rainfall reductions are predicted for the Wainui aquifer recharge zone; however due to the low flows extracted for the water supply scheme the climate change rainfall decrease is not expected to affect the availability of water.

Due to salt-water contamination of the previous bore, a replacement bore for the Birdlings Flat water supply scheme has been found. As the groundwater is taken from a deep aquifer, it is unlikely to be affected by climate change.

Akaroa, Takamatua, Duvauchelle, Pigeon Bay and Little River water supply schemes are fed from surface water sources, with groundwater also used in Akaroa and Little River. Decreased rainfall from climate change will result in reduced stream flows and are likely to reduce the availability of surface water. Increased turbidity as a result of increased rainfall intensity is also expected, increasing the load on the water treatment plants. Increased storage, upgraded water treatment plants and groundwater sources are possibilities to maintain water supplies to these areas in the future.

Reliability of Supply

It is expected that the reliability of supply will decrease, primarily due to increased reticulation failures in the ageing network. Reticulation failures cause short term (approximately 5 hour) outages to groups of individual properties, with typically one block or less affected.

Summer water restrictions are often imposed on Akaroa and Takamatua. A scheme involving a new water treatment plant, increased storage volume and merging the three existing schemes into a single scheme is underway, and is due for completion in 2015. On completion this is expected to reduce the need for future restrictions.

The decentralised nature of Christchurch City water sources provides a resilient network unlikely to be affected by failures at individual bores or pump stations.

Christchurch City hillside pressure zones are each fed from a single reservoir and Banks Peninsula water supplies (except for Lyttelton Harbour) are each fed from a single treatment plant. Lack of redundancy means reservoir or treatment plant failures could cause supply interruptions; however water storage means short-term faults will not result in supply interruptions.

Lyttelton Harbour Basin water supplies have a number of areas where resilience is an issue, these include supply pipes to Lyttelton through the road and rail tunnels, supply pipes on the seabed from Lyttelton to Diamond Harbour and the supply pipe from Lyttelton to Governors Bay. The Governors Bay pipeline is constructed from poor quality material and may fail prematurely. Renewal of this pipeline will be investigated in the near future.

Access to the pipes in the tunnels and on the seabed is limited and requires specialised equipment and expertise. Catastrophic failure of any of these pipes or the tunnels has the potential to cut water supply to individual settlements or to Lyttelton Harbour as a whole, although the length of interruption depends on the duration of outages, as water is stored in reservoirs in Lyttelton, Governors Bay and Diamond Harbour. Rail tunnel pipes are approaching the end of their lives and will be replaced, and resilience will be considered as part of that project.

5.2 Wastewater

Residential Red Zone

Approximately 41.4 kilometres of wastewater pipes are within the Avon River residential red zone. There is also infrastructure in rock-fall red zones.

Exact figures on the quantity of red zone pipes to be retained or abandoned are not yet available. For long term planning purposes, it has been assumed that all rock-fall red zone pipes will remain and all Avon River residential red zone pipes will be decommissioned, except for trunk mains where required to convey wastewater across the red zone. Once SCIRT projects are complete, exact figures will become available.

The exact process for abandoning infrastructure is uncertain and potential additional costs exist if Council needs to remove and backfill manholes. Pump stations, wastewater overflow points and trunk mains within the red zones will be retained.

Earthquake Legacy

Earthquake damage to the reticulation network includes large numbers of cracked pipes and separated joints on wastewater pipes. As a result of this damage, stormwater inflow and groundwater infiltration have significantly increased. In addition to allowing increased inflow and infiltration, cracks increase maintenance requirements by allowing intrusion of silt and tree roots, which can cause blockages. Crack growth over time also leads to premature pipe failure.

To optimise the rebuild and increase resilience, additional types of wastewater system are being constructed, including lift stations, pressure sewer systems and vacuum sewer systems. This will require a different approach to operations and maintenance, as well as renewals. The vacuum systems in Aranui and Shirley have been designed with little scope for additional connections, which will constrain development in these areas.

Earthquake damage reduced capacity and treatment performance at wastewater treatment plants, particularly at the Christchurch Wastewater Treatment Plant. Full capacity and treatment performance has been regained; however buildings and some standby equipment are yet to be repaired, especially at the Christchurch Wastewater Treatment Plant.

Overflows

Urban development also 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.

Dry weather overflows are infrequent and result from network faults. Overflows caused by blockages will decrease as damaged or failed pipes are renewed.

Wet weather 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. Renewals and repairs to decrease inflow and infiltration will reduce wet weather overflows.

Ageing Network

Wastewater collection services were first installed in Christchurch between 1876 -1885. Wastewater network construction resumed with significant periods of construction in the 1900-1912, 1924-1933, 1950-1975 and 1984-2008 periods. Materials changed over time with the first two construction booms using earthenware pipes, a mixture of earthenware and concrete between the wars, a mixture of reinforced concrete and asbestos cement post World War II, and plastic more recently. Older pipes are reaching the end of their lives, and this combined with reduced life due to earthquake damage, will mean that pipe renewals will need to increase.

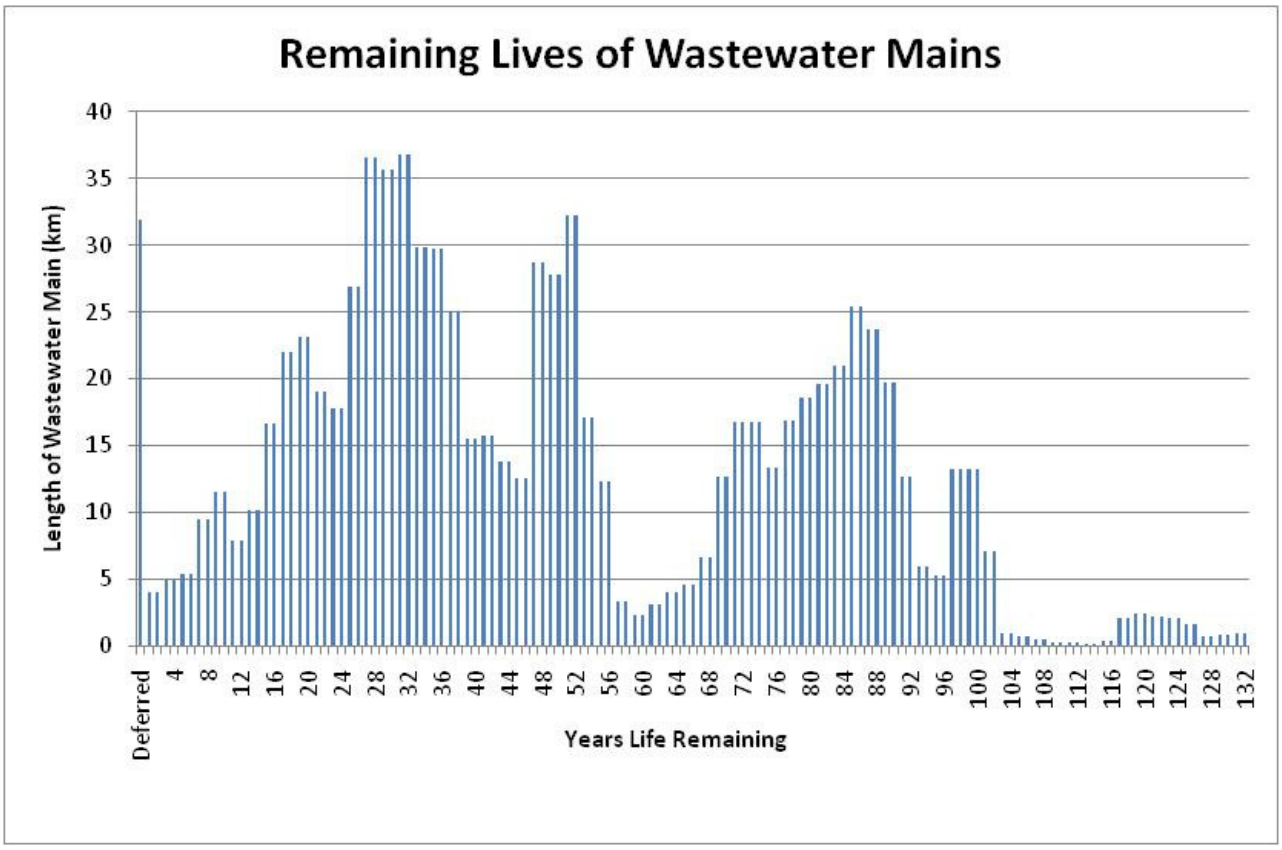


Figure 5-2: Remaining Life of Wastewater Mains

Figure 5-2 shows the remaining life of wastewater mains and therefore the estimated renewals requirements. Earthquake damage has reduced the lives of different pipe materials by different amounts. To date the required wastewater pipe renewals were approximately 1 – 2 kilometres per year, and if the earthquakes had not occurred, this trend would have continued until 2030 with only 3 kilometres of pipe deferred for renewal. Due to earthquake-related life reductions, there is now 32 kilometres of pipe overdue for renewal (deferred renewals). 5 kilometres of pipe will need renewing in 2020, 10 kilometres in 2027 and 30 kilometres in 2041. In addition to the renewals indicated by the remaining lives, the deferred renewals are proposed to be completed over the next 20 years.

Expectations of Service Delivery

In the mid to late twentieth century wastewater collection, treatment and disposal was seen as a basic human right and only noticed when problems existed. In the late twentieth century and early twenty-first century the expectation for wastewater services remains, however additional expectations have developed including compliance with cultural beliefs and improving discharge quality. These new expectations could potentially change the statutory requirements that must be met under resource consents for the wastewater system.

Iwi find discharges of human effluent to water bodies culturally offensive, and the community finds discharges to water undesirable in terms of food gathering and recreational uses. Environmental desires often include the treatment of wastewater to the highest standard possible before discharge. High levels of treatment, and discharge to land rather than water, are expensive and conflicts with the public desires for low costs. Finding an acceptable balance of cost, social, cultural and economic factors is important.

Increased environmental and cultural awareness is resulting in the public being less tolerant of wastewater overflows to water bodies and public pressure for the unrealistic goal of eliminating overflows may eventuate.

5.3 Stormwater

Asset Condition

Asset management for stormwater drainage is not as advanced as the other infrastructure groups and as such there are gaps in the asset data held and quality of that data. Very little documented asset condition data exists for the portfolio and most data pre-dates the earthquakes. SCIRT has surveyed a large proportion of the stormwater pipe network. The remainder of the portfolio needs to be accurately recorded into the Asset Management Information System. A programme of verifying and correcting asset data and collecting condition information is being developed, with the intention of having a fully populated asset register in two to three years' time.

Earthquake Legacy

Damage to the piped stormwater network is being repaired and rebuilt by SCIRT. There is a good understanding of what SCIRT has completed so far, but damage to all networks exceeds available funds and it is not known how much earthquake recovery work will remain when SCIRT ends in 2016. Ongoing additional maintenance is required to reinstate pre-quake levels of service in the stormwater drainage network, including extensive removal of liquefaction material and relining of lined channels. The final decisions about the Avon River residential red zone have yet to be made, however it is likely that any reticulated stormwater infrastructure in the area will become redundant.

Land settlement has exposed new areas to flood risk and adversely affected the natural drainage of some areas of the City. The Land Drainage Recovery Programme includes 63 projects to address the impacts of the earthquakes on land drainage and the associated infrastructure.

Capacity

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.

Dredging of waterways was a common practice up until the 1990s but has not been carried out on a significant scale since then. The degree of siltation across the network has been exacerbated by liquefaction material filling open channels.

SCIRT will generally replace damaged stormwater pipes like-for-like, or may increase capacity to restore the on-road level of service. The Council is working with SCIRT to identify under-capacity networks and where possible is contributing to the costs of upgrading these. A city wide hydraulic model is being proposed to identify capacity issues and future needs.

Flood Risks

The district has always been exposed to flood risk from both the sea and the river network, with the stormwater network (pipes and secondary flow paths) functioning well enough to deal with average sized flood events (1 in 10 year Annual Recurrence Interval). As the predicted climate change and sea level rise scenarios unfold flood risk will increase, exposing more people and properties to increasingly frequent flood events.

Flood risk has worsened since the earthquakes due to land settlement, loss of natural gravity drainage, loss of capacity and damaged assets. The level of damage and flood carrying capacity of waterways and the stormwater network is being assessed. Remedial work required is being prioritised and implemented. Land settlement has exposed new areas to flood risk and increased the size of existing areas. This was highlighted in the significant storm events of March 2014. Some short term measures have been implemented and longer term flood management schemes are being investigated, particularly in the Flockton area and the Lower Heathcote catchment.

There is an opportunity to provide stormwater treatment and flood management within the Avon River residential red zone, however final decisions on the use of this red-zoned land are yet to be made.

Climate Change

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 higher elevations. In time this will affect most stormwater systems east of Fitzgerald Avenue. 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.

Ageing Network

The majority of the piped stormwater network has been constructed since 1970, in response to major flooding in the Wahine storm and several severe floods that occurred in the 1970s. As a result the stormwater pipe network has a mean age of 30-40 years, and is about one third through its expected life. The most important components of the stormwater network are streams and rivers, whose channels have an indefinite life. However, urban activities have all but destroyed the ecology of urban streams and continually clog waterways with sediment. These issues have the potential to drive significant restoration costs.

Urban Development

Unmitigated urban development profoundly alters stormwater flows. When land is developed the vegetation that intercepts and slows rainfall run-off is removed. Grading flattens the terrain and fills in natural depressions that would normally provide temporary storage for rainfall and slow run-off. The topsoil and layers of humus are removed and the remaining subsoil is compacted. The addition of buildings, roads, car parks and other impervious surfaces increase stormwater run-off. Development and impervious surfaces also limit the amount of water that can infiltrate the soil and reach groundwater, reducing the amount of water that can recharge aquifers and feed springs. Finally, as stormwater runs over rooftops and lawns, car parks and industrial sites, it picks up a variety of contaminants and pollutants which are discharged into waterways and the coastal environment. Mitigation of flow increases and contaminant entrainment are provided for all new subdivisions, and are also retrofitted to existing unmitigated developments as opportunities arise, however this is an expensive addition to the City's infrastructure.

Stormwater Quality

All of the Zone Implementation Programmes relevant to Christchurch (Banks Peninsula, Christchurch-West Melton, and Selwyn-Waihora Zone Implementation Programmes) have recommendations related to surface water quality, although they differ with respect to the water bodies of concern (focused as they are on the water bodies within their respective zones) and to some degree on the contaminants of concern. There is a clear direction in the Christchurch-West Melton Zone Implementation Programme for improved water quality in Christchurch's streams, rivers and the estuary and work is already underway with the development and implementation of catchment-based stormwater management plans.

The recently updated National Policy Statement for Freshwater Management (2013) added a national objectives framework that includes a set of national bottom lines for a number of pollutants. Almost all water bodies will be expected to have water quality no worse than the national bottom lines and there are likely to be water bodies for which regional standards will be set that are more

stringent than the national bottom lines. Standards applicable to specific water bodies are to be determined by regional councils. It should be noted that there are water bodies in Christchurch that did not meet one or more national bottom lines per Environment Canterbury's monitoring data in 2011/12 and/or 2012/13 (e.g. ammonium nitrogen in Halswell retention basin and *E. coli* in the Heathcote River at Rose Street).

5.4 Flood Protection and Control Works

Earthquake Legacy and Subsidence

The most significant result of the earthquake series for flood protection has been the changes in land levels, with areas of settlement and areas of land rising. 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 as it discharges into the estuary has risen by 0.3 – 0.5 metres, which has flattened out the gradient. This has added to the siltation and reduced channel capacity. Capacity across the land drainage network has been reduced due to the large volumes of liquefaction material which has yet to be removed from the open channels.

The Land Drainage Recovery Programme (LDRP) was initiated in 2012 to investigate and redress the effects of the earthquakes on land drainage. The programme is made up of 63 projects, 10 of which are completed or near completion. The general approach for waterways in catchments suffering from ground settlement is to increase the capacity of the waterway (e.g. by widening the channel, bridges and culverts). For areas that have settled behind the Avon River stopbanks, detention ponds will be constructed behind the stopbanks to attenuate peak flows, and stormwater will be pumped from the ponds into the river. In some areas, it may be more cost effective to raise the habitable floor level of existing houses to avoid flooding, rather than improving network capacity (e.g. near the lower Heathcote River).

The stopbanks along the Avon River have been temporarily repaired and are expected to be relocated to more stable land further from the river's edge. This will necessitate a change to the outlets which run through the stopbanks and minor infrastructure in the residential red zone will become redundant. The Avon River residential red zone provides opportunities to re-think how this area is managed and how flood protection is provided in the future.

Sea Level Rise

Christchurch will experience sea level rise, by as much as 1 metre by 2115. This 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, so that the current investment in major flood protection infrastructure will also be compatible with the long term strategy for dealing with sea level rise and possible increases in rainfall intensity. In the medium term, Council is planning tide protection for some areas which would otherwise be affected by sea level rise, for an increase in sea level of around 0.5 metres. However, as a long term strategy, retreat from these areas is likely.

Climate Change

Climate change predictions indicate a warmer and drier climate, but with increased intensity of rain storms resulting in a more severe flood events. The current stormwater pipe network is designed to deal with a 1 in 5 year Average Recurrence Interval (ARI) rainfall event; any event beyond this scale results in the activation of 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. Christchurch is also within the limits of the Waimakariri River floodplain. Predicted increases in rainfall volumes at the headwaters will increase Waimakariri River flows but the risk of increased flooding is considered to be low because of the primary and secondary stopbank system along the river.

To reduce the impact of flooding, under the Proposed Replacement District Plan new houses in the Floor Level and Fill Management Areas will be required to have habitable floor levels 0.4 metres above the 200 year ARI flood level, or 0.4 metres above the 200 year ARI tide level taking into

account 1 metre sea level rise. Other areas will be required to 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).

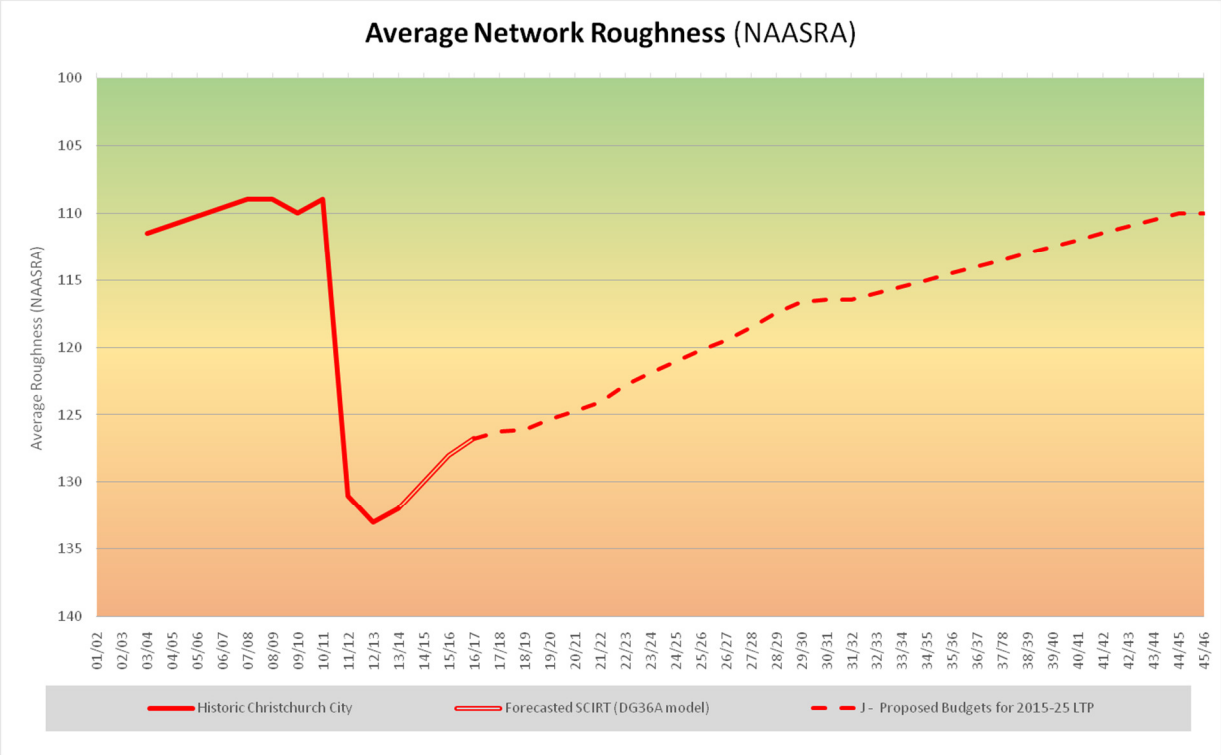
5.5 Roads and Footpaths

Earthquake Legacy and Levels of Service

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. The initial phases of repair or replacement of this infrastructure is a priority for recovery and is expected to be completed by SCIRT in 2016. However, in many instances even once the network is reinstated, it will not be to the same standard as was typical prior to the earthquakes and it will be approximately 30 years before the whole network is returned to a reasonable level of service. It is assumed that some of the roading will remain operational in the residential red zone network (e.g. through roads).

The repairs generally focus on structural repair, waterproofing and positive drainage. However this does not restore roughness or smooth travel exposure to pre-earthquake levels (as shown in Figure 5-3). Nor does it address the likely reduction in remaining asset life due to earthquake damage and partial repairs to road surfaces (e.g. trenching).

Figure 5-3: Road Roughness Prediction



Central City Recovery

The recovery of Christchurch's central city is a major priority. If current mode-share continues, the central city will experience severe congestion by 2041 due to an estimated extra 70,000 car trips being made per day. To avoid this scenario, a significantly larger share of future trips will need to be made using public transport, walking and cycling. "An Accessible City" is a group of central city transport projects that will improve the level of service in the Central Business District and help to achieve the goals in the Christchurch Central Recovery Plan. It is intended to deliver this more balanced transport network in the central city, and will be supported by integrated multi-modal networks in the wider city, such as improved public transport corridors and the major cycleways network.

Resilience

As 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 hard engineering (such as slips on the Port Hills). 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.

Travel Demand Growth, Congestion and Travel Choices

The closure of the Central Business District and retreat from the residential red zone has led to temporary and permanent dislocation for residents and businesses with associated changes in short and long term travel patterns. A return to steady travel patterns and modal splits is not expected in the next ten years. As the earthquake recovery continues, demand on the road network is expected to be highest in the west of Christchurch and repopulation of the central city is expected to increase parking demand, as well as demand for quality walking, cycling and public transport provision. Private vehicle trips are currently growing at 1% per year and freight trips at twice this rate. If current trends continue, by 2041 there could be a 30% growth in the volume of traffic compared with 2010 levels. This will put pressure on some areas of the network and result in increased delays.

Reducing congestion can provide a range of benefits, in particular reduced travel times and reduced vehicle operating costs, which will assist economic productivity. However, increasing capacity to accommodate increased traffic volumes is not desirable because it is expensive, resource intensive and encourages further traffic growth, creating more capacity problems in the long term and undermining sustainability objectives. Furthermore, it progressively creates an urban environment in which road infrastructure, vehicles and their storage take up an ever increasing share of space, reducing amenity, multi-modal connectivity and liveability.

A key challenge for congestion management is achieving a financially, environmentally and socially sustainable approach in which priority is given to optimising the use of existing infrastructure and providing multi-modal travel choices (in accordance with the priorities in the Christchurch Transport Strategic Plan).

Urban Development

A key challenge for the roading network is to ensure that investment to cater for new urban growth in the short to medium term does not contradict the long term plans for intensification in Christchurch, and also that provision is made to set land aside for any identified future transport corridors during the acceleration of greenfield development in the short term. New growth areas will in the first instance be catered for by optimising use of existing assets and providing travel choices, but some development of the infrastructure will be needed to support the development.

Regional and Nationally Important Roads

As mentioned above freight volumes are expected to grow significantly by 2041. It is important that these goods can be moved efficiently and effectively, while minimising any negative impact on the rest of the transport network. A key challenge will be identifying and implementing measures that will improve freight efficiency without encouraging increased general traffic volumes on those routes thereby undermining any gains made for freight. Accompanying this freight growth will be an increase in the number of High Productivity Motor Vehicles on the network. This entails a need for infrastructure on strategic freight routes (particularly bridges) to be constructed and maintained to a sufficient standard to accommodate the increased weight and increased numbers of these vehicles.

Funding for Roads and Footpaths

Funding for transport activities is sourced from rates, developer contributions (for growth projects), borrowing and financial assistance from the National Land Transport Fund managed by NZTA.

Nationally less fuel excise tax is being generated year on year and, therefore, less money available in the National Land Transport Fund to invest in the transport system. This means the transport funding environment is more competitive and investment is increasingly targeted to central Government priorities. Also in recent times the Government Policy Statement funding allocation for local road maintenance has not increased in line with inflation. This means that, in real terms, local authorities have diminishing funding for maintaining local roads, requiring either increased prioritisation of network maintenance, a rise in rates or a reduction in service levels. Over time, this may necessitate the managed downgrading of some lower priority infrastructure to allow for more critical upkeep of high priority infrastructure. This presents a financial and political challenge, as well as challenge to the sustainability of the network.

NZTA has been reviewing the Funding Assistance Rates for all local authorities and these will be changing over the next several years; for Christchurch this will means that the share of the funding provided by NZTA for projects will increase from the current rate of 48% to 51%.

NZTA and Local Government New Zealand have also been developing the One Network Road Classification to assist with funding discussions. This is a classification system that will cater for all roads in the country, including state highways and local roads. This system is still in development and the intention is to have it fully adopted across the country by 2018. The next step for Council is to develop a transition plan outlining how this will be implemented into our planning processes.

6 Financial Estimates and Assumptions

6.1 Total Expenditure

30 Year Expenditure Profile

Total expenditure required for Council's infrastructure over the coming 10 years is approximately $330 million per year. This increases steadily in the following 20 years, mostly due to inflation, but also increased operational expenditure due to increasing population, and increasing renewals expenditure. A breakdown of the expenditure into the various components that make up the total is shown in Figure 6-1; this includes inflation over the 30 year period. Please refer to Figures 8-1, 8-2 and 8-3 in Appendix B for financial forecasts for operations and maintenance, renewals and capital improvements.

Please refer to Appendix A for graphs showing expenditure based on current year (2015) values for each of the infrastructure types. This is so that it is clear how the Council's planned spend is changing over time in today's dollars, as inflation masks the trends over such a long period. The budgets given in this section include inflation, unless otherwise stated.

Financial data in this Infrastructure Strategy is based on the final Long Term Plan. The 2015 Asset Management Plans will need to be updated to reflect the final Long Term Plan; this will be done between July and September 2015.

Overview

- Operational expenditure remains relatively consistent over the 30 year period.
- Significant capital expenditure is required for the first ten years to assist with the rebuild of the City following the earthquakes.
- Renewals expenditure remains low for the first ten years of the programme, due to Council's borrowing constraints and funding of the rebuild. From Year 11 onwards, it increases to allow for deferred works and other long term issues.

Overall Confidence

Council has good asset registers and good condition data and would normally have a high level of confidence in its financial estimates. However, due to the uncertainty in the amount of earthquake damage that will not be repaired by SCIRT, and post-earthquake re-settlement patterns, there is a moderate level of confidence in the financial estimates for water, wastewater, stormwater, roads and footpaths. There is a low level of confidence in the flood protection estimates, as the asset register for these assets is incomplete, and scoping of projects is yet to be completed.

6.2 Assumptions and Financial Risks

Overall Assumptions and Financial Risks

In determining the financial forecast the following assumptions were made:

- The current asset data is correct and up-to-date
- Effective/useful lives used in models are correct
- Expenditure includes inflation, which is expected to vary between 2.0 – 3.0% per year over the 30 year period (refer to Appendix B for a table showing the inflation for each year).
- The growth-related capital programme is based on rate of growth and growth areas as recorded in the Land Use Recovery Plan, with a focus on the north and south-west areas of the city.

- Critical assets are renewed at 100% of their effective life; other assets are renewed at 105 – 120% of their effective life.

Assumptions and Financial Risks – Water Supply

In determining the financial forecast for water supply, the following assumptions were made:

- Growth will occur primarily in the southwest over the first five years.
- Reticulation renewal diameters are like-for-like
- No allowance is made for SCIRT's optimisation process and it is assumed that their programme of works as at November 2013 will be completed as planned.
- All rock-fall red zone pipes will remain and all Avon River residential red zone pipes will be decommissioned, except for trunk mains where required to convey water across the red zone.
- All rock-fall red zone water supply pump stations, reservoirs and associated access tracks will be retained.
- Capital cost estimates for renewing water supply assets are based on pre-quake renewal rates adjusted for inflation, market escalation and increased construction requirements. Should costs not reduce to these levels, either an increased budget would be required, or some renewals works would be deferred.
- Infrastructure rebuild related projects have been excluded (the future SCIRT programme). This is currently estimated to be valued at $20 million.
- Projects required to implement the Facilities rebuild programme (including renewals required as part of the North Frame, East Frame and South Frame, Avon River Precinct and "An Accessible City") have been excluded. This is currently estimated to be valued at $3 million.

Assumptions and Financial Risks – Wastewater

In determining the financial forecast for wastewater, the following assumptions were made:

- Growth will occur primarily in the southwest over the first five years
- Asset lives for pipe networks have been reduced by 3-50 years depending on material, due to earthquake damage as per professional advice based on inspection of the network
- Reticulation renewal diameters are like-for-like
- No allowance is made for SCIRT's optimisation process and it is assumed that their programme of works as at November 2013 will be completed as planned.
- Capital cost estimates for renewing wastewater assets are based on pre-quake renewal rates adjusted for inflation, market escalation and increased construction requirements. Should costs not reduce to these levels, either an increased budget would be required, or some renewals works would be deferred.
- Infrastructure rebuild related projects have been excluded (the future SCIRT programme). This is currently estimated to be valued at $340 million. Projects required to implement the Facilities rebuild programme (including renewals required as part of the North Frame, East Frame and South Frame, Avon River Precinct and "An Accessible City") have been excluded. This is currently estimated to be valued at $10 million.

Assumptions and Financial Risks – Stormwater

In determining the financial forecast for stormwater, the following assumptions were made:

- Land drainage expenditure is calculated as a whole and has been split appropriately between stormwater drainage and flood protection.
- SCIRT infrastructure rebuild related projects have been excluded. This is currently estimated to be valued at $38 million.
- Projects required to implement the Facilities rebuild programme (including renewals required as part of the North Frame, East Frame and South Frame, Avon River Precinct and "An Accessible City") have been excluded. This is currently estimated to be valued at $5 million.

Assumptions and Financial Risks – Flood Protection and Control Works

In determining the financial forecast for flood protection and control works, the following assumptions were made:

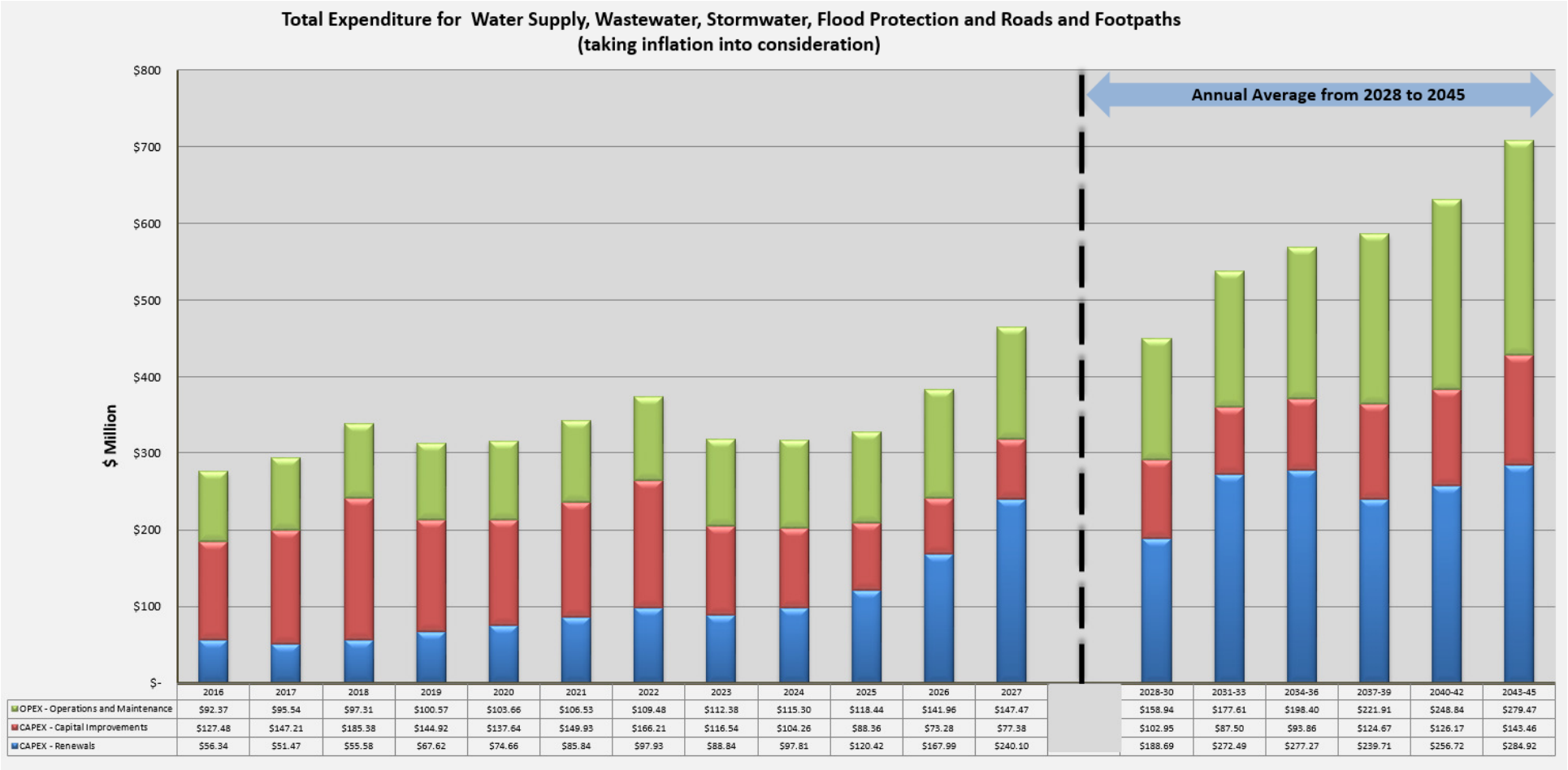
- Land drainage expenditure is calculated as a whole and for the purposes of this strategy has been split between stormwater drainage and flood protection.

The projects to be undertaken under the Land Drainage Recovery Programme are still being developed and prioritised and there is a large amount of uncertainty about the budget for the programme. The proposed budget for the next ten years is $299 million based on optimising the programme. The current scope of the programme is expected to extend significantly beyond the 10 years of the current Long Term Plan, but the projects and budgets beyond Year 10 are yet to be developed; this will be done for the next Long Term Plan.

Assumptions and Financial Risks – Roads and Footpaths

In determining the financial forecast the following specific assumptions were made:

- Allowance has been made for the pavement related issues arising from the SCIRT optimisation process, with $27.3 million (2015 dollars) worth of work to be handed back to Council to remediate in the long term.
- No allowance has been made for structures related issues arising from the SCIRT optimisation process, as this is still being determined at the time of writing this document. This is currently estimated to be valued at $44 million (2015 dollars).
- Infrastructure rebuild related projects have been excluded (the SCIRT programme, second coat sealing to utility trenches, asphalt surfacing to roads within the four avenues and paving to City Mall and High Street). This is currently estimated to be valued at $324 million.
- Projects required to implement the Facilities rebuild programme (including parking, public transport and “An Accessible City”) have been excluded. This is currently estimated to be valued at $212 million.
- Some of the roads will remain in the Avon River residential red zone.



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028-30	2031-33	2034-36	2037-39	2040-42	2043-45
OPEX - Operations and Maintenance	$92.37	$95.54	$97.31	$100.57	$103.66	$106.53	$109.48	$112.38	$115.30	$118.44	$141.96	$147.47	$158.94	$177.61	$198.40	$221.91	$248.84	$279.47
CAPEX - Capital Improvements	$127.48	$147.21	$185.38	$144.92	$137.64	$149.93	$166.21	$116.54	$104.26	$88.36	$73.28	$77.38	$102.95	$87.50	$93.86	$124.67	$126.17	$143.46
CAPEX - Renewals	$56.34	$51.47	$55.58	$67.62	$74.66	$85.84	$97.93	$88.84	$97.81	$120.42	$167.99	$240.10	$188.69	$272.49	$277.27	$239.71	$256.72	$284.92

Figure 6-1: Total Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (with inflation)

6.3 Water Supply

Financial Estimates

Total expenditure required for Council's water supply over the coming 30 years is approximately $35-40 million per year (2015 dollars). A breakdown of the expenditure into the various components that make up the total is shown in Figure 6-2.

Overview

- Constant increases in operational expenditure are anticipated due to population growth. Decreasing earthquake related costs mitigate these increases slightly, especially in the first 10 years.
- Capital improvement expenditure in the 2016 financial year is high to enable water supply to new developments required as a result of earthquakes.
- Capital expenditure on renewing water supply assets increases over the first five years then plateaus for the remainder of the 2016-25 period, followed by two years of decreased renewals then 15 years of high renewals. The 15 years of high renewals are due to deferrals during the first ten years.

Significant Projects

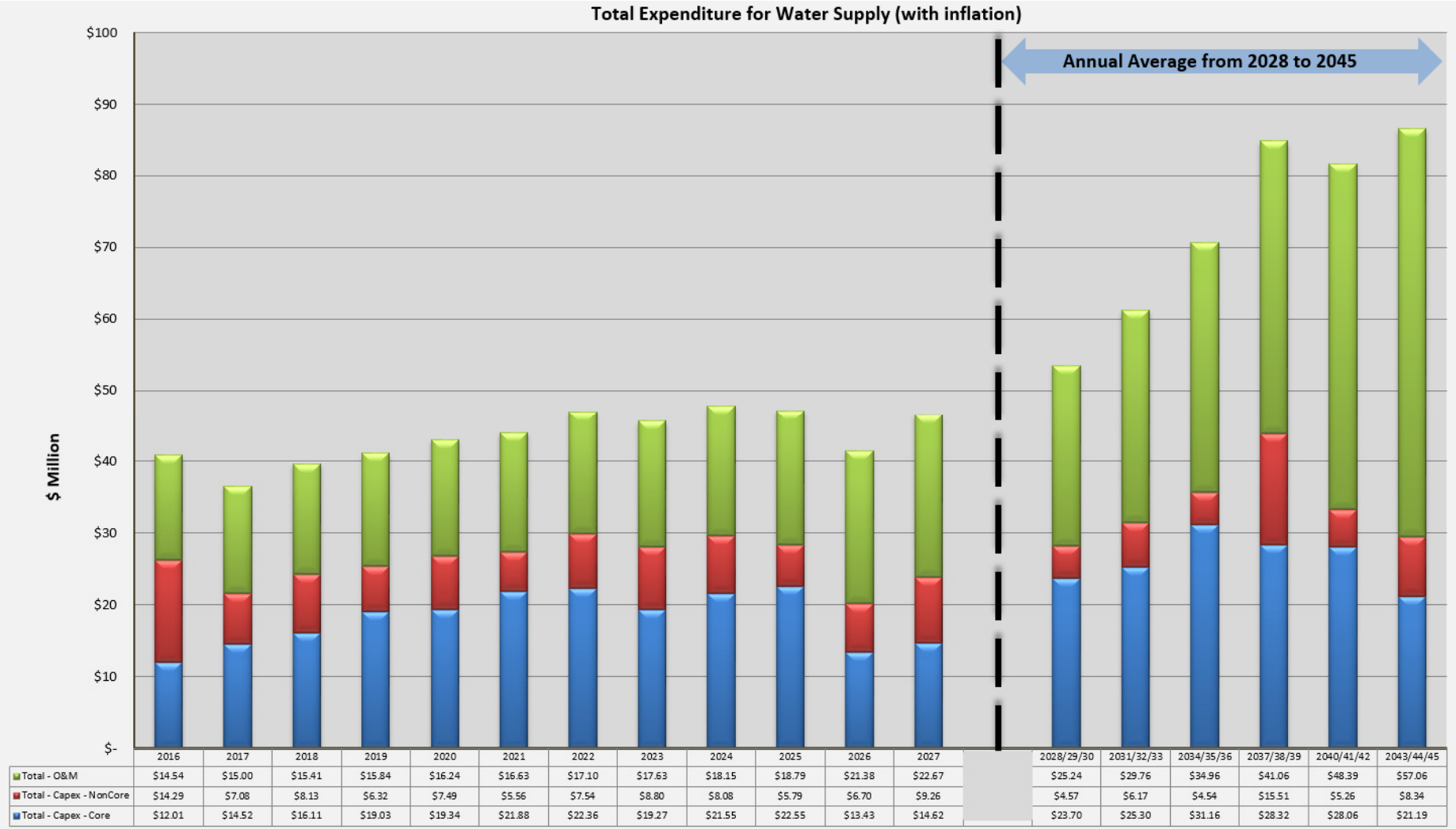
There are several key projects included within the expenditure profile including:

- Christchurch Central Business District trunk main renewal, $9.1 million over financial years 2017-19
- Averill Pump Station Renewal, $5.8 million over financial years 2023-25
- Pressure management project, $13.6 million over financial years 2019-25
- Supplementary water supply source to Akaroa, $26.5 million over financial years 2036-39.

Confidence

Predictions for water supply expenditure are based on modelling using asset register data that is comprehensive and current. As the uncertain work areas of the red-zone and SCIRT programme have been excluded from the renewals model there is high confidence that the required costs are not overestimated. On clarification of the works required post-SCIRT and in the red zone there is potential for costs to increase.

Diameter increases to meet demand, or diameter decreases where demand has decreased may be required at renewal. No allowance has been made for these changes; however these changes are not anticipated to significantly affect the accuracy of the models. Growth patterns for the long term are difficult to predict in the post-earthquake environment and may require significant changes to the capital expenditure programme depending on re-settlement trends. Therefore, there is a moderate level of confidence in the financial estimates for the first this strategy.



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Total - O&M	$14.54	$15.00	$15.41	$15.84	$16.24	$16.63	$17.10	$17.63	$18.15	$18.79	$21.38	$22.67	$25.24	$29.76	$34.96	$41.06	$48.39	$57.06
Total - Capex - NonCore	$14.29	$7.08	$8.13	$6.32	$7.49	$5.56	$7.54	$8.80	$8.08	$5.79	$6.70	$9.26	$4.57	$6.17	$4.54	$15.51	$5.26	$8.34
Total - Capex - Core	$12.01	$14.52	$16.11	$19.03	$19.34	$21.88	$22.36	$19.27	$21.55	$22.55	$13.43	$14.62	$23.70	$25.30	$31.16	$28.32	$28.06	$21.19

Figure 6-2: Total Expenditure – Water Supply (with inflation)

6.4 Wastewater

Financial Estimates

Total expenditure required for Council's wastewater schemes over the coming 30 years is approximately $60-100 million per year (2015 dollars). A breakdown of the expenditure into the various components that make up the total is shown in Figure 6-3 (including inflation).

Overview

- Operational expenditure is expected to steadily increase due to population growth. Increases may be mitigated by decreasing earthquake related costs.
- Significant capital expenditure on improving wastewater assets is required. Projects to meet legal requirements such as overflow reduction form the majority of capital expenditure until at least 2045, apart from low expenditure in 2023-25. Expenditure to cater for growth will decrease over the first five years and remain constant from then on.
- Capital expenditure on renewing wastewater reticulation assets is expected to steadily increase over the next 30 years, predominantly due to an increase in reticulation renewal requirements. Renewals deferred from the 2016-25 period result in high renewals costs from 2026-36. Capital expenditure on renewing parts of the Christchurch Wastewater Treatment Plant is variable, but is expected to peak during 2026-36.

Significant Projects

There are several key projects included within the expenditure profile including:

- Wastewater Pump Station 20 (Locarno St) upgrade, $7.9 million in financial years 2024-26
- Heathcote wet weather wastewater overflow reduction project, $19.3 million over financial years 2019-25
- Northern Relief project, $46.7 million over financial years 2019-25
- Riccarton Interceptor wastewater trunk main project, $13.7 million over financial years 2016-18
- Wainui Wastewater Treatment Plant - Stage 2, $8.7 million over financial years 2019-20
- Christchurch Wastewater Treatment Plant trickling filter media renewal, $26.2 million over financial years 2021-25
- Akaroa Wastewater Treatment Plant replacement, $33.0 million over financial years 2016-19
- Diversion of Lyttelton Harbour Basin wastewater to Christchurch Wastewater Treatment Plant, $52.6 million over financial years 2016-23
- Wet weather overflow reduction improvements, $358 million over financial years 2026-45.

Significant Changes Since Previous Long Term Plan

Due to financial constraints, some projects that were included in the previous Long Term Plan have not been fully included in this Long Term Plan. In particular, for the Riccarton Interceptor wastewater catchment, there is more clarity around the projects required to solve capacity issues, with between $21 million and $35 million required to fix all capacity issues. However, the budget is $13.7 million, so only capacity issues in the lower half of the catchment will be addressed. This means that development will continue to be constrained in the upper half of the catchment (approximately west of the University of Canterbury, and between Yaldhurst Road and Memorial Avenue) and no additional wastewater connections will be permitted.

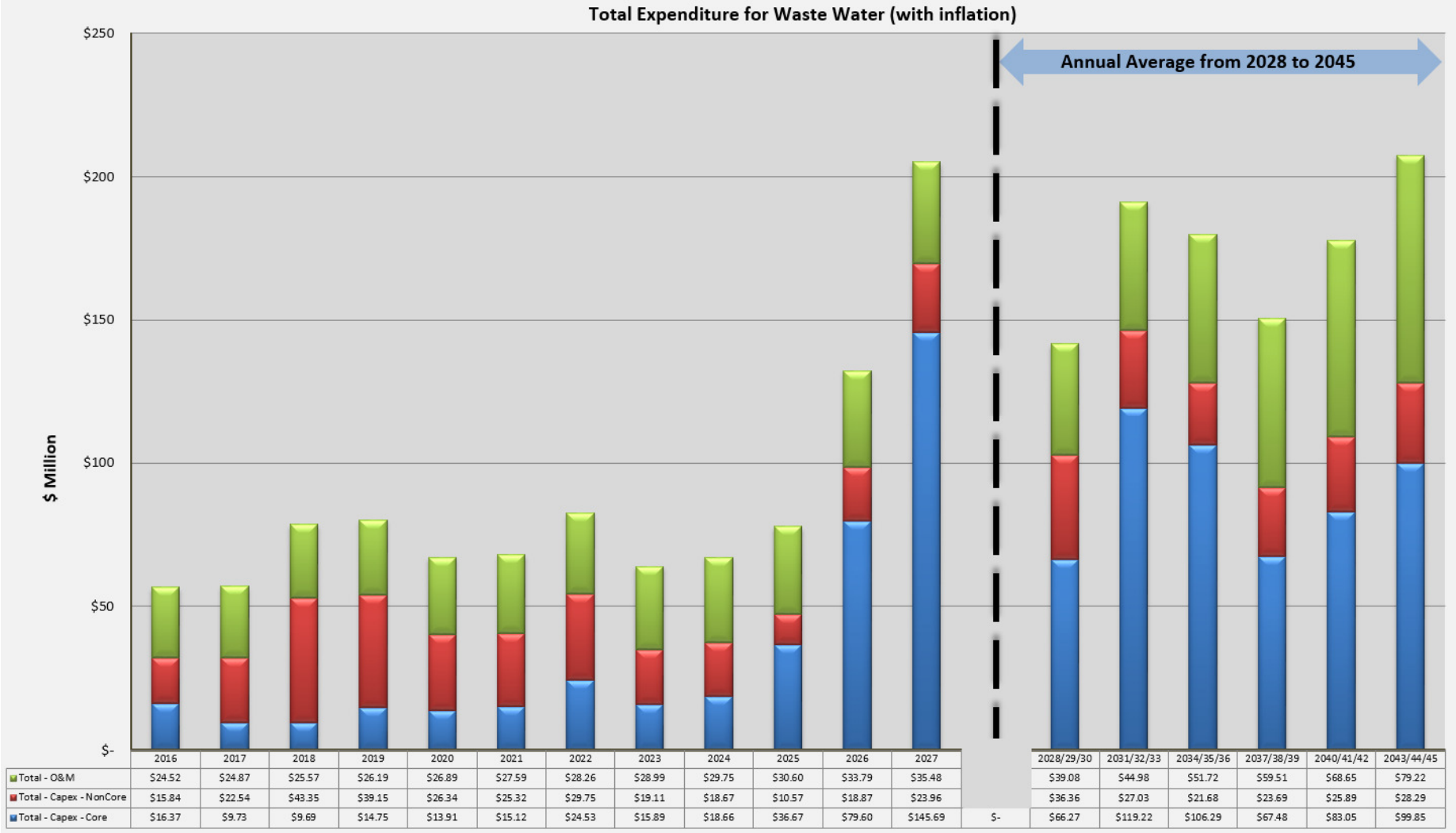
Over the last few years, Council has been working on a new wastewater treatment scheme for Wainui. Stage One of the scheme – where treated wastewater from Seaview Lane was diverted from Akaroa Harbour to a land irrigation in a forest block above Warnerville Road – was completed in May 2013. Since then the Council has been working on the second stage, which would involve extending the network to the remaining Wainui homes and businesses and building a new wastewater treatment plant. This was planned for construction in 2014/15 but was then delayed due to earthquake related costs. This project is now planned for the 2019 and 2020 financial years.

Confidence

Predictions for wastewater expenditure are based on asset register data that is reasonably comprehensive and current. This information has been updated with analysis results from the assessment of earthquake impacts on remaining life of pipe assets undertaken by SCIRT. However, there is a significant risk that the medium to long term impact of the earthquakes requires additional funding or a change to the funding timing. Similarly, growth patterns for the long term are difficult to predict in the post-earthquake environment and may require significant changes to the capital expenditure programme depending on re-settlement trends.

Pipe diameter increases to meet demand, or diameter decreases where demand has decreased may be required at renewal. No allowance has been made for these changes; however these changes are not anticipated to significantly affect the accuracy of the models.

As the uncertain work areas of the red-zone and SCIRT programme have been excluded from the renewals model there is high confidence that the required costs are not overestimated. On clarification of the works required post-SCIRT and in the red zone there is potential for costs to increase.



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027		2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Total - O&M	$24.52	$24.87	$25.57	$26.19	$26.89	$27.59	$28.26	$28.99	$29.75	$30.60	$33.79	$35.48		$39.08	$44.98	$51.72	$59.51	$68.65	$79.22
Total - Capex - NonCore	$15.84	$22.54	$43.35	$39.15	$26.34	$25.32	$29.75	$19.11	$18.67	$10.57	$18.87	$23.96		$36.36	$27.03	$21.68	$23.69	$25.89	$28.29
Total - Capex - Core	$16.37	$9.73	$9.69	$14.75	$13.91	$15.12	$24.53	$15.89	$18.66	$36.67	$79.60	$145.69	$-	$66.27	$119.22	$106.29	$67.48	$83.05	$99.85

Figure 6-3: Total Expenditure – Wastewater (with inflation)

6.5 Stormwater

Financial Estimates

Total expenditure required for Council's stormwater networks over the coming 30 years is $55-60 million for the first three years (due to the Land Drainage Recovery Programme) followed by a reduction to around $20 million per year to 2025, increasing to around $40 million per year for the remainder of the 30 year period. A breakdown of the expenditure into the various components that make up the total is shown in Figure 6-4.

Overview

- Year on year the operational expenditure is relatively consistent over the 30 year period. A constant increase in the operational expenditure is expected due to population increase. Earthquake operational costs have not been included in this document but are programmed for financial years 2016 and 2017.
- Following the initial 3 years of high capital expenditure due to the Land Drainage Recovery Programme, capital improvement peaks in the 2026-33 period due to large growth related projects. Note that some projects for the Land Drainage Recovery Programme are included in the Flood Protection and Control Works budget.
- Renewals expenditure remains low for the first ten years of the programme, due to Council's borrowing constraints and funding of the rebuild. From 2026 onwards it increases to allow for deferred works and other long term issues.

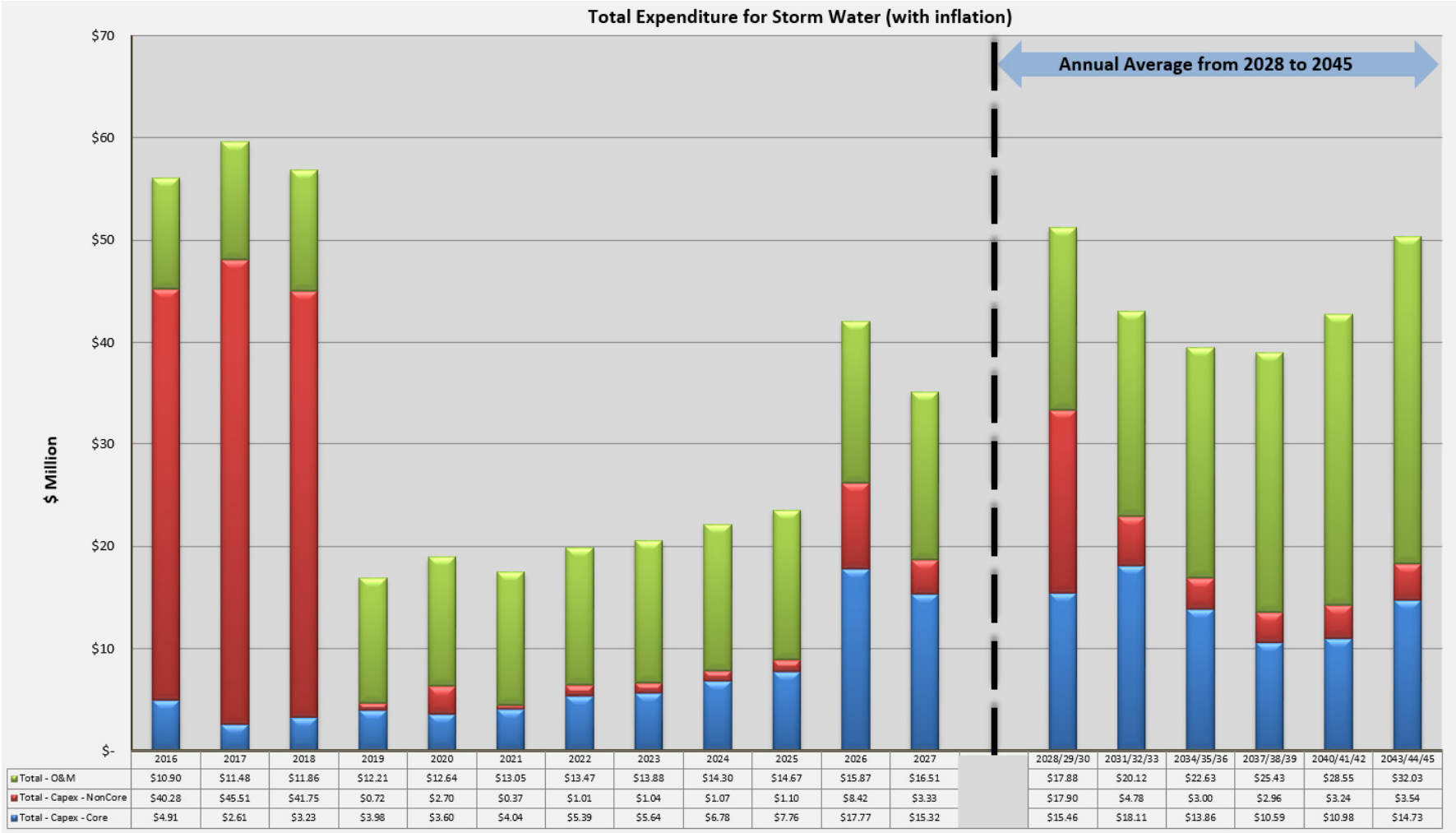
Significant Projects

There are several key projects included within the expenditure profile including:

- Stormwater pipe renewals programme including $72 million backlog renewals, $90 million over the next 30 years including $19.5 million over the 2016-25 period.
- Growth related stormwater management plans for the Central City and Belfast/Styx areas, $150M over the next 30 years.
- Land Drainage Recovery Programme, a total of $125.8 million over the next 5 years. No allowance has been made for capital investment for the Land Drainage Recovery Programme for the remaining 25 years of this strategy. The need for this will be identified as the programme is delivered.

Confidence

Sufficient asset information exists which has enabled renewal modelling for stormwater pipes and line channels. Moderate confidence exists for these renewal expenditure forecasts. There is limited quality asset data for the remainder of the portfolio which lowers the confidence in the expenditure forecasts. Detailed planning and programming involved with the development of the Stormwater Management Plans has informed much of the capital improvements expenditure. Confidence in these estimates is high. However, given the uncertainty around re-settlement patterns and the extent of earthquake damage yet to be repaired, there is a moderate level of confidence in the financial estimates overall.



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Total - O&M	$10.90	$11.48	$11.86	$12.21	$12.64	$13.05	$13.47	$13.88	$14.30	$14.67	$15.87	$16.51	$17.88	$20.12	$22.63	$25.43	$28.55	$32.03
Total - Capex - NonCore	$40.28	$45.51	$41.75	$0.72	$2.70	$0.37	$1.01	$1.04	$1.07	$1.10	$8.42	$3.33	$17.90	$4.78	$3.00	$2.96	$3.24	$3.54
Total - Capex - Core	$4.91	$2.61	$3.23	$3.98	$3.60	$4.04	$5.39	$5.64	$6.78	$7.76	$17.77	$15.32	$15.46	$18.11	$13.86	$10.59	$10.98	$14.73

Figure 6-4: Total Expenditure – Stormwater (with inflation)

6.6 Flood Protection and Control Works

Financial Estimates

Total expenditure required for Council's flood protection infrastructure over the coming 30 years is approximately $32 million per year (2015 dollars). A breakdown of the expenditure into the various components that make up the total is shown in Figure 6-5.

Overview

- Operational expenditure remains relatively consistent over the 30 year period.
- Renewals expenditure is constant and relatively low for the duration of the plan. These low renewals costs assume renewal of components of flood protection assets rather than complete asset renewal.

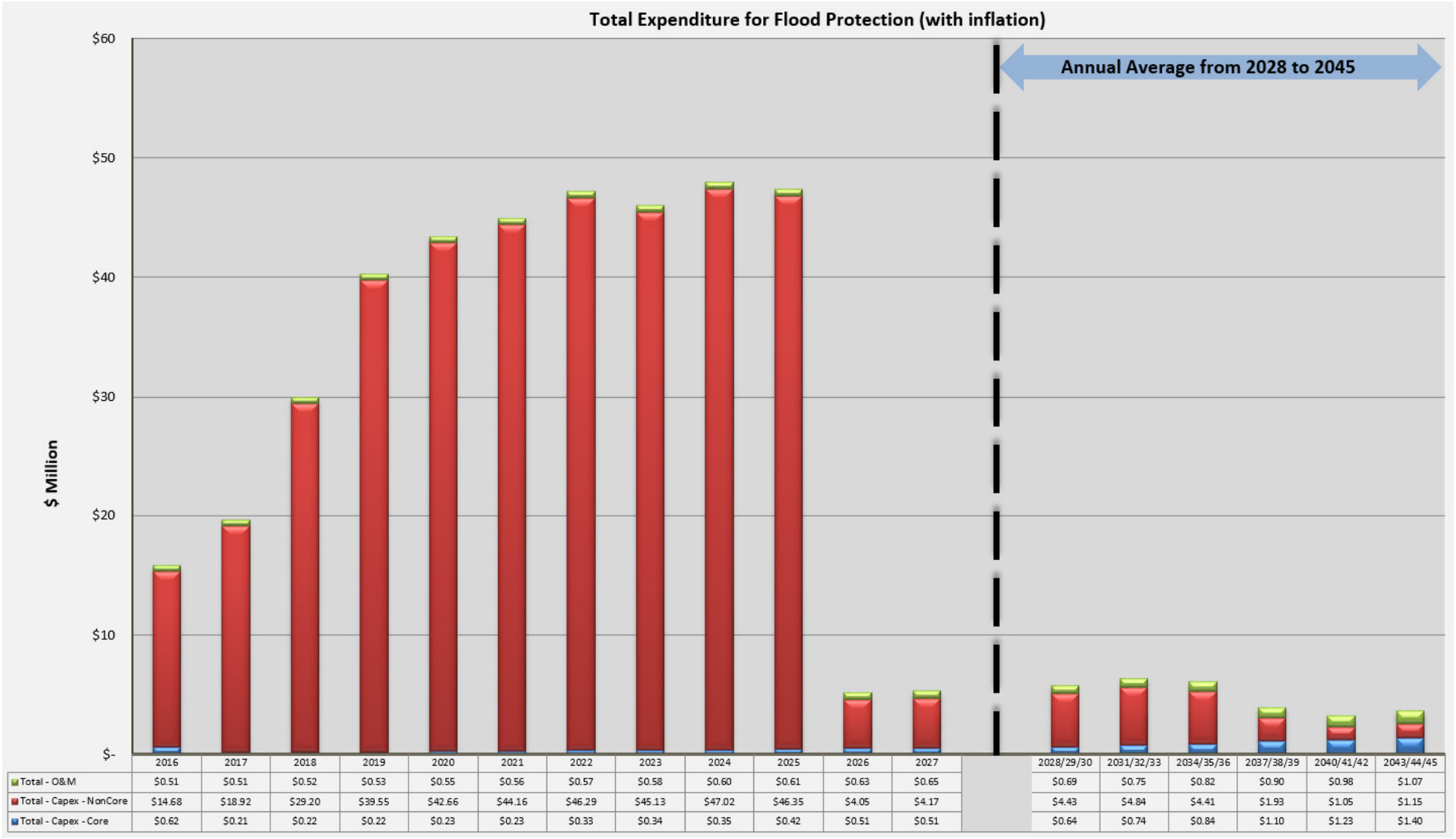
Significant Projects

There are several key projects included within the expenditure profile including:

- Land Drainage Recovery Programme, a total of $173.5 million over the next 10 years. No allowance has been made for capital investment for the remaining 20 years of this strategy. The need for this will be identified as the programme is delivered. Note that some projects for the Land Drainage Recovery Programme are included in the Stormwater budget.
- South West Stormwater Management, $57.1 million over financial years 2016-25.

Confidence

The asset register for all land drainage assets including flood protection assets is incomplete, which has lowered the confidence levels of the renewal programme. Until the scoping projects within the Land Drainage Recovery Programme have been fully developed, the capital improvements programme remains provisional. The Stormwater Management Plans also cover flood protection and provide sufficient detail to feed into the capital programme. The overall confidence in these financial estimates is low.



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Total - O&M	$0.51	$0.51	$0.52	$0.53	$0.55	$0.56	$0.57	$0.58	$0.60	$0.61	$0.63	$0.65	$0.69	$0.75	$0.82	$0.90	$0.98	$1.07
Total - Capex - NonCore	$14.68	$18.92	$29.20	$39.55	$42.66	$44.16	$46.29	$45.13	$47.02	$46.35	$4.05	$4.17	$4.43	$4.84	$4.41	$1.93	$1.05	$1.15
Total - Capex - Core	$0.62	$0.21	$0.22	$0.22	$0.23	$0.23	$0.33	$0.34	$0.35	$0.42	$0.51	$0.51	$0.64	$0.74	$0.84	$1.10	$1.23	$1.40

Figure 6-5: Total Expenditure – Flood Protection (with inflation)

6.7 Roads and Footpaths

Financial Estimates

Total expenditure required for Council's roads and footpaths over the coming 30 years is approximately $80-160 million per year. A breakdown of the expenditure into the various components that make up the total is shown in Figure 6-6.

Overview

- Operational expenditure remains relatively consistent in the first 10 years but increases for the following 20 years.
- Significant capital expenditure is required for the first seven years to assist with the recovery of the City following the earthquakes, and to fund the major cycleways. This includes growth projects, safety projects, corridor improvements (safety and capacity), bus infrastructure and cycleways.
- Renewals expenditure steadily increases over the thirty year period to allow for deferred works and other long term issues.

Significant Projects

There are several key projects included within the expenditure profile including:

- Major cycleways, $163.9 million in financial years 2016-22.
- Northern Arterial extension (Cranford - QEII) and links and downstream improvements, $77.0M in financial years 2016-23.
- Renewal of the Main North Road Bridge over the Waimakariri River, $35.8 million in financial years 2037-40.
- Wigram-Magdala link, $19.1 million in financial years 2016-17.

Significant Changes Since Previous Long Term Plan

Significant changes that have been made since the previous Long Term Plan include suburban bus interchanges, prioritisation of the streets renewal programme and bridge strengthening.

While Environment Canterbury is responsible for providing public transport, Council is responsible for providing the infrastructure to support it. Environment Canterbury has altered its programme to focus on improvements along key routes to reduce bus travel times and so improve service reliability. Council's infrastructure programme has been altered to support this approach. This has meant a shift from constructing suburban bus interchanges to more bus priority lanes.

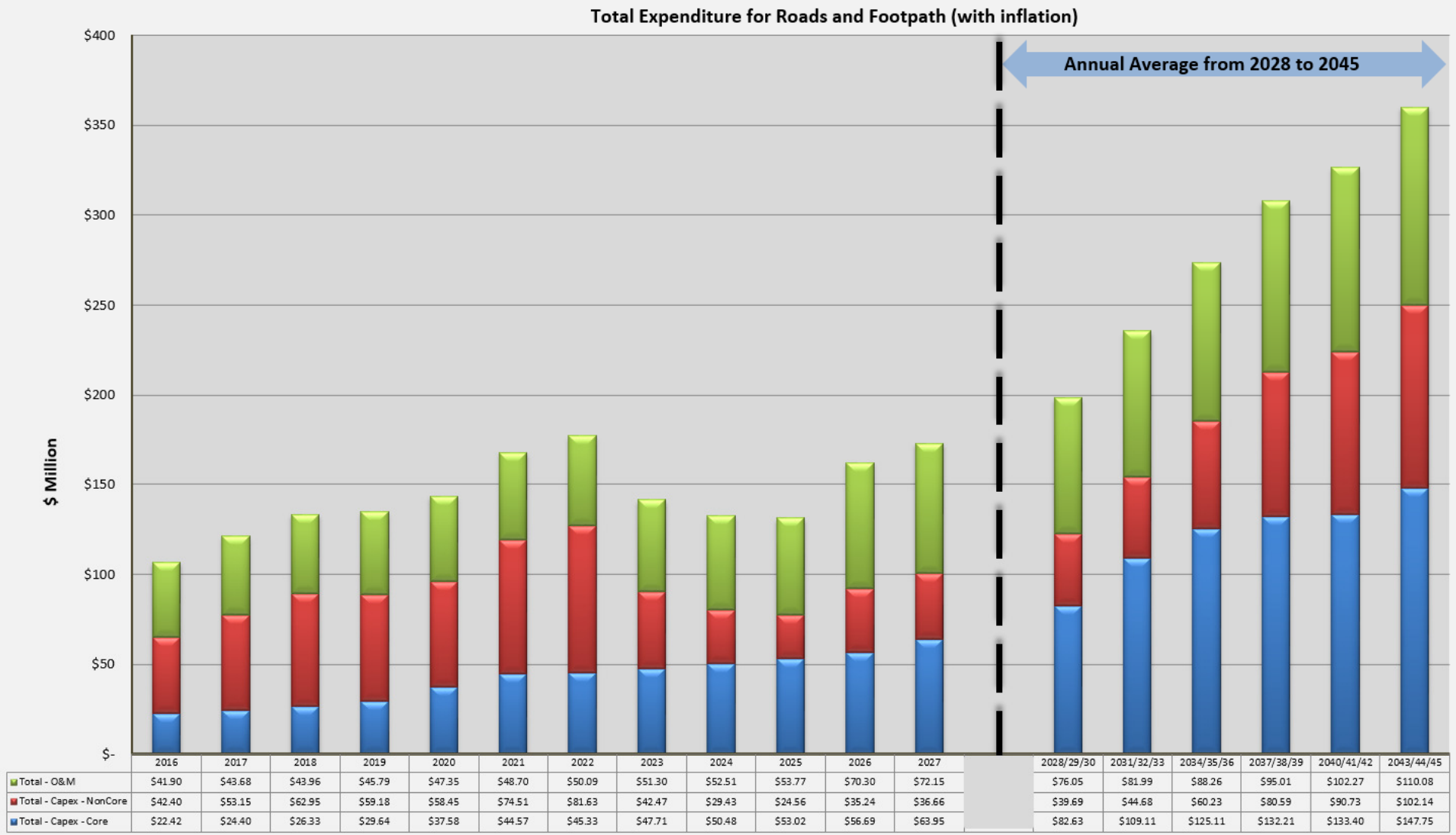
The street renewals programme has been reprioritised following the earthquakes and is now prioritised based on earthquake damage, network condition and criticality.

The programme to strengthen bridges to resist earthquakes has been delivered earlier than planned for some bridges through SCIRT's earthquake rebuild programme. Seismic strengthening of the remaining bridges is included within this Long Term Plan.

Confidence

Reliable condition information is available for Council's transport infrastructure and their life cycles are well understood. However, given the uncertainty around re-settlement patterns and the extent of

earthquake damage yet to be repaired, there is a moderate level of confidence in the financial estimates overall.

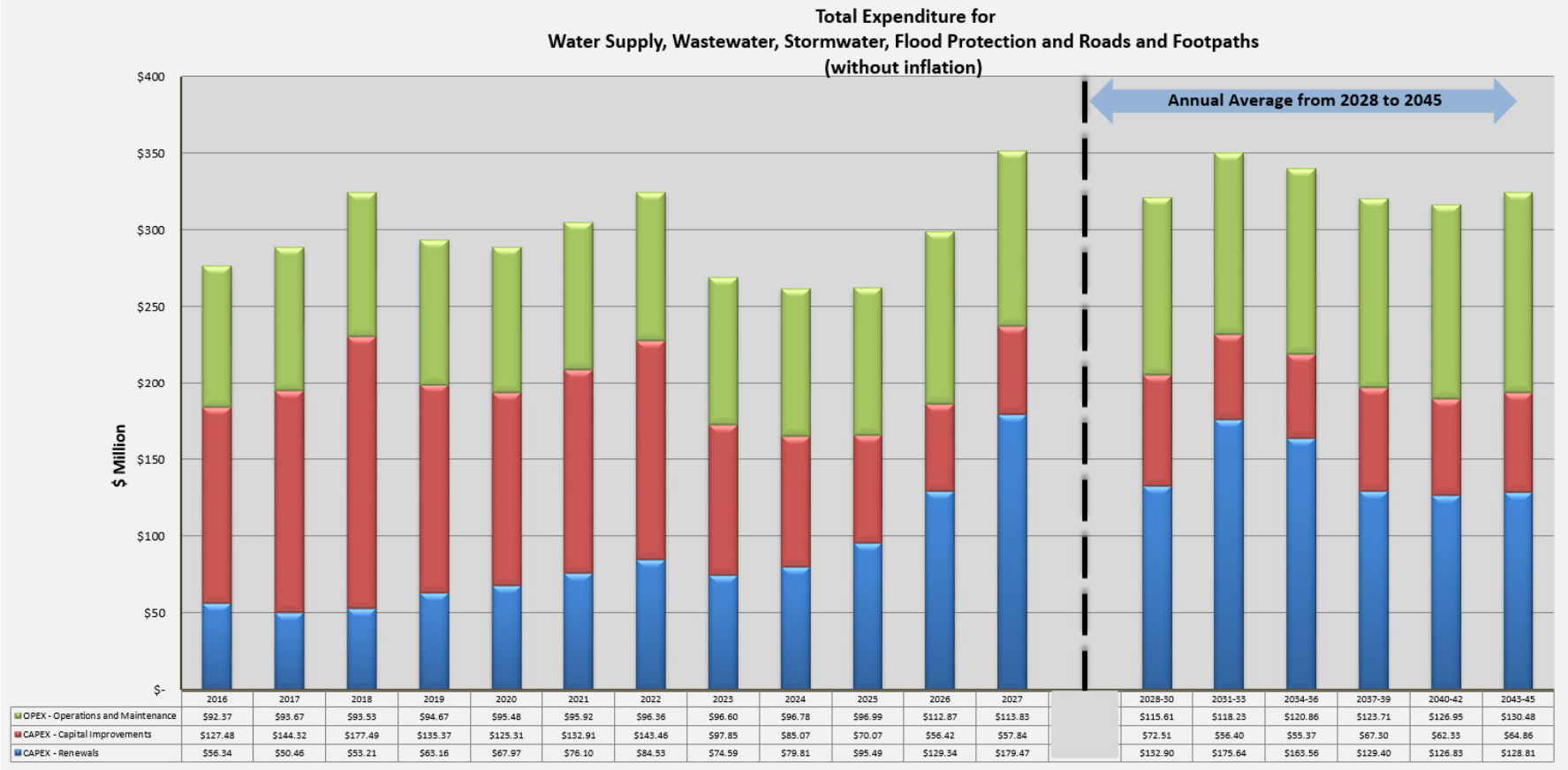


	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Total - O&M	$41.90	$43.68	$43.96	$45.79	$47.35	$48.70	$50.09	$51.30	$52.51	$53.77	$70.30	$72.15	$76.05	$81.99	$88.26	$95.01	$102.27	$110.08
Total - Capex - NonCore	$42.40	$53.15	$62.95	$59.18	$58.45	$74.51	$81.63	$42.47	$29.43	$24.56	$35.24	$36.66	$39.69	$44.68	$60.23	$80.59	$90.73	$102.14
Total - Capex - Core	$22.42	$24.40	$26.33	$29.64	$37.58	$44.57	$45.33	$47.71	$50.48	$53.02	$56.69	$63.95	$82.63	$109.11	$125.11	$132.21	$133.40	$147.75

Figure 6-6: Total Expenditure – Roads and Footpaths (with inflation)

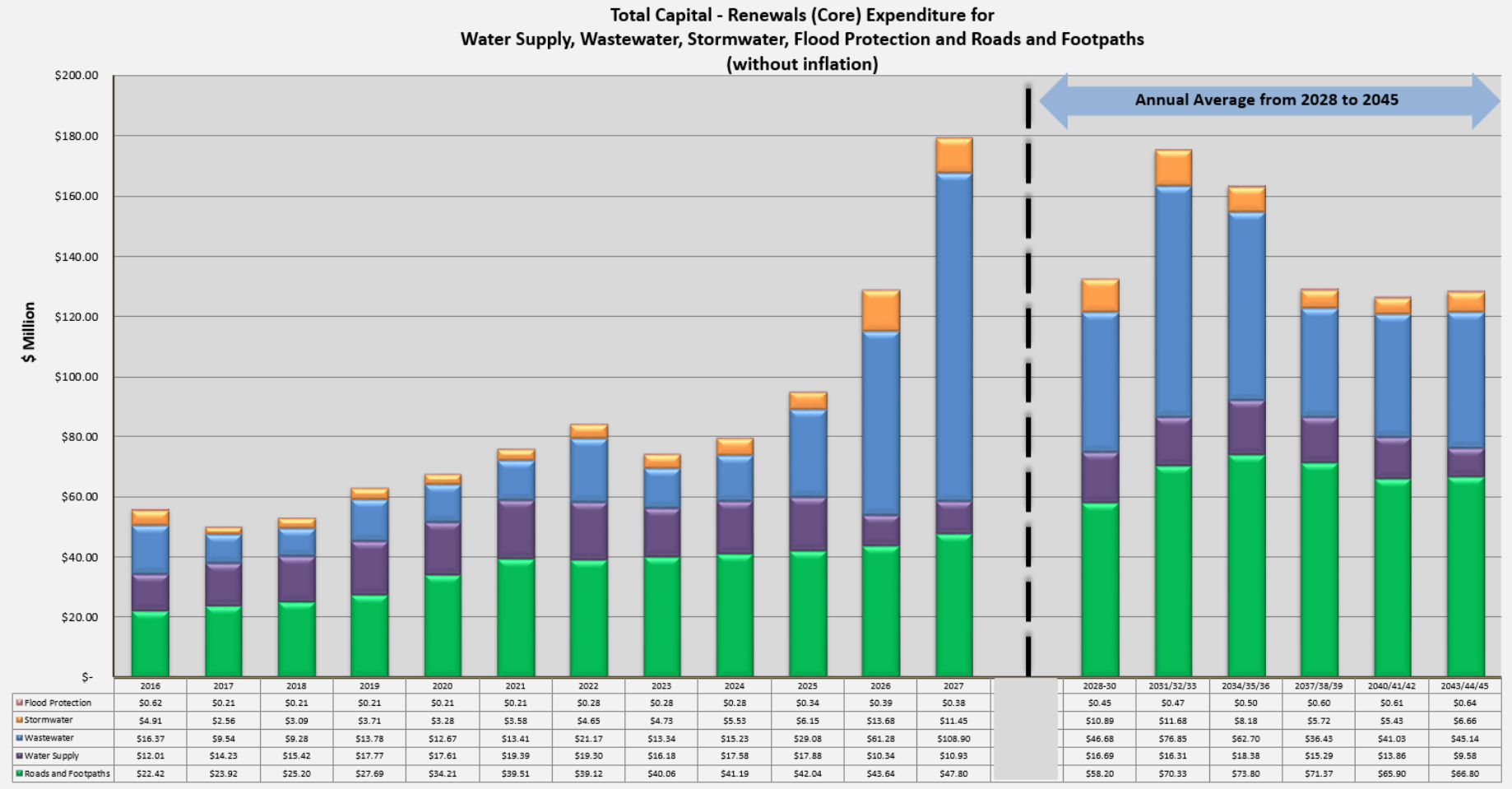
7 Appendix A – Financial Forecasts (without inflation)

Operations and Maintenance, Renewals and Capital Improvements (without inflation)



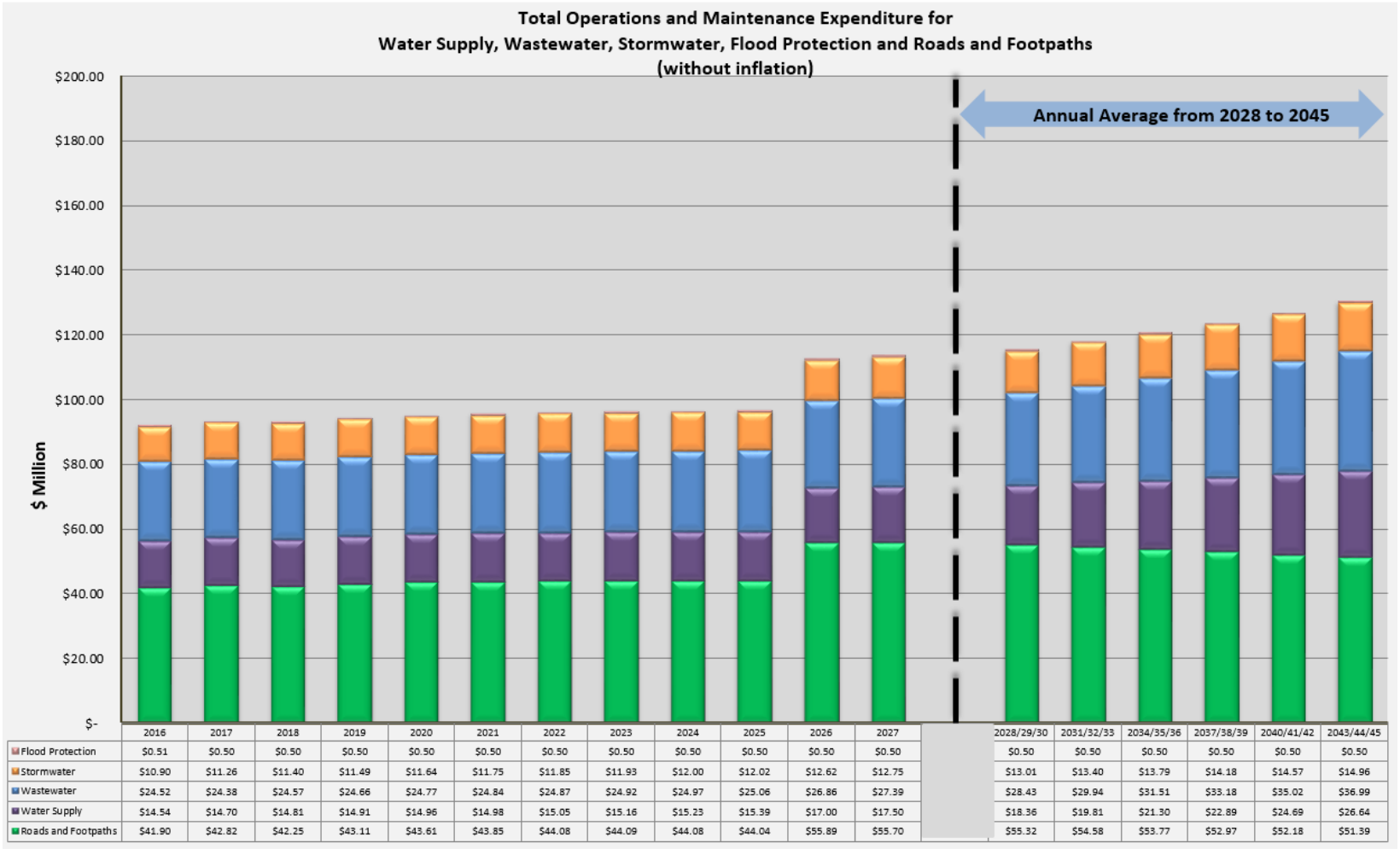
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028-30	2031-33	2034-36	2037-39	2040-42	2043-45
OPEX - Operations and Maintenance	$92.37	$93.67	$93.53	$94.67	$95.48	$95.92	$96.36	$96.60	$96.78	$96.99	$112.87	$113.83	$115.61	$118.23	$120.86	$123.71	$126.95	$130.48
CAPEX - Capital Improvements	$127.48	$144.32	$177.49	$135.37	$125.31	$132.91	$143.46	$97.85	$85.07	$70.07	$56.42	$57.84	$72.51	$56.40	$55.37	$67.30	$62.33	$64.86
CAPEX - Renewals	$56.34	$50.46	$53.21	$63.16	$67.97	$76.10	$84.53	$74.59	$79.81	$95.49	$129.34	$179.47	$132.90	$175.64	$163.56	$129.40	$126.83	$128.81

Figure 7-1: Total Expenditure for Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (without inflation)



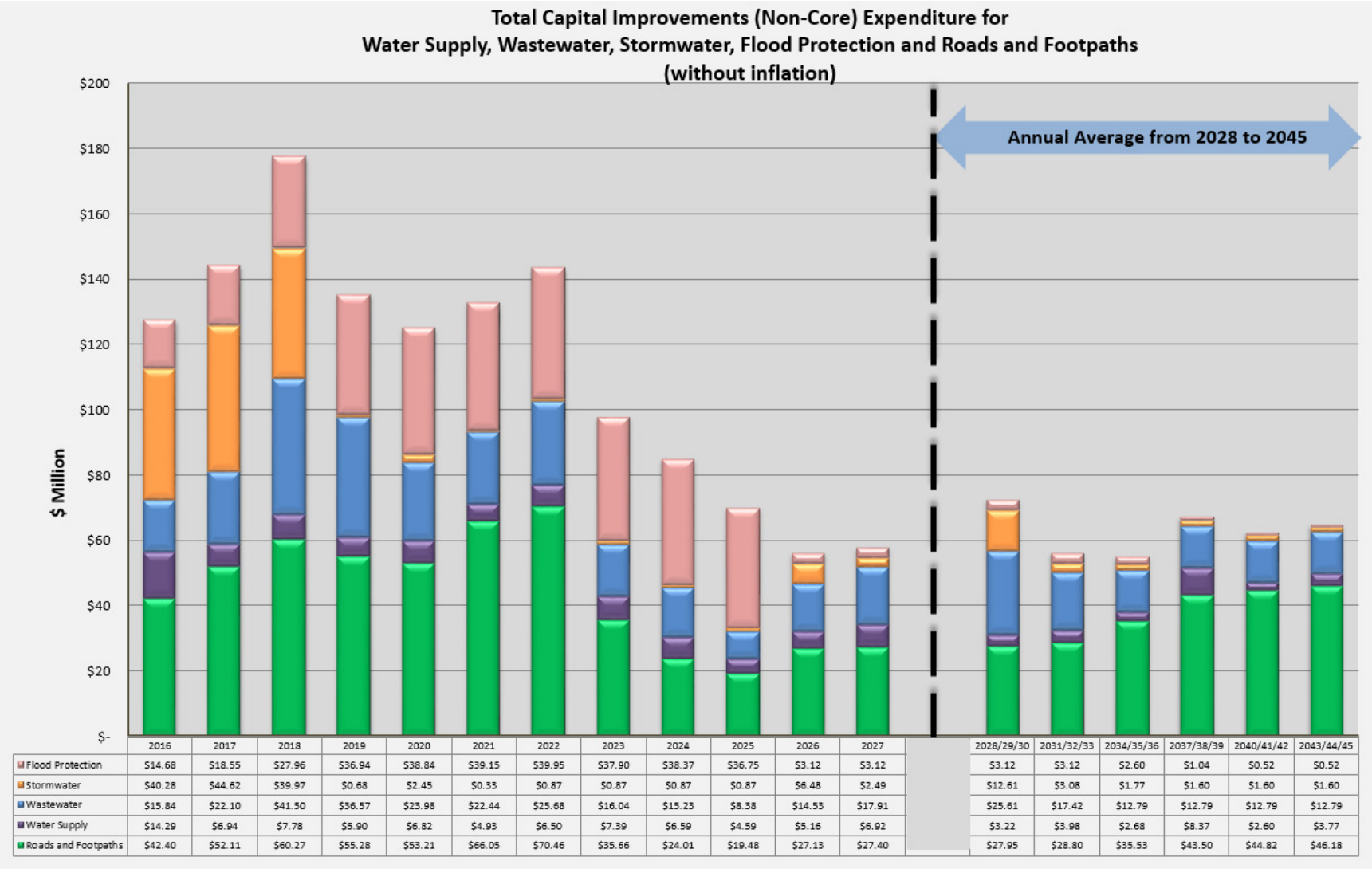
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028-30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Flood Protection	$0.62	$0.21	$0.21	$0.21	$0.21	$0.21	$0.28	$0.28	$0.28	$0.34	$0.39	$0.38	$0.45	$0.47	$0.50	$0.60	$0.61	$0.64
Stormwater	$4.91	$2.56	$3.09	$3.71	$3.28	$3.58	$4.65	$4.73	$5.53	$6.15	$13.68	$11.45	$10.89	$11.68	$8.18	$5.72	$5.43	$6.66
Wastewater	$16.37	$9.54	$9.28	$13.78	$12.67	$13.41	$21.17	$13.34	$15.23	$29.08	$61.28	$108.90	$46.68	$76.85	$62.70	$36.43	$41.03	$45.14
Water Supply	$12.01	$14.23	$15.42	$17.77	$17.61	$19.39	$19.30	$16.18	$17.58	$17.88	$10.34	$10.93	$16.69	$16.31	$18.38	$15.29	$13.86	$9.58
Roads and Footpaths	$22.42	$23.92	$25.20	$27.69	$34.21	$39.51	$39.12	$40.06	$41.19	$42.04	$43.64	$47.80	$58.20	$70.33	$73.80	$71.37	$65.90	$66.80

Figure 7-2: Total Capital - Renewals (Core) Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (without inflation)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Flood Protection	$0.51	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50	$0.50
Stormwater	$10.90	$11.26	$11.40	$11.49	$11.64	$11.75	$11.85	$11.93	$12.00	$12.02	$12.62	$12.75	$13.01	$13.40	$13.79	$14.18	$14.57	$14.96
Wastewater	$24.52	$24.38	$24.57	$24.66	$24.77	$24.84	$24.87	$24.92	$24.97	$25.06	$26.86	$27.39	$28.43	$29.94	$31.51	$33.18	$35.02	$36.99
Water Supply	$14.54	$14.70	$14.81	$14.91	$14.96	$14.98	$15.05	$15.16	$15.23	$15.39	$17.00	$17.50	$18.36	$19.81	$21.30	$22.89	$24.69	$26.64
Roads and Footpaths	$41.90	$42.82	$42.25	$43.11	$43.61	$43.85	$44.08	$44.09	$44.08	$44.04	$55.89	$55.70	$55.32	$54.58	$53.77	$52.97	$52.18	$51.39

Figure 7-3: Total Operations and Maintenance Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (without inflation)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027		2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Flood Protection	$14.68	$18.55	$27.96	$36.94	$38.84	$39.15	$39.95	$37.90	$38.37	$36.75	$3.12	$3.12		$3.12	$3.12	$2.60	$1.04	$0.52	$0.52
Stormwater	$40.28	$44.62	$39.97	$0.68	$2.45	$0.33	$0.87	$0.87	$0.87	$0.87	$6.48	$2.49		$12.61	$3.08	$1.77	$1.60	$1.60	$1.60
Wastewater	$15.84	$22.10	$41.50	$36.57	$23.98	$22.44	$25.68	$16.04	$15.23	$8.38	$14.53	$17.91		$25.61	$17.42	$12.79	$12.79	$12.79	$12.79
Water Supply	$14.29	$6.94	$7.78	$5.90	$6.82	$4.93	$6.50	$7.39	$6.59	$4.59	$5.16	$6.92		$3.22	$3.98	$2.68	$8.37	$2.60	$3.77
Roads and Footpaths	$42.40	$52.11	$60.27	$55.28	$53.21	$66.05	$70.46	$35.66	$24.01	$19.48	$27.13	$27.40		$27.95	$28.80	$35.53	$43.50	$44.82	$46.18

Figure 7-4: Total Capital Improvements (Non-Core) Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (without inflation)

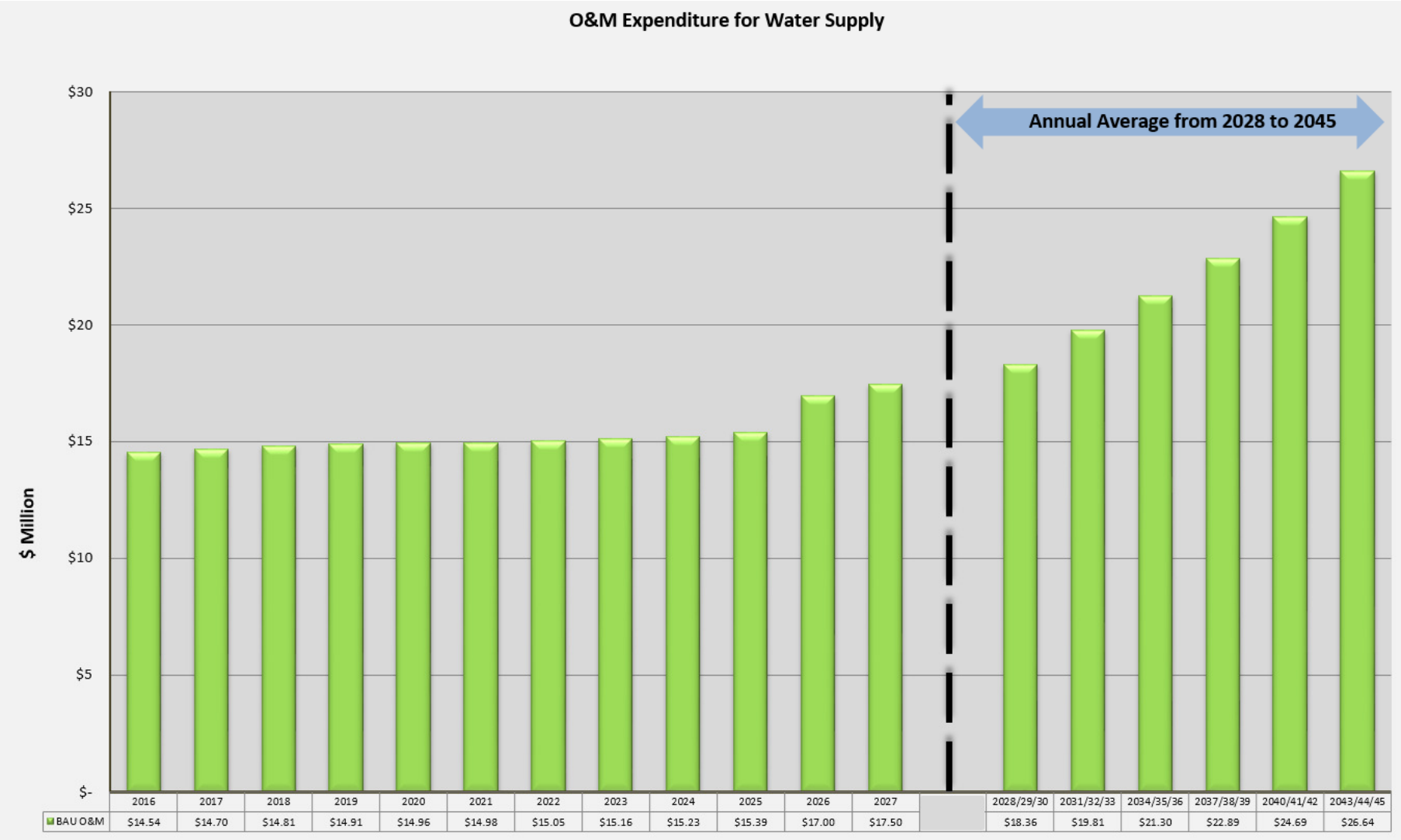
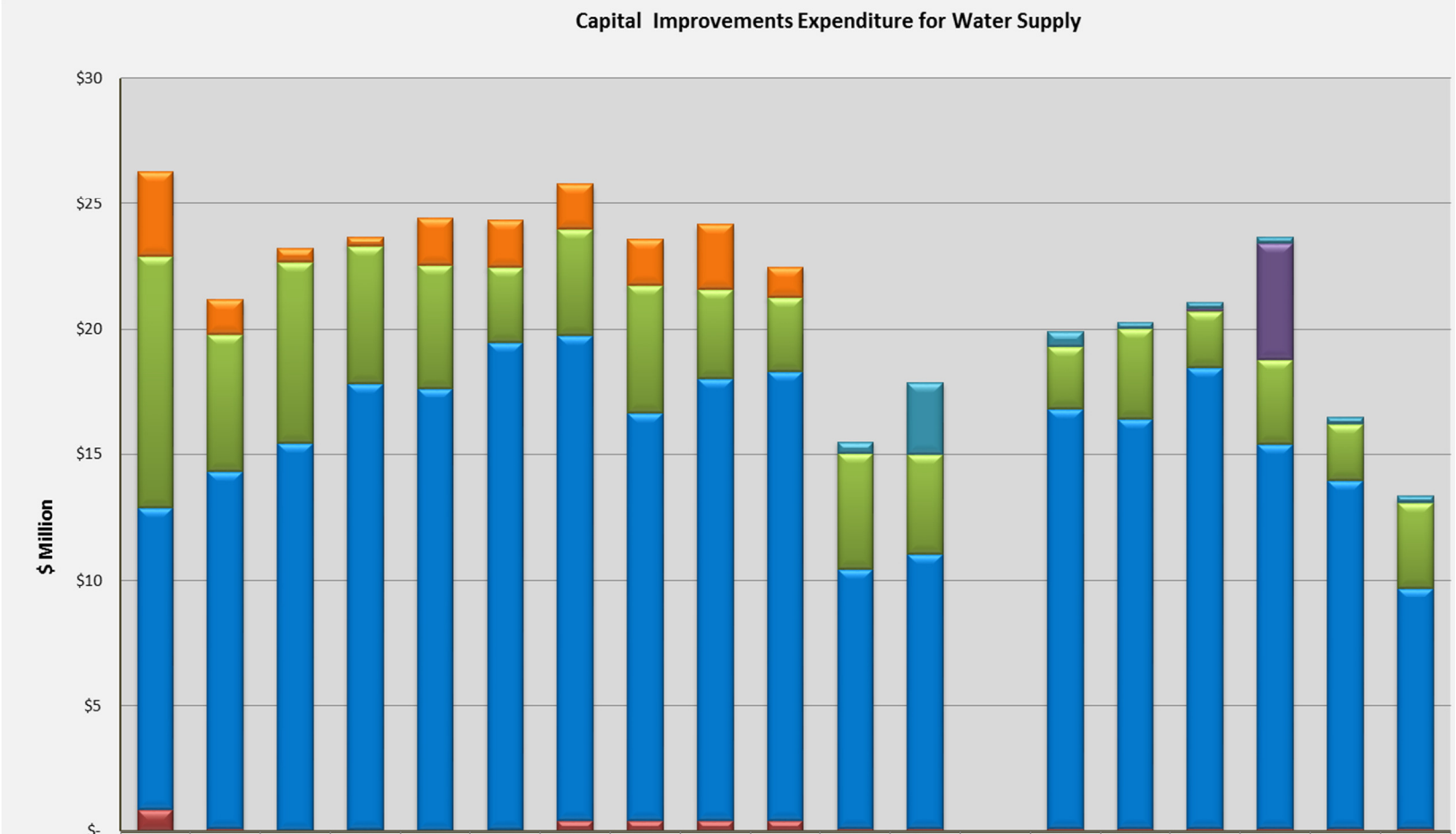
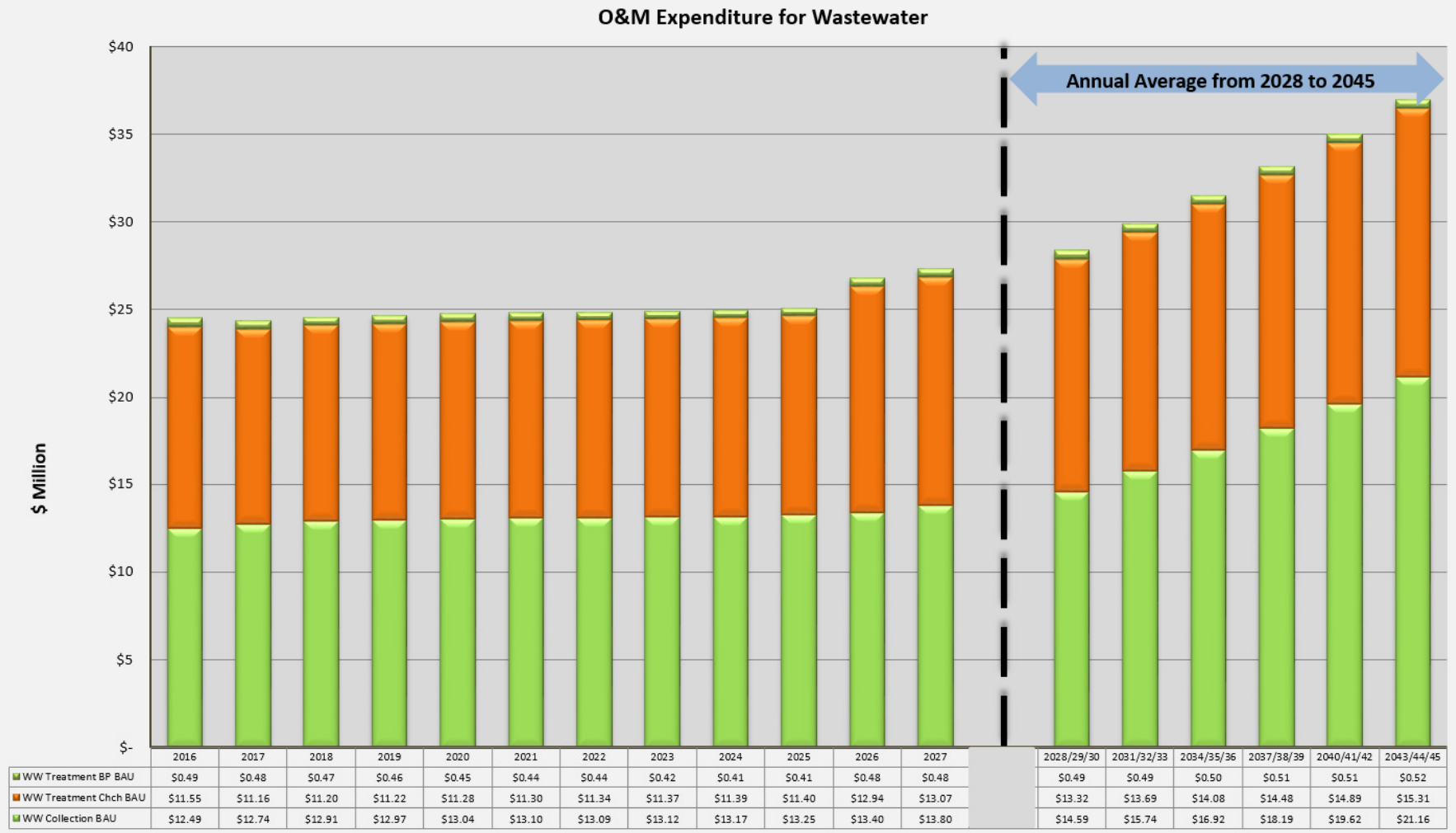


Figure 7-5: Operations and Maintenance Expenditure – Water Supply (without inflation)



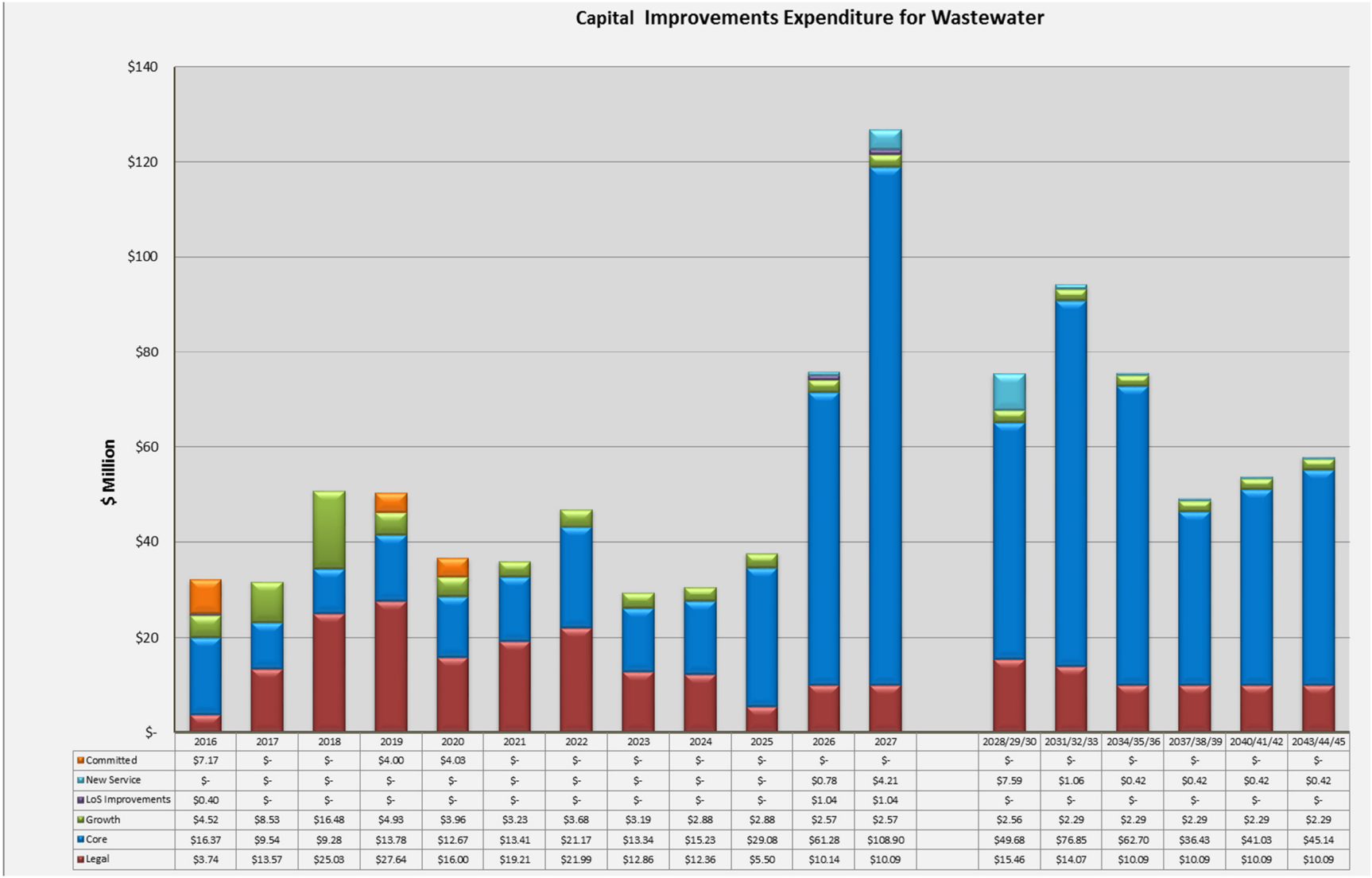
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027		2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Committed	$3.39	$1.37	$0.53	$0.36	$1.87	$1.87	$1.82	$1.82	$2.60	$1.22	$-	$-		$-	$-	$-	$-	$-	$-
New Service	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$0.47	$2.86		$0.61	$0.26	$0.26	$0.26	$0.26	$0.26
LoS Improvements	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-		$-	$-	$0.08	$4.60	$-	$-
Growth	$10.05	$5.48	$7.23	$5.47	$4.93	$2.99	$4.25	$5.13	$3.56	$2.93	$4.59	$3.96		$2.51	$3.62	$2.24	$3.41	$2.24	$3.41
Core	$12.01	$14.23	$15.42	$17.77	$17.61	$19.39	$19.30	$16.18	$17.58	$17.88	$10.34	$10.93		$16.69	$16.31	$18.38	$15.29	$13.86	$9.58
Legal	$0.85	$0.09	$0.02	$0.07	$0.02	$0.07	$0.43	$0.44	$0.44	$0.44	$0.10	$0.10		$0.10	$0.10	$0.10	$0.10	$0.10	$0.10

Figure 7-6: Capital Expenditure – Water Supply (without inflation)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
WW Treatment BP BAU	$0.49	$0.48	$0.47	$0.46	$0.45	$0.44	$0.44	$0.42	$0.41	$0.41	$0.48	$0.48	$0.49	$0.49	$0.50	$0.51	$0.51	$0.52
WW Treatment Chch BAU	$11.55	$11.16	$11.20	$11.22	$11.28	$11.30	$11.34	$11.37	$11.39	$11.40	$12.94	$13.07	$13.32	$13.69	$14.08	$14.48	$14.89	$15.31
WW Collection BAU	$12.49	$12.74	$12.91	$12.97	$13.04	$13.10	$13.09	$13.12	$13.17	$13.25	$13.40	$13.80	$14.59	$15.74	$16.92	$18.19	$19.62	$21.16

Figure 7-7: Operations and Maintenance Expenditure – Wastewater (without inflation)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027		2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Committed	$7.17	$-	$-	$4.00	$4.03	$-	$-	$-	$-	$-	$-	$-		$-	$-	$-	$-	$-	$-
New Service	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$0.78	$4.21		$7.59	$1.06	$0.42	$0.42	$0.42	$0.42
LoS Improvements	$0.40	$-	$-	$-	$-	$-	$-	$-	$-	$-	$1.04	$1.04		$-	$-	$-	$-	$-	$-
Growth	$4.52	$8.53	$16.48	$4.93	$3.96	$3.23	$3.68	$3.19	$2.88	$2.88	$2.57	$2.57		$2.56	$2.29	$2.29	$2.29	$2.29	$2.29
Core	$16.37	$9.54	$9.28	$13.78	$12.67	$13.41	$21.17	$13.34	$15.23	$29.08	$61.28	$108.90		$49.68	$76.85	$62.70	$36.43	$41.03	$45.14
Legal	$3.74	$13.57	$25.03	$27.64	$16.00	$19.21	$21.99	$12.86	$12.36	$5.50	$10.14	$10.09		$15.46	$14.07	$10.09	$10.09	$10.09	$10.09

Figure 7-8: Capital Expenditure – Wastewater (without inflation)

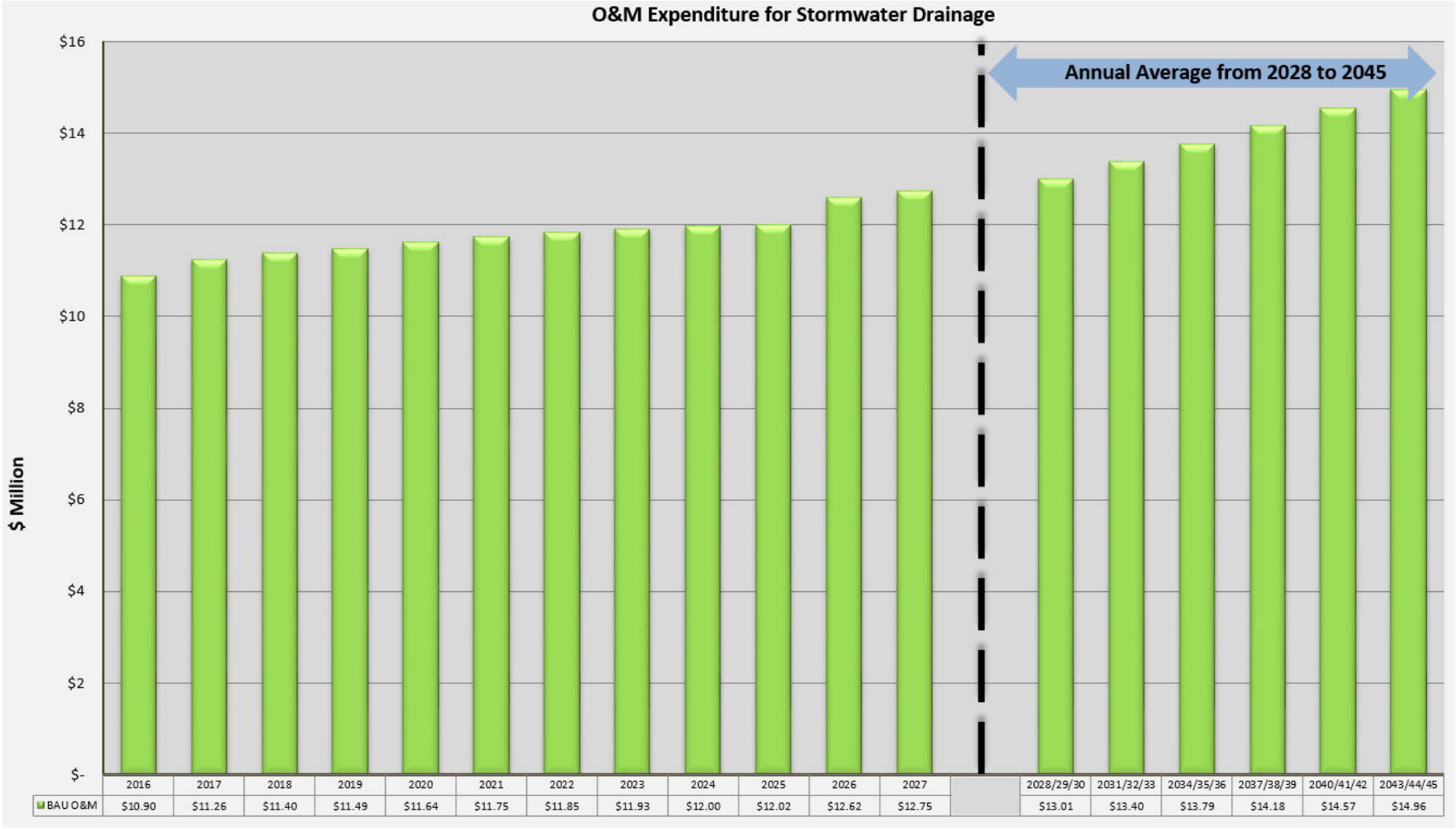
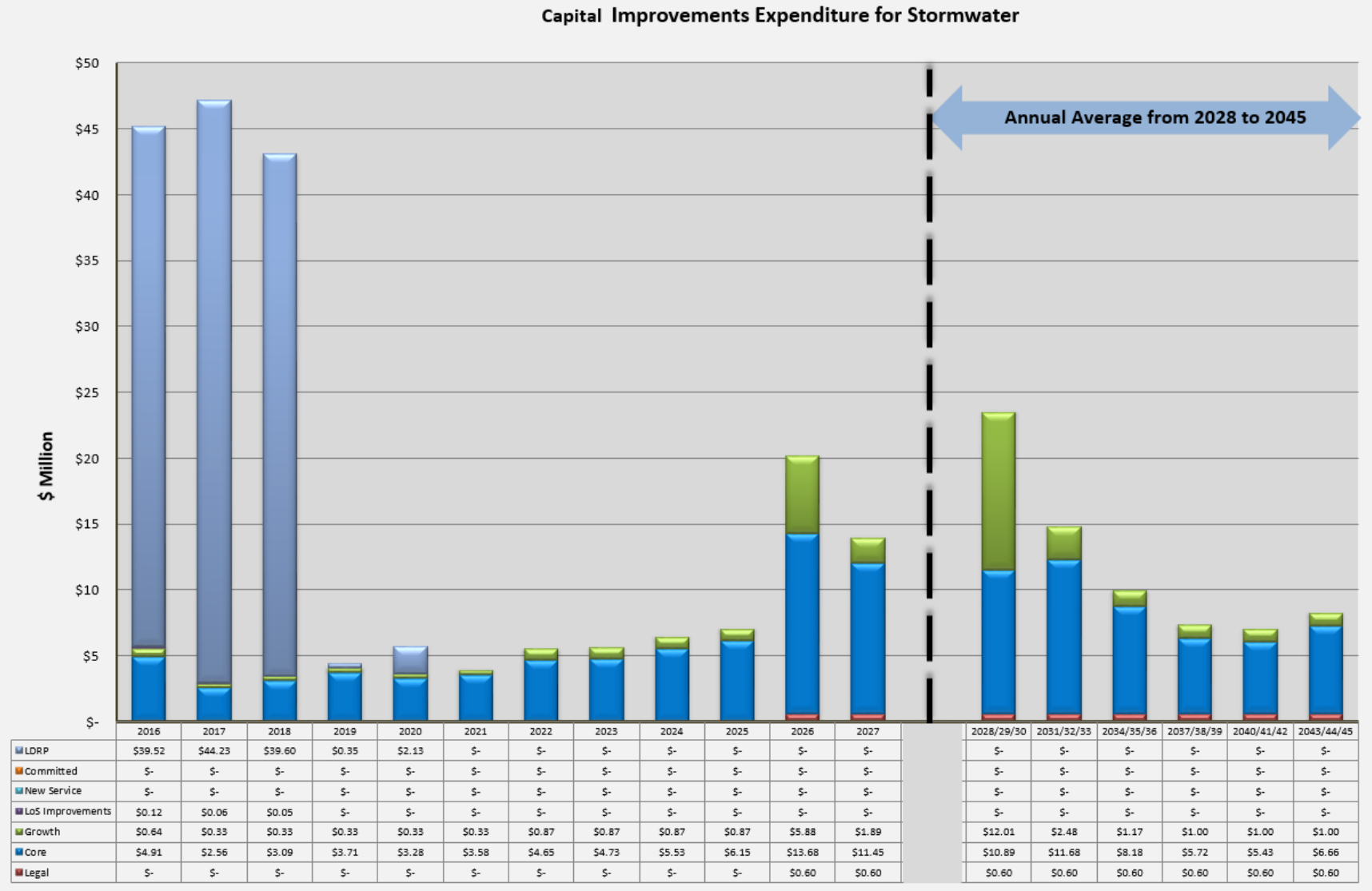


Figure 7-9: Operations and Maintenance Expenditure – Stormwater (without inflation)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
LDRP	$39.52	$44.23	$39.60	$0.35	$2.13	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Committed	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
New Service	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
LoS Improvements	$0.12	$0.06	$0.05	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
Growth	$0.64	$0.33	$0.33	$0.33	$0.33	$0.33	$0.87	$0.87	$0.87	$0.87	$5.88	$1.89	$12.01	$2.48	$1.17	$1.00	$1.00	$1.00
Core	$4.91	$2.56	$3.09	$3.71	$3.28	$3.58	$4.65	$4.73	$5.53	$6.15	$13.68	$11.45	$10.89	$11.68	$8.18	$5.72	$5.43	$6.66
Legal	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$0.60	$0.60	$0.60	$0.60	$0.60	$0.60	$0.60	$0.60

Figure 7-10: Capital Expenditure – Stormwater (without inflation)

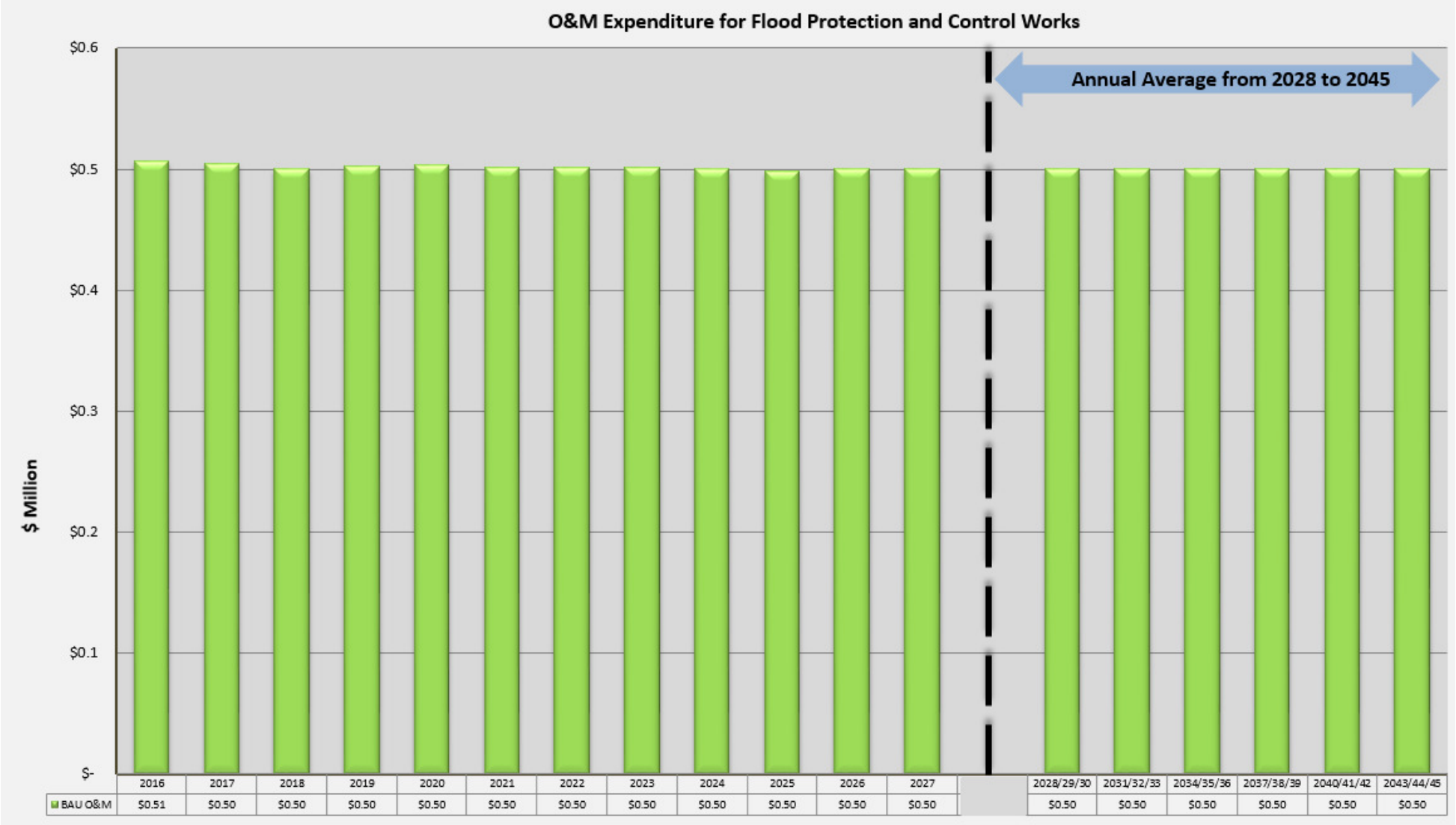
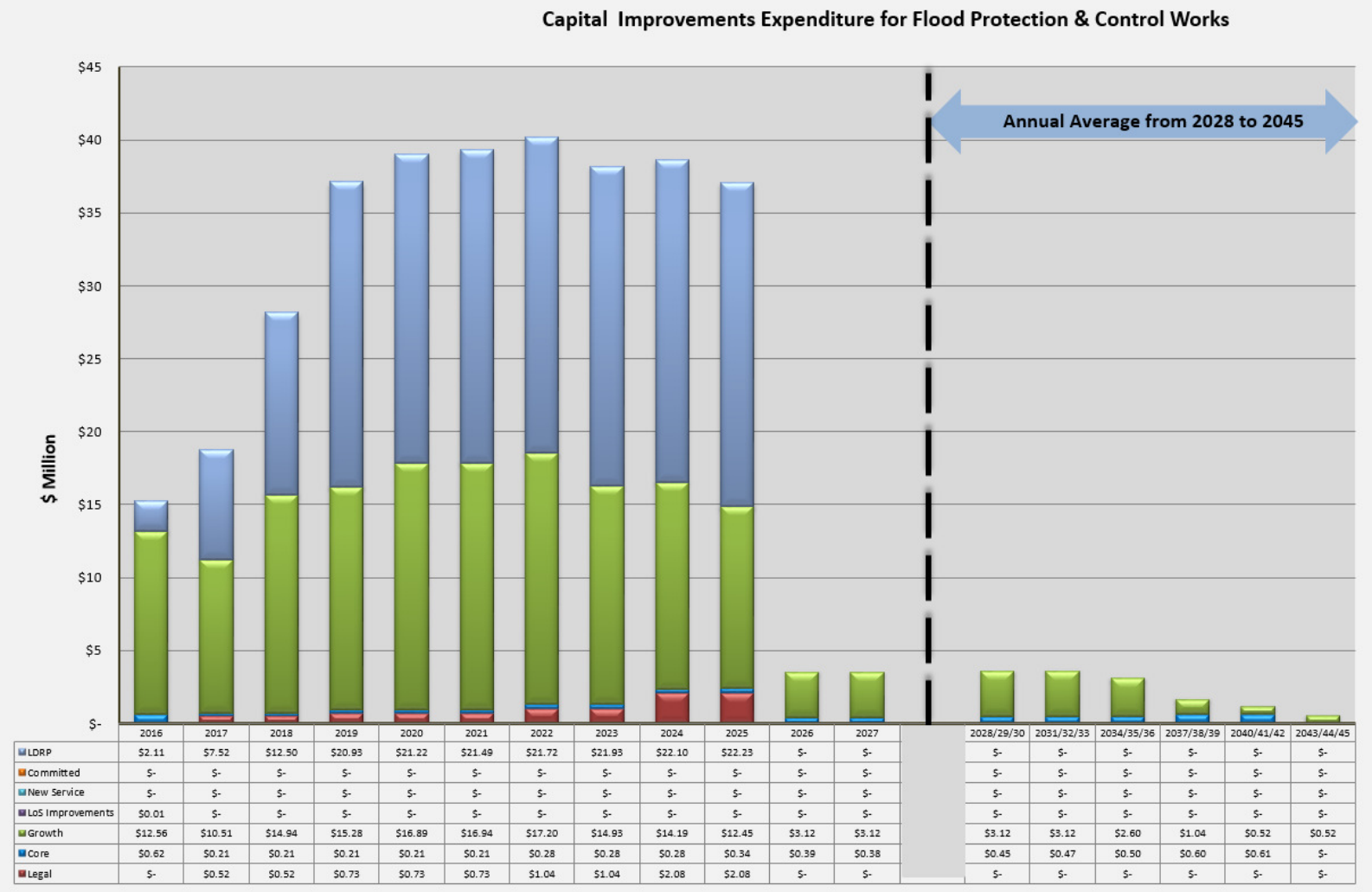
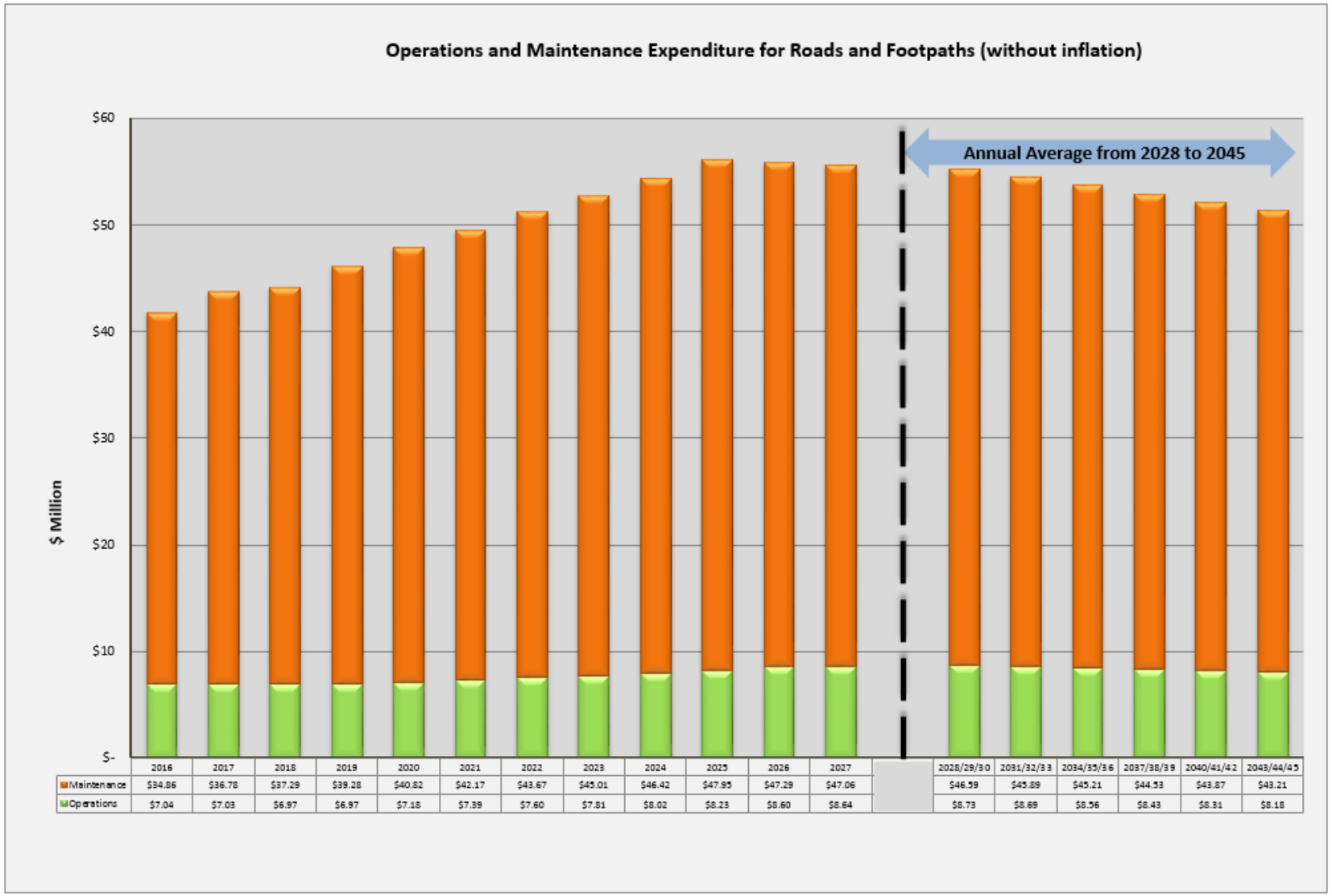


Figure 7-11: Operations and Maintenance Expenditure – Flood Protection and Control Works (without inflation)



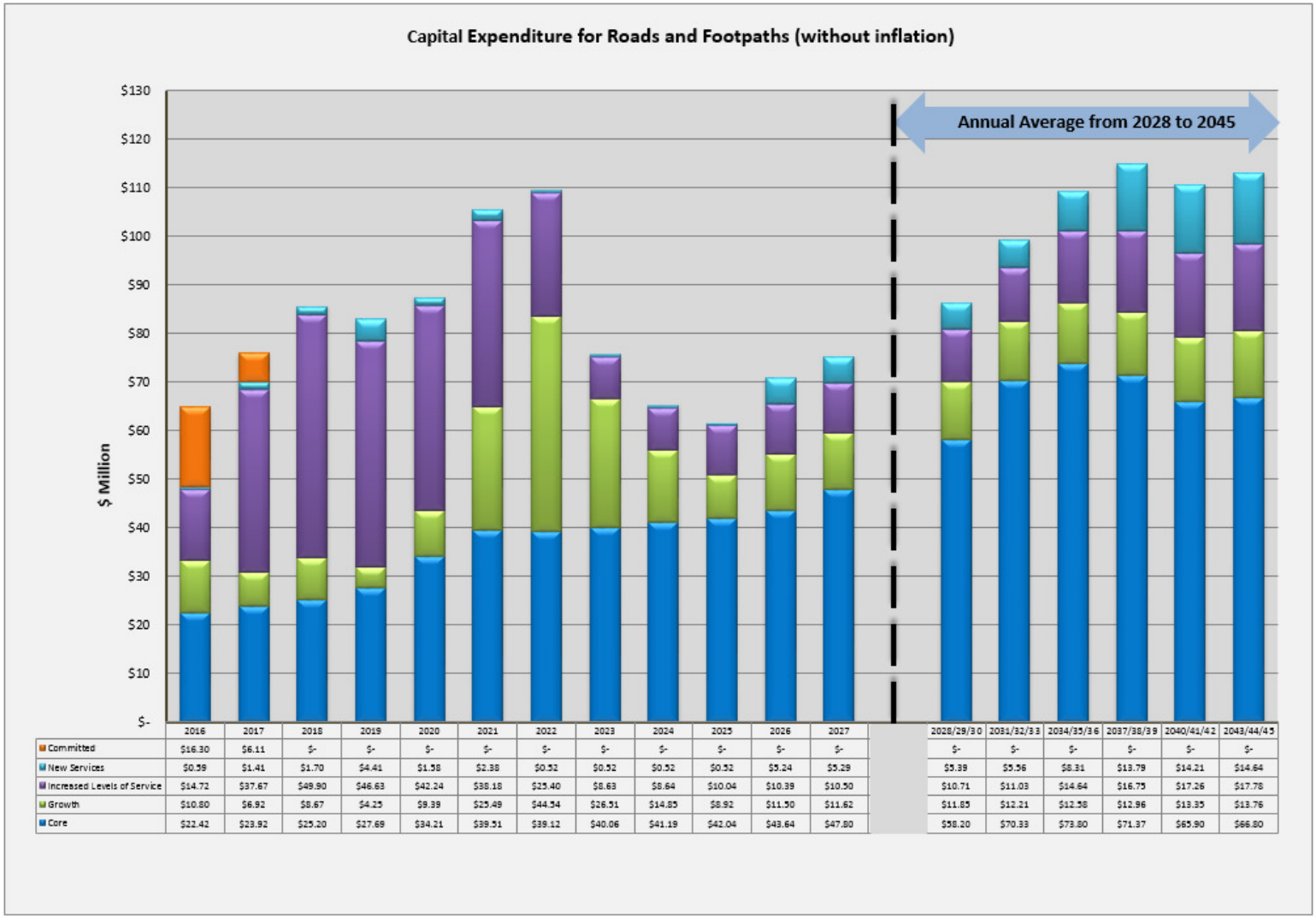
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027		2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
LDRP	$2.11	$7.52	$12.50	$20.93	$21.22	$21.49	$21.72	$21.93	$22.10	$22.23	$-	$-		$-	$-	$-	$-	$-	$-
Committed	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-		$-	$-	$-	$-	$-	$-
New Service	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-		$-	$-	$-	$-	$-	$-
LoS Improvements	$0.01	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-		$-	$-	$-	$-	$-	$-
Growth	$12.56	$10.51	$14.94	$15.28	$16.89	$16.94	$17.20	$14.93	$14.19	$12.45	$3.12	$3.12		$3.12	$3.12	$2.60	$1.04	$0.52	$0.52
Core	$0.62	$0.21	$0.21	$0.21	$0.21	$0.21	$0.28	$0.28	$0.28	$0.34	$0.39	$0.38		$0.45	$0.47	$0.50	$0.60	$0.61	$-
Legal	$-	$0.52	$0.52	$0.73	$0.73	$0.73	$1.04	$1.04	$2.08	$2.08	$-	$-		$-	$-	$-	$-	$-	$-

Figure 7-12: Capital Expenditure – Flood Protection and Control Works (without inflation)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Maintenance	$34.86	$36.78	$37.29	$39.28	$40.82	$42.17	$43.67	$45.01	$46.42	$47.95	$47.29	$47.06	$46.59	$45.89	$45.21	$44.53	$43.87	$43.21
Operations	$7.04	$7.03	$6.97	$6.97	$7.18	$7.39	$7.60	$7.81	$8.02	$8.23	$8.60	$8.64	$8.73	$8.69	$8.56	$8.43	$8.31	$8.18

Figure 7-13: Operational Expenditure – Roads and Footpaths (without inflation)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Committed	$16.30	$6.11	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
New Services	$0.39	$1.41	$1.70	$4.41	$1.58	$2.38	$0.52	$0.52	$0.52	$0.52	$5.24	$5.29	$5.39	$5.56	$8.31	$13.79	$14.21	$14.64
Increased Levels of Service	$14.72	$37.67	$49.90	$46.63	$42.24	$38.18	$25.40	$8.63	$8.64	$10.04	$10.39	$10.50	$10.71	$11.03	$14.64	$16.75	$17.26	$17.78
Growth	$10.80	$6.92	$8.67	$4.25	$9.39	$25.49	$44.54	$26.51	$14.85	$8.92	$11.50	$11.62	$11.85	$12.21	$12.58	$12.96	$13.35	$13.76
Core	$22.42	$23.92	$25.20	$27.69	$34.21	$39.51	$39.12	$40.06	$41.19	$42.04	$43.64	$47.80	$58.20	$70.33	$73.80	$71.37	$65.90	$66.80

Figure 7-14: Capital Expenditure – Roads and Footpaths (without inflation)

8 Appendix B – Financial Forecasts Accounting for Inflation

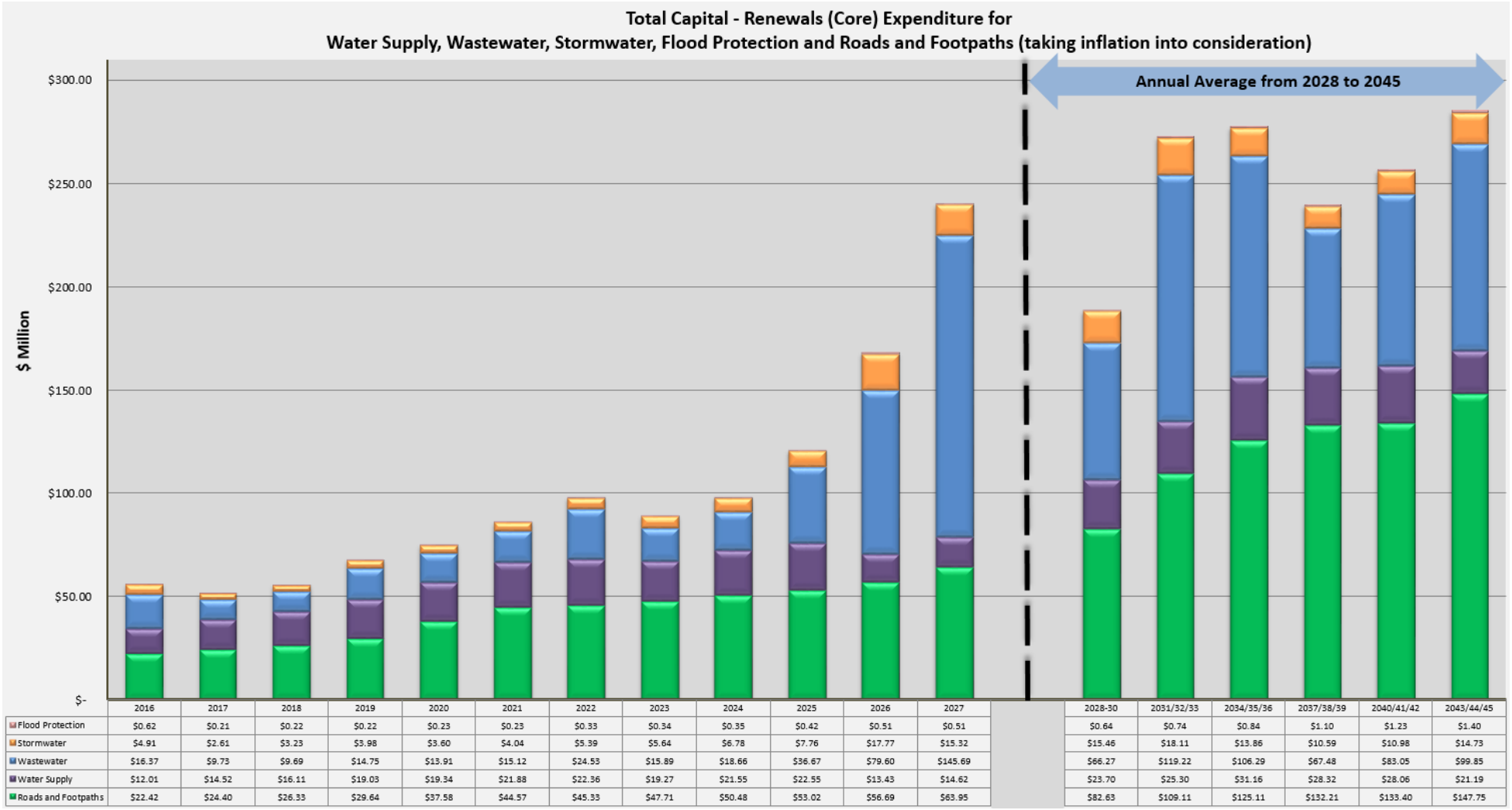
The financial forecasts have been updated to account for the inflation assumptions shown in the table below, and the resulting graphs can be found in Figures 8-1 to 8-3.

LTP years	Financial Year	Years	Opex Annual inflation	Opex Inflation Cumulative	Capex Annual inflation	Capex Infation Cumulative
1	2016	2015/16	-	***1.0000***	-	***1.0000***
2	2017	2016/17	2.0%	***1.0200***	2.0%	***1.0200***
3	2018	2017/18	2.0%	***1.0404***	2.4%	***1.0445***
4	2019	2018/19	2.1%	***1.0622***	2.5%	***1.0706***
5	2020	2019/20	2.2%	***1.0856***	2.6%	***1.0984***
6	2021	2020/21	2.3%	***1.1106***	2.7%	***1.1281***
7	2022	2021/22	2.3%	***1.1361***	2.7%	***1.1585***
8	2023	2022/23	2.4%	***1.1634***	2.8%	***1.1910***
9	2024	2023/24	2.4%	***1.1913***	2.9%	***1.2255***
10	2025	2024/25	2.5%	***1.2211***	2.9%	***1.2611***
11	2026	2025/26	3.0%	***1.2577***	3.0%	***1.2989***
12	2027	2026/27	3.0%	***1.2955***	3.0%	***1.3379***
13,14,15	2028/29/30	2028/29/30	3.0%	***1.3748***	3.0%	***1.4197***
16,17,18	2031/32/33	2031/32/33	3.0%	***1.5022***	3.0%	***1.5514***
19,20,21	2034/35/36	2034/35/36	3.0%	***1.6415***	3.0%	***1.6953***
22,23,24	2037/38/39	2037/38/39	3.0%	***1.7938***	3.0%	***1.8525***
25,26,27	2040/41/42	2040/41/42	3.0%	***1.9601***	3.0%	***2.0242***
28,29,30	2043/44/45	2043/44/45	3.0%	***2.1418***	3.0%	***2.2119***

Figure 8-1: Total Capital - Renewals (Core) Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (taking inflation into account)

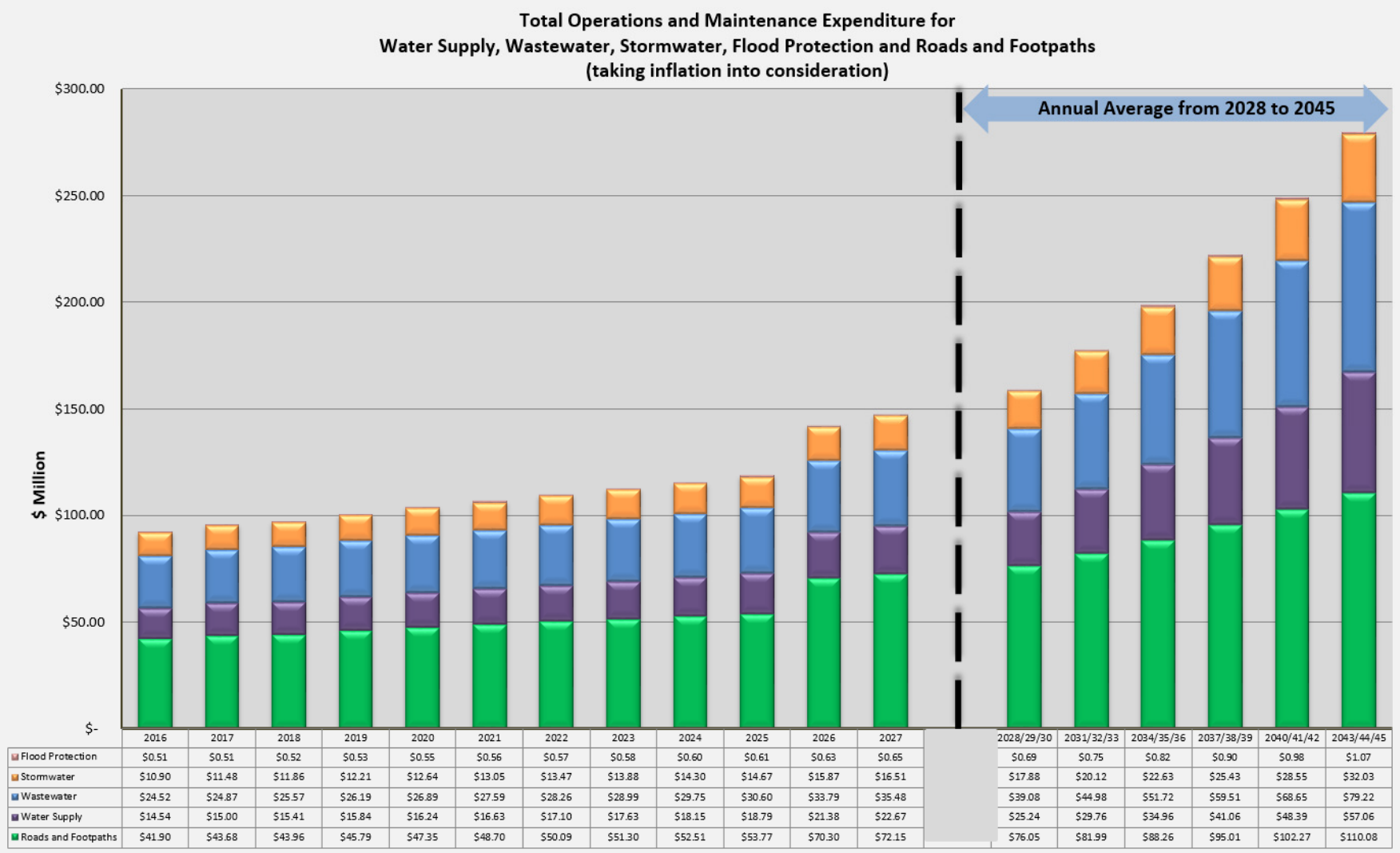
Figure 8-2: Total Operations and Maintenance Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (taking inflation into account)

Figure 8-3: Total Capital Improvements (Non-Core) Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (taking inflation into account)



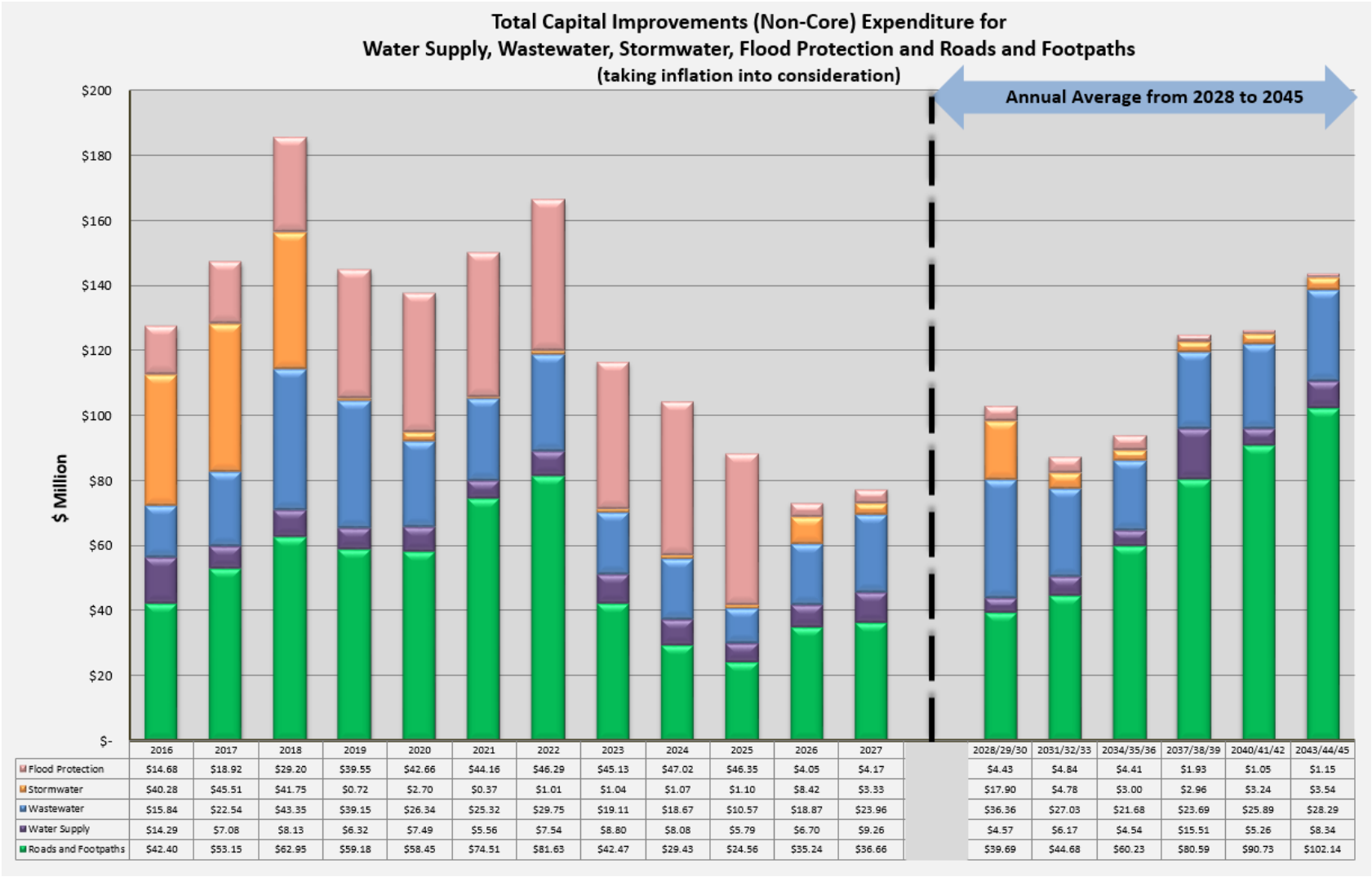
	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028-30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Flood Protection	$0.62	$0.21	$0.22	$0.22	$0.23	$0.23	$0.33	$0.34	$0.35	$0.42	$0.51	$0.51	$0.64	$0.74	$0.84	$1.10	$1.23	$1.40
Stormwater	$4.91	$2.61	$3.23	$3.98	$3.60	$4.04	$5.39	$5.64	$6.78	$7.76	$17.77	$15.32	$15.46	$18.11	$13.86	$10.59	$10.98	$14.73
Wastewater	$16.37	$9.73	$9.69	$14.75	$13.91	$15.12	$24.53	$15.89	$18.66	$36.67	$79.60	$145.69	$66.27	$119.22	$106.29	$67.48	$83.05	$99.85
Water Supply	$12.01	$14.52	$16.11	$19.03	$19.34	$21.88	$22.36	$19.27	$21.55	$22.55	$13.43	$14.62	$23.70	$25.30	$31.16	$28.32	$28.06	$21.19
Roads and Footpaths	$22.42	$24.40	$26.33	$29.64	$37.58	$44.57	$45.33	$47.71	$50.48	$53.02	$56.69	$63.95	$82.63	$109.11	$125.11	$132.21	$133.40	$147.75

Figure 8-1: Total Capital - Renewals (Core) Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (with inflation)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Flood Protection	$0.51	$0.51	$0.52	$0.53	$0.55	$0.56	$0.57	$0.58	$0.60	$0.61	$0.63	$0.65	$0.69	$0.75	$0.82	$0.90	$0.98	$1.07
Stormwater	$10.90	$11.48	$11.86	$12.21	$12.64	$13.05	$13.47	$13.88	$14.30	$14.67	$15.87	$16.51	$17.88	$20.12	$22.63	$25.43	$28.55	$32.03
Wastewater	$24.52	$24.87	$25.57	$26.19	$26.89	$27.59	$28.26	$28.99	$29.75	$30.60	$33.79	$35.48	$39.08	$44.98	$51.72	$59.51	$68.65	$79.22
Water Supply	$14.54	$15.00	$15.41	$15.84	$16.24	$16.63	$17.10	$17.63	$18.15	$18.79	$21.38	$22.67	$25.24	$29.76	$34.96	$41.06	$48.39	$57.06
Roads and Footpaths	$41.90	$43.68	$43.96	$45.79	$47.35	$48.70	$50.09	$51.30	$52.51	$53.77	$70.30	$72.15	$76.05	$81.99	$88.26	$95.01	$102.27	$110.08

Figure 8-2: Total Operations and Maintenance Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (with inflation)



	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028/29/30	2031/32/33	2034/35/36	2037/38/39	2040/41/42	2043/44/45
Flood Protection	$14.68	$18.92	$29.20	$39.55	$42.66	$44.16	$46.29	$45.13	$47.02	$46.35	$4.05	$4.17	$4.43	$4.84	$4.41	$1.93	$1.05	$1.15
Stormwater	$40.28	$45.51	$41.75	$0.72	$2.70	$0.37	$1.01	$1.04	$1.07	$1.10	$8.42	$3.33	$17.90	$4.78	$3.00	$2.96	$3.24	$3.54
Wastewater	$15.84	$22.54	$43.35	$39.15	$26.34	$25.32	$29.75	$19.11	$18.67	$10.57	$18.87	$23.96	$36.36	$27.03	$21.68	$23.69	$25.89	$28.29
Water Supply	$14.29	$7.08	$8.13	$6.32	$7.49	$5.56	$7.54	$8.80	$8.08	$5.79	$6.70	$9.26	$4.57	$6.17	$4.54	$15.51	$5.26	$8.34
Roads and Footpaths	$42.40	$53.15	$62.95	$59.18	$58.45	$74.51	$81.63	$42.47	$29.43	$24.56	$35.24	$36.66	$39.69	$44.68	$60.23	$80.59	$90.73	$102.14

Figure 8-3: Total Capital Improvements (Non-Core) Expenditure – Water Supply, Wastewater, Stormwater, Flood Protection, Roads and Footpaths (with inflation)