Watercare Services Limited

Asset Management Plan 2016 to 2036

(Forecasts from 1 July 2016 to 30 June 2036)

Watercare
An Auckland Council Organisation

Foreword by the Chief Executive

Asset Management Plan 2016 to 2036

Watercare Services Limited (Watercare) is responsible for the provision of water and wastewater services to the Auckland Region. Watercare owns and operates $8.4 billion of water and wastewater infrastructure assets. Each year we prepare an Asset Management Plan (AMP) to show how the business will operate, maintain and renew existing water and wastewater assets and provide new assets to meet demand as Auckland grows. Whilst the AMP has a 20 year horizon, Watercare's planning horizon extends out 50 years and beyond due to the long life and strategic nature of our infrastructure assets.

Auckland's population is forecast to grow by up to one million people over the next 30 years. This is a significant increase on the 1.4 million people currently connected to our water and wastewater networks. The Proposed Auckland Unitary Plan proposes significant intensification across the Auckland region with three quarters of the one million people forecast to be located within the existing urban area. There will also be significant growth in the satellite towns of Pukekohe and Warkworth.

We have been working closely with Auckland Council to identify areas where there is sufficient water and wastewater capacity to support growth in the short term and to align the planning of new or upgraded infrastructure to meet Council's spatial development priorities. Watercare currently has capacity for 45,000 dwellings and, in the next ten years alone, will add capacity for a further 195,000 dwellings. Forty six per cent of our first 10-year's capital expenditure forecast of $4.9 billion is associated with providing capacity for growth.

Developers continue to express interest in more rural developments, which are outside the Rural Urban Boundary. This places pressure on us to extend networks or build small isolated treatment plants which would need to be operated and maintained. Where a proposed development is not contiguous with the existing system the developer will be required to construct and fund the connection from their development to our existing network.

Watercare's business is intrinsically linked to the natural environment and we have a significant role to play in the future well-being of the community. More directly than most organisations, the sustainability of our business is dependent upon the health of the natural environment. We actively measure and mitigate our effects on the environment and embed environmental protection into our daily operations. Our water demand management programme is aiming to reduce the per capita consumption of water from 272 litres per person per day to 255 litres per person per day by 2025. This will focus on reducing non-revenue water through targeted leak detection, the replacement of ageing water meters and for our customers, encouraging the efficient use of water through education.

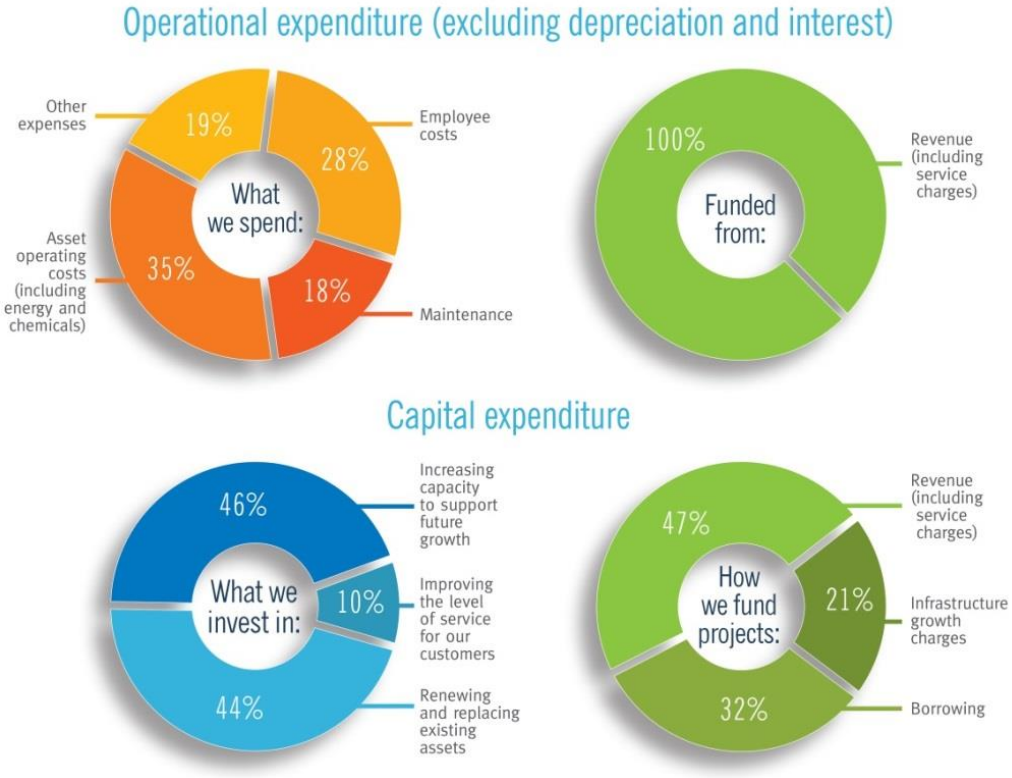
The inflow and infiltration of stormwater into our wastewater system can result in uncontrolled overflows from manholes and pumping stations during heavy rain. We are developing a region-wide inflow and infiltration programme to identify and minimise the level of stormwater entering our wastewater system. This initiative will be managed in conjunction with the Stormwater Unit of Auckland Council.

Part of the older area of Auckland's wastewater system was designed as a combined wastewater/stormwater system collecting both wastewater and stormwater flows in a common pipe. The system includes around 110 overflow structures that discharge diluted wastewater to the Waitemata Harbour during heavy rainfall, 50 of which discharge more than 50 times per year. Watercare's proposed Central Interceptor is being provided to enable growth in the central and southern areas of Auckland and also provides an interim solution for stormwater issues, providing time for Auckland Council to construct adequate stormwater infrastructure to service the area. Continued reliance on the wastewater system for the collection and treatment of stormwater is not sustainable for a growing and liveable city.

Legislation requires us to manage our operations with a view to keeping the overall cost of water supply and wastewater services to our customers (collectively) at minimum levels and we are prohibited from paying a dividend or distributing a surplus in any way, directly or indirectly. Watercare does not receive any revenue from Auckland Council or the Government.

The total forecast operational expenditure (in nominal dollars excluding depreciation and interest) for the first 10-year period is $2.6 billion and is funded from revenue while capital expenditure at $4.9 billion (nominal dollars) is funded from a combination of revenue, Infrastructure Growth Charges and borrowings.

Raveen Jaduram
CHIEF EXECUTIVE



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Glossary

ADWF	Average Dry Weather Flow
AELG	Auckland Engineering Lifelines Group
AMP	Asset Management Plan
BNR	Biological Nutrient Removal
BPO	Best Practicable Option
CCO	Council Controlled Organisation
EOP	Engineered Overflow Point
FULSS	Future Urban Land Supply Strategy
FFO Ratio	Funds From Operations to Interest Cover ratio
IGC	Infrastructure Growth Charge
km	kilometres
LoSI	Level of Service Improvement
L/p/d	Litres per person per day
LTP	Long Term Plan
m^2	Square metres
m^3	Cubic metres
m^3/d	Cubic metres per day
m^3/s	Cubic metres per second
ML	Mega litres or million litres
MLD	Mega litres per day or million litres per day
NDC	Network Discharge Consent
PAUP	Proposed Auckland Unitary Plan
PDWF	Peak Dry Weather Flow
PWWF	Peak Wet Weather Flow
RCM	Reliability Centred Maintenance
RUB	Rural Urban Boundary

1. Executive Summary

Watercare Services Limited (Watercare) prepares an Asset Management Plan (AMP) to show how the business will operate, maintain and renew existing water and wastewater assets and provide new assets to meet demand as Auckland grows. Whilst the AMP has a 20 year horizon, Watercare's planning horizon extends out for 50 years and beyond due to the long life and strategic nature of the water and wastewater infrastructure assets.

Every three years, the financial information contained in the AMP forms the basis of Watercare's submission to the Auckland Council for the preparation of its Long Term Plan (LTP).

This AMP covers the period 1 July 2016 to 30 June 2036.

1.1. Scope of Activities

Watercare is a limited liability company registered under the Companies Act 1993, and a local government organisation.

The legislative framework enabling and governing Watercare's operations as the regional provider of water and wastewater services in Auckland is found largely in three Acts and amendments:

1. Local Government Act 2002
2. Local Government (Auckland Council) Act 2009
3. Local Government (Auckland Transitional Provisions) Act 2010.

The company became a council-controlled organisation (CCO) on 1 July 2012.

Watercare's Board is appointed by Auckland Council to govern Watercare in accordance with the statutory obligations and the agreed Statement of Intent.

The Statement of Intent sets out the activities to be undertaken by Watercare and specific economic, social and environmental objectives for the company. It establishes targets which are used to measure the company's performance. The Statement of Intent is available on Watercare's website, www.watercare.co.nz .

Watercare is responsible for:

- Collecting, treating, and distributing drinking water
- Collecting, treating, and disposing of wastewater
- Transferring, treating, and disposing of trade wastes from industries
- Commercial laboratory services

Figure 1 and **Figure 2** show the extent of Watercare's water and wastewater network coverage respectively.

Figure 1: Watercare Water Network Area of Service

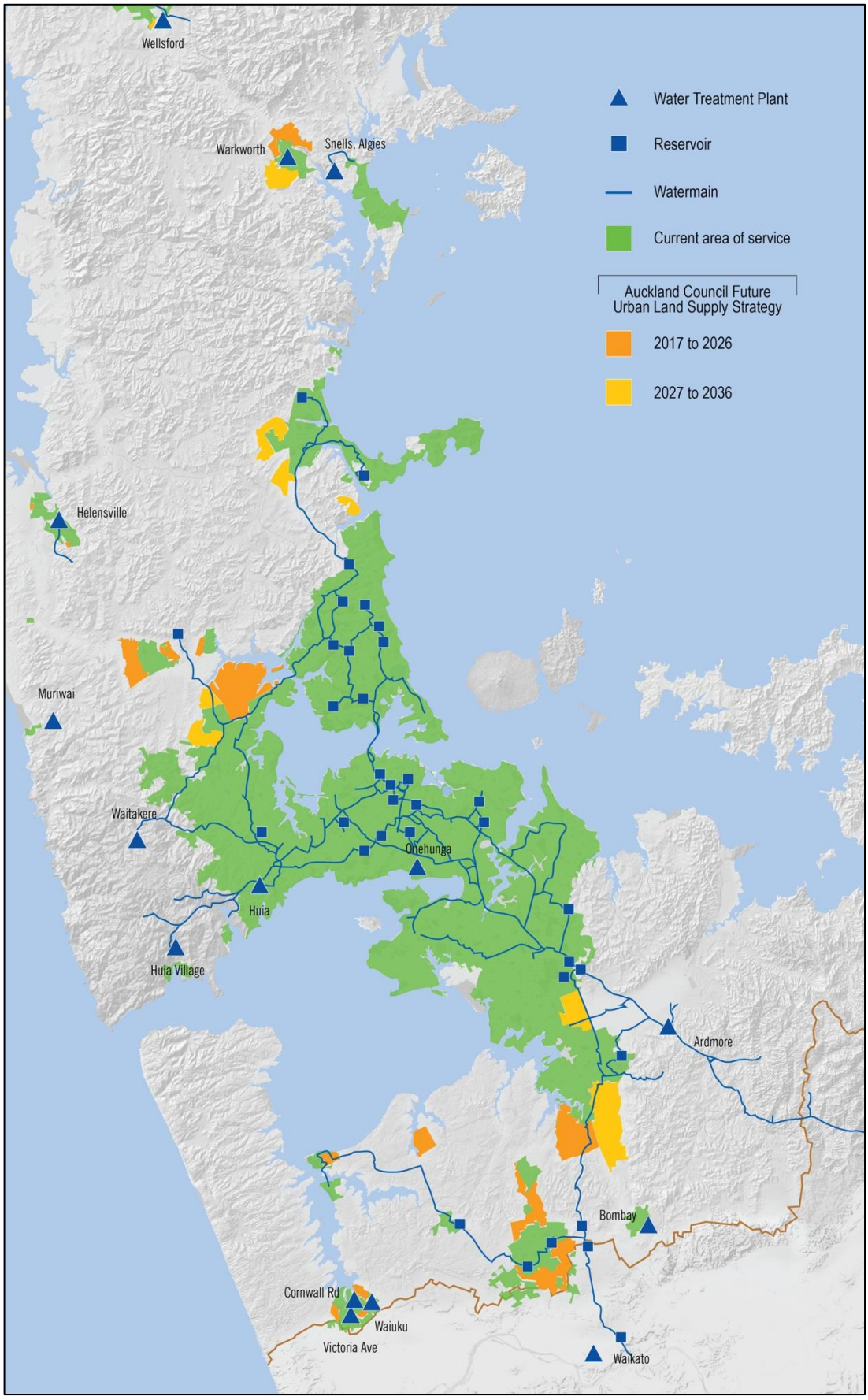
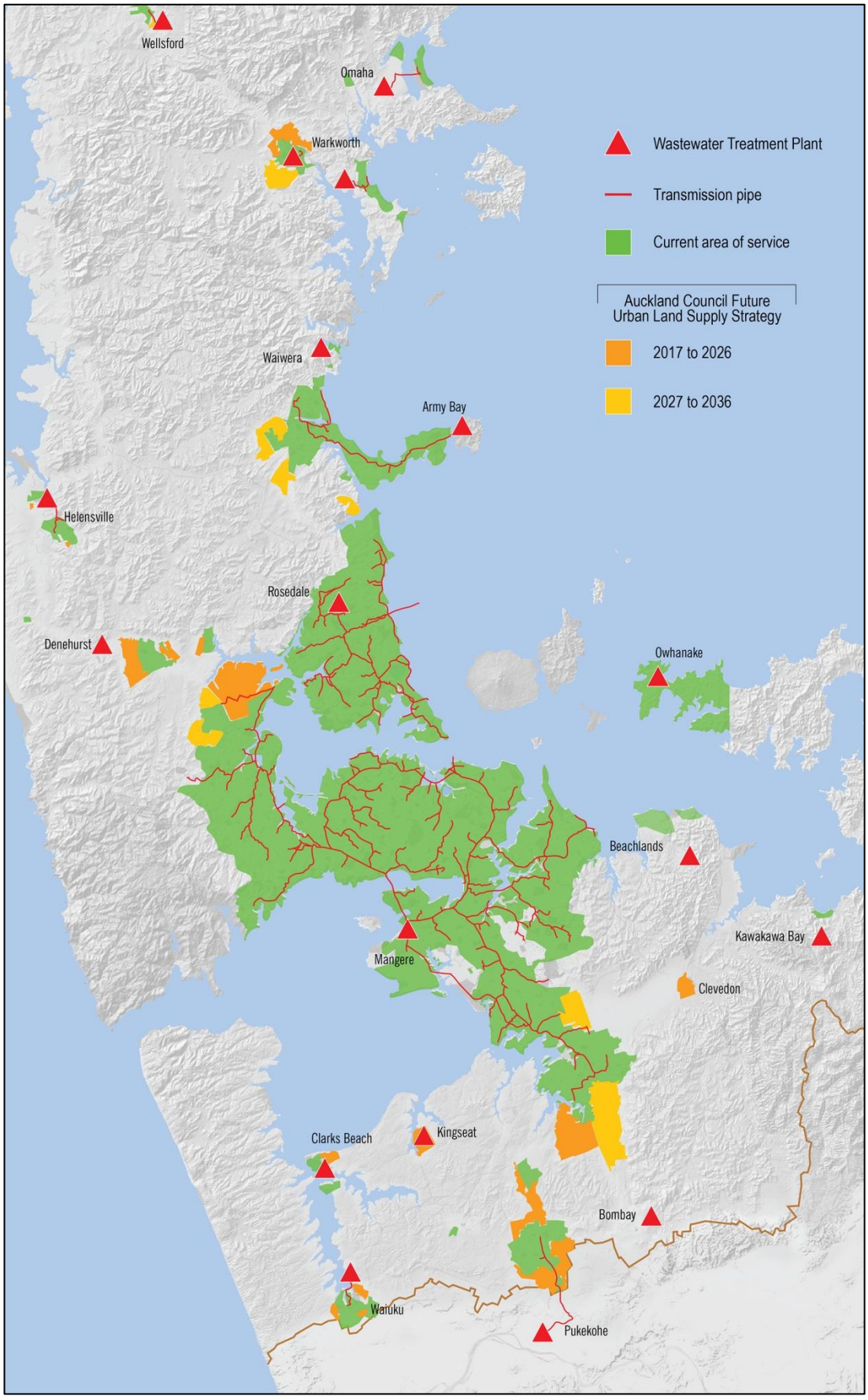


Figure 2: Watercare Wastewater Network Area of Service



1.2. Key Issues

1.2.1. Growth and Demand

Auckland's population is forecast to grow by approximately one million people over the next 30 years. This is a significant increase on the 1.4 million people currently connected to our water and wastewater networks. The Proposed Auckland Unitary Plan (PAUP) proposes significant intensification across the Auckland region with three quarters of the one million people forecast to be located within the existing urban area. There will also be significant growth in the satellite towns of Pukekohe and Warkworth. Depending on the scale and location of actual development, duplication and upgrading of existing assets will be required. It is clear that significant investment in new infrastructure or upgrades will be required to service the growing city.

1.2.2. Location of New Development

The location, size and timing of new development have a direct bearing on the infrastructure required to service that development. A significant challenge for Watercare is how to plan and provide infrastructure for Auckland's expected growth.

Watercare has been working closely with Auckland Council to identify areas where there is sufficient water and wastewater capacity to support growth in the short term and to align the planning of new or upgraded infrastructure to meet Council's spatial development priorities.

Developers continue to express interest in more rural developments, which are outside the Rural Urban Boundary (RUB). This places pressure on Watercare to extend networks or build small isolated treatment plants which would need to be operated and maintained.

1.3. Significant Work Programmes

1.3.1. Water Asset Strategy

In the next ten years the population serviced by the metropolitan water system is expected to increase by 260,000 from 1.41 million to 1.67 million, based on Council's medium growth projection. During this period, demand management initiatives are expected to reduce the per capita consumption from 272 litres per person per day (L/p/d) to 255 L/p/d. The average daily demand for water is therefore forecast to increase from 390 mega-litres per day (MLD) to 435 MLD. The key infrastructure required to meet growth while increasing resilience of supply includes the following:

- Completion of the Hunua 4 Watermain to Khyber Reservoirs to increase conveyance of water to Central Auckland and to provide resilience.
- Expansion of the Waikato Water Treatment Plant to 175 MLD to meet the three-day peak demand and to provide system resilience.
- Boost pumping of the Waikato watermain to increase conveyance of water to the Redoubt Road reservoirs.

- New water storage in Pukekohe East (50 ML) and additional storage at Redoubt Road (+50 ML) to meet the daily water storage and 3-day peak demand.
- Replacement of the Huia Water Treatment Plant to treat up to 140 MLD.
- Additional water storage in the west associated with the Huia Water Treatment Plant to meet the daily water storage requirement and three-day peak demand.
- Construction of the North Harbour 2 watermain to convey water to Albany and the north.
- Boost pumping to convey water from the central region to the west to provide resilience against an outage of the Huia Water Treatment Plant.
- Replacement of Khyber 2 Reservoir.
- Boost pumping of the North Shore watermains across the Harbour Bridge.
- New watermain and boost pumping to Pinehill Reservoir to provide resilience to the area.
- New Harbour crossing coinciding with the planned New Zealand Transport Agency Waitemata Harbour crossing.
- Non-metropolitan water supplies including, Wellsford, Warkworth, Snells/Algies, Helensville and Waiuku.
- Replacement of transmission watermains.

A spatial overview of these strategic works is provided in Section 3 Water Asset Strategy.

1.3.2. Wastewater Asset Strategy

The overall level of growth is the same as for the water network, although there are some spatial variations due to communities that are only supplied with wastewater services.

The majority of the growth is forecast to occur in the metropolitan areas and affects Watercare's four largest wastewater treatment plants, Mangere, Rosedale, Army Bay and Pukekohe, as well as the smaller Warkworth and Snells rural wastewater treatment plants. There are an additional 12 smaller rural plants servicing communities across the Auckland region.

The current gross per capita wastewater production is 291 L/p/d and is expected to reduce to 273 L/p/d in line with the reduction in per capita water consumption. Strategic initiatives around a reduction in wet weather influences may reduce this figure further.

Key infrastructure, from north to south, to meet growth while maintaining existing levels of service includes the following:

- Construction of a North East Sub-Regional Wastewater Treatment Plant and associated conveyance to accommodate growth in the Warkworth and Snells/Algies catchments.
- Construction of the Army Bay Wastewater Treatment Plant outfall and plant upgrade to increase disposal of treated wastewater from the Whangaparaoa Peninsula, Wainui and Silverdale-Dairy Flat.

- Construction of the first two phases of the Northern Interceptor connecting Whenuapai and Hobsonville to the Rosedale Wastewater Treatment Plant.
- Construction of the Central Interceptor tunnel and collector sewers to divert flow from the combined wastewater/stormwater area to the Mangere Wastewater Treatment Plant.
- Newmarket Gully augmentation to significantly reduce wastewater overflows to Hobson Bay.
- Construction of the Howick Diversion to divert the head of the Howick Interceptor's catchment to the Tamaki East Interceptor.
- Construction of the Hingaia Pump Station and initial network upgrades as the first stage of the augmentation of the Southern Interceptor between Hingaia and Manurewa to support growth in Papakura.
- Construction of the South West Sub-Regional Wastewater Treatment Plant and associated conveyance to accommodate growth in the Clarks Beach, Glenbrook, Waiuku and Kingseat catchments.
- Completion of the Pukekohe trunk sewer upgrade to convey wastewater from Pukekohe to its wastewater treatment plant.
- Expansion of the Pukekohe Wastewater Treatment Plant doubling its capacity to support the planned growth.

A spatial overview of these strategic works is provided in Section 4 Wastewater Asset Strategy.

1.4. Expenditure Forecasts

All forecasts in this AMP exclude risk provisions, are expressed in nominal dollars (unless stated otherwise) and exclude GST.

1.4.1. Capital Expenditure Forecasts

The need for and timing of all works have been reviewed in developing the capital expenditure forecasts in this AMP. A total of $4.9 billion of capital expenditure is forecast for the next 10 years. This comprises of $1.9 billion in water infrastructure assets, $2.8 billion in wastewater infrastructure assets with the remaining $0.2 billion for shared services. Forty six per cent of the investment is to service expected growth, 44% for the renewal of existing assets when they reach the end of their economic life and 10% to improve the levels of service and operational efficiency.

Table 1 provides a summary of the capital expenditure forecast for the first 10 years from 1 July 2016 to 30 June 2026, the second 10-year period (2027 to 2036) and the 20-year total. The forecasts are broken down by business areas and strategic drivers.

Table 1: Summary of Capital Expenditure Forecasts (Nominal $ millions)

Business Area	Contributing Driver	2017-2026	2027-2036	20-year Total
WATER	Growth	787.6	955.7	1,743.3
	Renewals	988.1	1,749.5	2,737.5
	LoSI	145.8	87.0	232.8
WATER Total		**1,921.5**	**2,792.1**	**4,713.6**
WASTEWATER	Growth	1,395.5	1,764.6	3,160.1
	Renewals	998.2	1,040.9	2,039.1
	LoSI	367.6	255.1	622.7
WASTEWATER Total		**2,761.3**	**3,060.6**	**5,821.9**
SHARED SERVICES	Growth	36.3	41.2	77.5
	Renewals	150.8	176.2	327.0
	LoSI	-	-	-
SHARED SERVICES Total		**187.1**	**217.4**	**404.5**
Grand Total		**4,869.9**	**6,070.1**	**10,940.0**

1.4.2. Operational Expenditure Forecast

Watercare's operational expenditure forecast for the first 10 years from 1 July 2016 to 30 June 2026, the second 10-year period (2027 to 2036) and the 20-year total is shown in nominal dollar terms (i.e. including inflation) in Table 2.

Table 2: Summary of Operational Expenditure Forecasts (Nominal $ millions)

Business Area		2017-2026	2027-2036	20-year Total
WATER	Asset operating Costs	295.2	457.0	752.2
	Maintenance Costs	231.5	349.9	581.4
	Employee Benefit Expenses	353.7	541.0	894.7
	Other Expenses	196.6	308.6	505.3
WATER Total		**1,077.0**	**1,656.5**	**2,733.5**
WASTEWATER	Asset operating Costs	451.0	694.3	1,145.3
	Maintenance Costs	217.0	326.0	543.0
	Employee Benefit Expenses	528.5	767.8	1,296.3
	Other Expenses	283.9	420.3	704.2
WASTEWATER Total		**1,480.4**	**2,208.4**	**3,688.8**
ALL WATERCARE	Asset operating Costs	746.2	1,151.3	1,897.5
	Maintenance Costs	448.6	675.9	1,124.4
	Employee Benefit Expenses	882.2	1,308.8	2,191.0
	Other Expenses	480.5	728.9	1,209.4
WATERCARE Total		**2,557.4**	**3,864.9**	**6,422.3**

1.5. Summary of Assets

A summary of the water and wastewater assets owned by Watercare and their replacement cost is shown in Table 3.

Table 3: Watercare's Key Infrastructure Assets (as at 30 June2015)

Asset Class	Quantity	Gross Replacement Cost ($ millions)[1]
Water Supply Assets		
Water Supply Dams	11	757
Groundwater Sources	11	
River Abstraction	3	
Raw Water Aqueducts	13	
Raw Water Tunnels	23	
Raw Watermains (pipe length in km)	76	
Water Treatment Plants	15	390
Treated Watermains (pipe length in km)	8,990	3,857
Water Pump Stations (raw and treated)	90	27
Water Reservoirs	89	320
Valves	82,600	174
Hydrants	41,404	130
Meters & Service Connections	433,611	172
Other		34
TOTAL WATER ASSETS		**5,861**
Wastewater Assets		
Sewer Mains (pipe length in km)	7,896	4,791
Manholes	165,610	1,384
Wastewater Pump Stations	506	307
Wastewater Treatment Plants	18	976
Other		16
TOTAL WASTEWATER ASSETS		**7,474**
Other Assets		
Land		152
Buildings (non-operations and operations)		124
Other		64
TOTAL OTHER ASSETS		**340**
TOTAL KEY INFRASTRUCTURE ASSETS		**13,675**

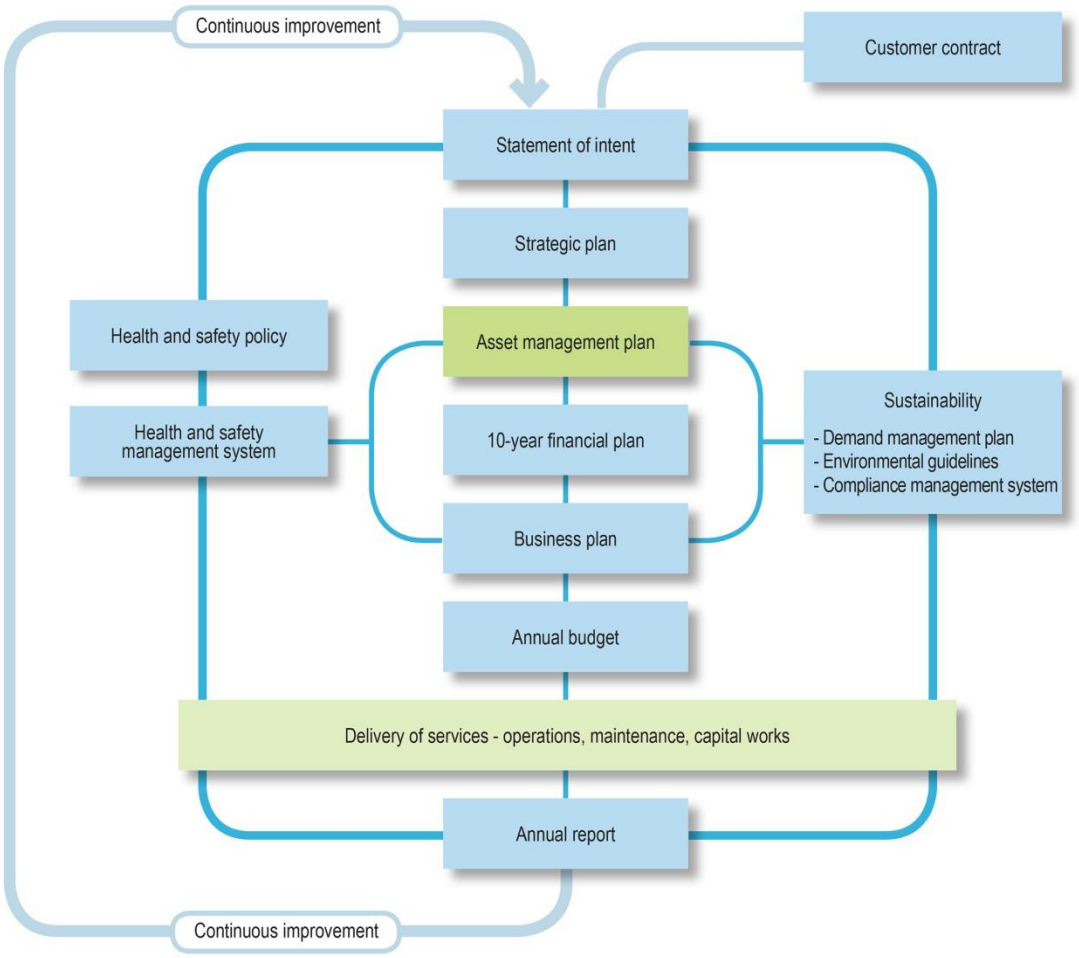
[1] Replacement cost values and asset quantities are current as at the 30 June 2015 valuation

2. Business Overview

2.1. About This Plan

The AMP is Watercare's tactical plan for managing the company's infrastructure cost-effectively in order to achieve long-term strategic goals. The relationship between the AMP and other company documents is shown below in **Figure 3**.

Figure 3: Watercare's Management System

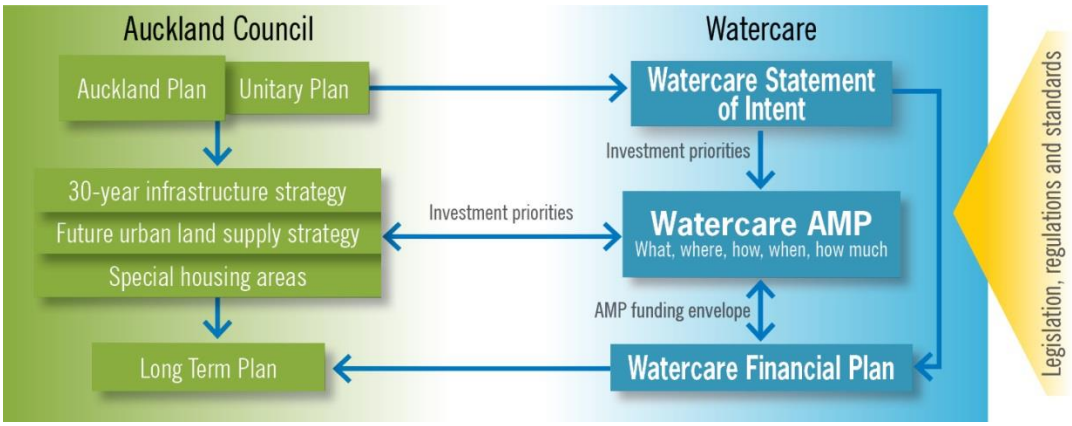


The AMP sets out the levels of service that Watercare is required to provide and the lifecycle asset management strategies, programmes and costs to deliver those services.

The plan includes water and wastewater treatment services for Tuakau and Pokeno in the Waikato District and excludes the Papakura network operated under contract by Veolia Water.

The AMP is aligned with Auckland Council's strategic plans and is an important part of the Auckland Council planning framework, as illustrated in **Figure 4**.

Figure 4: Alignment of Watercare AMP with the Auckland Plan



2.2. Strategic Framework

Watercare's responsibilities for the supply of drinking water and the treatment and disposal of wastewater make the company a major contributor to the health, prosperity and well-being of the Auckland-wide community. Watercare also provides drinking water to Tuakau and Pokeno from the Waikato water treatment plant and treats Tuakau and Pokeno's wastewater at the Pukekohe wastewater treatment plant. Watercare's vision, mission and strategic priorities are:

Vision

Trusted by our communities for exceptional performance every day.

Better tomorrow than we are today | Pai ake apopo atu i tenei ra

Mission

Reliable, safe and efficient water and wastewater services.

Strategic Priorities

Customer Focus

1. We understand our customer needs and deliver value
2. We consistently provide exceptional products and service
3. We are trusted by our customers who understand our purpose and value our service

Business Excellence

4. We have a safe and engaged team
5. We are a commercially savvy business
6. We are responsible stewards of our assets
7. We continually strive for process excellence

Financial Responsibility

8. We are a minimum cost service provider
9. We are financially stable over the long term

Fully Sustainable

10. We are a socially responsible business
11. We protect and enhance our natural environment
12. We meet all our legal; and regulatory obligations

2.2.1. Statement of Intent

The Statement of Intent represents Watercare's public expression of activities, intentions and objectives, and legislative expression of accountability to its shareholder, the Auckland Council. The Statement of Intent sets out the performance measures for each of Watercare's key goals and how these are linked to Auckland Plan priorities. Each goal can be viewed as a level of service statement. A copy of Watercare's Statement of Intent can be viewed on Watercare's website.

2.3. Asset Management Policy

The Asset Management Policy sets out to ensure that the water and wastewater infrastructure assets of the company are planned, designed, constructed, acquired, maintained, operated, rehabilitated and disposed of, for present and future customers, in a manner that:

- Provides a defined level of service to our customers and protects the public health of the community
- Takes an asset life cycle approach
- Develops cost effective management strategies for the long-term, including optimising the cost of maintaining and operating the networks
- Manages risks associated with asset failure
- Uses physical resources sustainably and with respect for the natural environment
- Continuously monitors and improves the asset performance and management practices.

2.4. Asset Management Objectives

Watercare is committed to best-practice asset management and to achieving the following high level goals:

- To operate and maintain the water and wastewater systems in an efficient manner
- To ensure there is sufficient infrastructural capacity to meet growth and demand
- To meet regulatory requirements and levels of service
- To replace assets when they reach the end of their economic life.

2.5. Business Drivers

2.5.1. Expansion (Growth)

Regional growth in population, industry and commerce has a direct impact on the demand for water and wastewater services. Optimal planning for growth requires

certainty around how much growth there will be and where it will take place so that infrastructure can be built on time, and in the right location to meet desired service levels.

Watercare is required by legislation to give effect to Auckland Council plans and strategies as set out in the Auckland Plan.

The Auckland Plan sets the strategic direction on how the additional one million people will be accommodated. As part of a quality compact approach to growth, the Auckland Plan anticipates that up to 70% of new dwellings will be built within the existing urban area and up to 40% within greenfield areas.

The notified Proposed Auckland Unitary Plan (PAUP) identifies approximately 11,000 hectares of rural land for future urbanisation. This land has the potential to accommodate approximately 110,000 dwellings by 2036, or around one quarter of the new dwellings needed. The future urban land forms an important part of the overall strategy for enabling Auckland's growth and requires the provision of water and wastewater services to realise its full potential.

In November 2015, Auckland Council approved the Future Urban Land Supply Strategy (FULSS). The FULSS identifies a programme to sequence the urbanisation of future urban land over 30 years and will assist with the on-going supply of greenfield land for development. This land is predominantly rural and has not previously been identified for urbanisation, so will require bulk servicing infrastructure to be provided. This programme will help provide greater clarity and certainty to landowners, iwi, developers, infrastructure providers and council about when future urban land will have bulk infrastructure in place and be ready for urban development. Watercare has aligned the provision of transmission infrastructure to the timing of the structure planning within the approved FULSS.

The PAUP proposes significant intensification across Auckland with three quarters of the million people forecast to be located within the existing urban area. There will also be significant growth expected in the satellite towns of Pukekohe and Warkworth. Watercare will be responsible for the provision of the transmission infrastructure with the developer responsible for the water and wastewater networks to connect to these or the existing networks. Where a proposed development is not contiguous with the existing system the developer will be required to construct and fund the connection from their development to the existing network in accordance with Watercare's Water and Wastewater Code of Practice for Land Development and Subdivision (refer Watercare's website).

Population growth has placed pressure on housing availability and competition for housing has also influenced housing affordability. In October 2013 the Auckland Council and central government entered into an accord to create Special Housing Areas targeted at increasing housing supply and improving housing affordability in Auckland. A total of 154 Special Housing Areas have been approved with the potential for 56,000 new homes to be built on these sites.

2.5.2. Replacement and Rehabilitation (Renewals)

Asset replacement and rehabilitation programmes are in place to maintain existing levels of service and are derived from the assets' age profiles and maintenance histories, as well as on-going condition assessments and risk analysis. Capital works are prioritised according to the criticality of the asset and the probability and consequence of system failure.

2.5.3. Improvement (Level of Service)

Service level improvement programmes are developed to ensure Watercare complies with legislative and regulatory operating conditions, to increase operational efficiency, and to improve the quality of service Watercare provides to the region.

2.5.4. Health and Safety

Watercare has health and safety policies and safety management systems in place to protect staff, contractors and members of the public from the hazards associated with operating and maintaining the water and wastewater systems.

All contractors working on the Watercare assets must prepare and operate under specific health and safety plans and procedures in accordance with the Health and Safety at Work Act 2015 and other regulations.

2.5.5. Sustainable Management

Sustainable development means that the decisions and actions of an entity effectively balance the needs of present and future customers. Consideration of the interrelated components of environmental, economic, social and cultural well-being is essential for Watercare to take a sustainable development approach. From an asset management perspective, sustainability is critical, as many assets have a long lifespan and the asset itself and any externalities must be 'future-proofed' in order to meet the needs and expectations of future generations.

In 2015, Watercare included "Fully Sustainable" as one of its four strategic priorities.

Watercare's business is intrinsically linked to the natural environment and has a significant role to play in the future well-being of our community. Being fully sustainable means delivering positive outcomes for our community, our environment and our organisation while acting with integrity and ethics. This is reflected in the way we manage our effect on the environment and our approach to community engagement in that:

We are a socially responsible business

Being socially responsible means we act with integrity and ethically and do the right thing by our people, our communities, iwi and our environment. For our business, this means having the policies and governance arrangements to support ethical behaviour and being a positive member of our community.

We protect and enhance our natural environment

More directly than most organisations, the sustainability of our business is dependent upon the health of the natural environment. We actively measure and mitigate our impacts on the environment and embed environmental protection into our daily operations. We encourage water conservation and where appropriate provide leadership and advocacy in improving the health of the environment and in relation to long-term environmental and social challenges such as climate change.

We meet all our legal and regulatory requirements

Meeting our legal and regulatory obligations are baseline requirements for the organisation. Watercare's assets are subject to a large number of consent conditions. We are also subject to a large number of laws and statutory expectations associated with the governance and financial management of the organisation.

Integrating sustainability into everything we do is key to our role as a trusted community and iwi partner.

2.5.6. Regulatory Framework

Legislation governs where and how water and wastewater services are delivered. The company's obligations to deliver water and wastewater services for Auckland, are set out in Part 5 section 57(1) of the Local Government (Auckland Council) Act 2009 which stipulates amongst others, that an Auckland water organisation:

a) must manage its operations efficiently with a view to keeping the overall costs of water supply and wastewater services to its customers (collectively) at the minimum levels consistent with the effective conduct of its undertakings and the maintenance of the long-term integrity of its assets; and
b) must not pay any dividend or distribute any surplus in any way, directly or indirectly, to any owner or shareholder; and
c) is not required to comply with section 68(b) of the Local Government Act 2002; and
d) must have regard for public safety (for example, the safety of children in urban areas) in relation to its structures.

Further legislation prescribes how the water and wastewater networks are managed, to ensure that public health and the environment is protected.

Table 4 lists the Acts of Parliament that affect the delivery of the water and wastewater services and provides a summary of the specific requirements under these Acts.

Table 4: Legislative Requirements

Legislation	Requirement
Local Government Act 2002	• Obligation to maintain public water services, unless that service supplies water to 200 or fewer persons. • Obligation for Council to adopt a significance policy setting out (among other requirements) a list of assets Council considers being 'strategic assets'. Strategic assets are those assets vital for delivery of Council's services to the community. As such, Council has determined the water and wastewater schemes to be 'strategic assets'. • Undertake assessments of water and sanitary services. • Not use the water services assets as security, or divest ownership to a non-local government organisation, lose control of, sell, or otherwise dispose of the significant infrastructure for providing water services. • Not restrict or stop water supply to a property unless all criteria under the Act are met.
Local Government Act 1974	• Obligation to provide fire hydrants in the public water supply networks
Local Government (Auckland Council) Act 2009	• Local activities must be identified in the Long Term Plan • Manage water & wastewater operations efficiently to keep costs to customers at a minimum while maintaining effective management and maintenance of the long-term integrity of its assets • Must not pay any dividend or distribute any surplus in any way, directly or indirectly, to any owner or shareholder • Give written notice for road opening (unless for emergency work) • Must have regard for public safety in relation to its structures
Health Act 1956	• Improve, promote and protect public health • Provide adequate supply and monitoring
Health and Safety at Work Act 2015	• The main purpose of this Act is to provide for a balanced framework to secure the health and safety of workers and workplaces
Health (Drinking Water) Amendment Act 2007	• Develop and implement Water Safety Plans • Take all practicable steps to comply with the Drinking Water Standards for New Zealand
Building Act 1991	• Enforce the provisions of the Building Code in relation to safe and adequate water supplies
Resource Management Act 1991	• Promote sustainable management of natural and physical resources • That the taking of water and the discharge of wastewater to the natural environment are done in compliance with resource consent conditions
Civil Defence Emergency Management Act 2002	• Requires lifeline utilities to ensure they are able to function to the fullest possible extent, and have plans in place, to cope during an emergency • Participate in/provide information for Civil Defence Emergency Management strategy and plans

2.5.7. Resource Consents

The Resource Management Act 1991 promotes the sustainable management of the environment. Resource consents are a legislative requirement for activities that may have an impact on the environment. Resource consents have specific conditions associated with the consented activity including operational, monitoring and compliance reporting requirements.

As a water and wastewater service provider, Watercare has resource consents associated with:

- Water abstraction from a source for the purposes of potable water supply
- Discharges associated with water and wastewater treatment plants
- Discharges associated with water and wastewater networks
- Consents associated with infrastructure construction activities

Consenting strategy

Watercare operates a consent management system to monitor the performance of the water and wastewater systems to ensure compliance with the conditions of its resource consents. Ahead of each consent expiry the need for the consent is re-examined and the abstraction or discharge assessed against the planned growth for the region to be serviced.

The assessment of options for a resource consent considers the cultural, social, environmental, technological and cost implications to determine the preferred outcome. A consent period of 35 years is typically sought to provide sufficient certainty to facilitate long-term planning and to support the associated financial investment decisions.

2.5.8. Inflow and Infiltration of Wastewater Networks

The capacity of wastewater networks can be compromised with stormwater entry. This can be via the illegal connection of building downpipes to the wastewater systems or through low gully traps (inflow); or by groundwater entering the system through defective pipe joints and manholes, either within Watercare's network or private drainage (infiltration).

This phenomenon is known as inflow and infiltration and results in uncontrolled overflows from manholes and pump stations during and after heavy rain. Watercare is developing a region-wide inflow and infiltration reduction programme as part of its wet weather overflow reduction strategy.

2.5.9. Conditional Connections

For the majority of the Auckland metropolitan region there is available capacity to connect to the existing water and wastewater systems. However wastewater networks in parts of the city are nearing their capacity. Wastewater connections in these areas are subject to conditions to limit the discharges to current levels until the planned augmentation works are carried out.

In the combined wastewater/stormwater part of the city, Auckland Council requires property owners to remove stormwater from the wastewater network as a condition of giving approval for any development with an increase in impervious area of greater than 20m^2, where there is a stormwater network within 30 metres of the property. Where there is no stormwater network within 30 metres of the property, Auckland Council require the inclusion of a stormwater storage tank with throttle outlet to attenuate stormwater before discharge into the wastewater system. Watercare is working with Auckland Council to progress the removal of stormwater from the wastewater collection system.

The networks in Waiwera and Waiheke have reached capacity. Watercare has sought clarification from Council of the growth plans for these communities.

2.6. Risk and Emergency Management

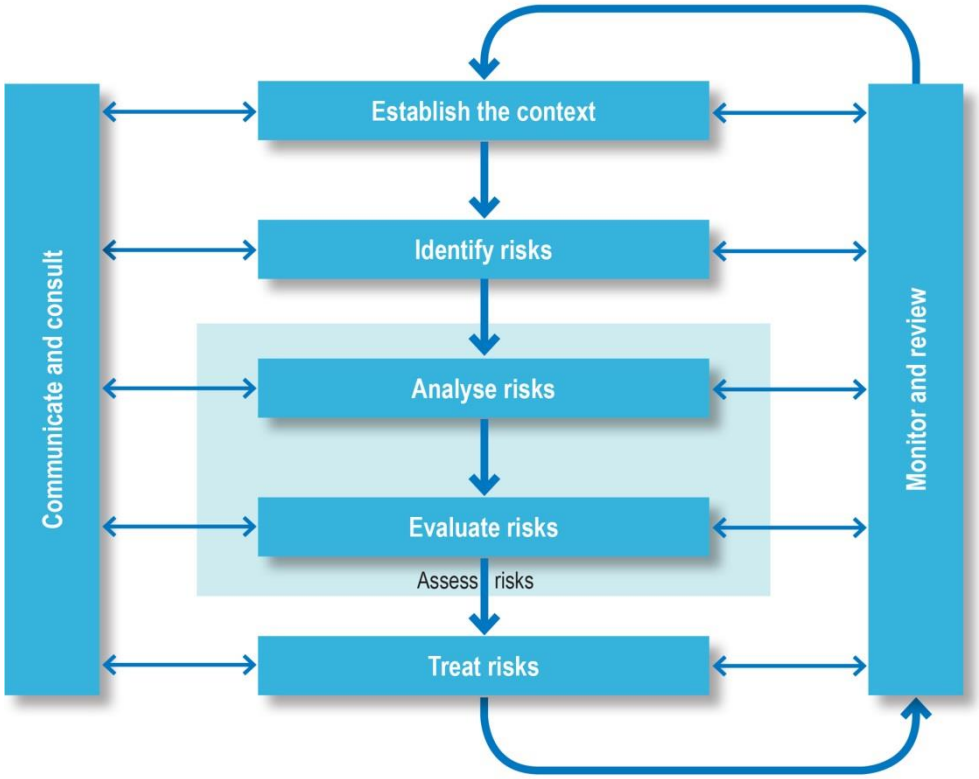
2.6.1. Risk Management

Risk management is an integral part of the lifecycle of major infrastructure assets.

Watercare takes an enterprise wide approach to managing risks and opportunities through a formal enterprise risk management framework and supporting processes which align with AS/NZS ISO 31000:2009 Standard (Risk Management – Principles and Guidelines).

The continued application of risk management processes ensures that Watercare identifies the risks to achieving its business objectives. Risks are analysed; prioritised for treatment, and then appropriate risk treatments are applied. **Figure 5** illustrates Watercare's risk management process.

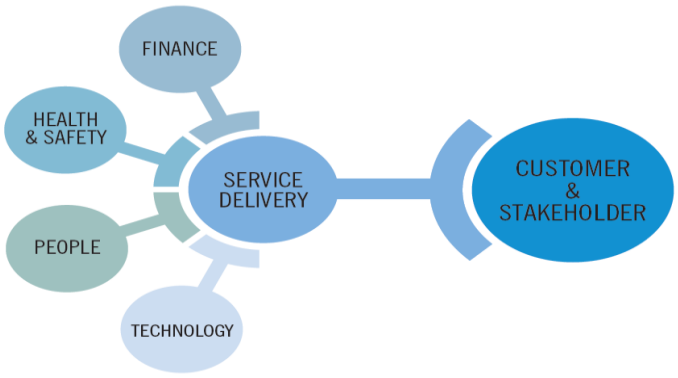
Figure 5: Risk Management Process



As part of Watercare's improvement programme, the Risk Management Framework and Enterprise Risks have been revised to better reflect a service orientation.

The revised Enterprise Risks reflect the wider dependencies that Watercare faces when delivering water and wastewater services.

There are a number of key risk areas which together are critical to Watercare:



- Enablers: Health & Safety, Financial, People, Technology
- Water and wastewater service delivery
- Customers supported including external stakeholders

All of these elements are critical to Watercare's ability to meet its strategic objectives.

2.6.2. Enterprise Risks

Watercare has identified 24 enterprise risks that are reported to the Board each month. These are categorised into the following six strategic risk areas with responsibility assigned to the executive team.

Finance Strategic Risk Area

Prudent financial management of the company is critical to achieving its regulatory requirement to keep the overall costs of its services at minimum levels while maintaining the long-term integrity of its assets. The Finance risk profile is characterised as a high inherent risk with well-established control and mitigating actions in place to ensure both the likelihood and impact of these risks are managed.

Health and Safety Strategic Risk Area

In providing the services required of Watercare, workers are exposed to significant process and operational safety risks which have the potential to cause serious and fatal injuries to these workers or to members of the public. Watercare has identified those risks which result in a significant consequence (serious and fatal injuries), and is continuously reviewing existing controls, and developed mitigation actions to further reduce risk to as low as reasonably practicable.

People Strategic Risk Area

Watercare's role as a lifeline utility, operating and managing specialist infrastructure requires highly qualified, skilled and competent staff. There are a number of technical and specialist roles in Watercare where the employment market cannot provide qualified and competent resources quickly. The loss of personnel in critical roles has the potential to compromise Watercare's service to its customers, and to threaten our capacity to maintain Drinking-water Standards for New Zealand

accreditation and statutory and health and safety compliance. In addition to this, maintaining a high performing and engaged workforce is vital for our customer service and overall company performance.

Technology Strategic Risk Area

Continued operation of business information systems and operational control systems is critical to Watercare continuing to meet its service delivery standards. Given the broader societal and technological trends there are now an increasing number of challenges to ensuring continued efficient operation of these systems and the profile of a number of these risks is increasing.

Service Delivery Strategic Risk Area

The provision of water and wastewater services includes the operation and maintenance of all water and wastewater treatment, storage, transmission and network infrastructure. In the provision of these services, there are risks that exist which can compromise the ability of Watercare to maintain the current level of service. Failure to provide these services has the potential to significantly impact on the social, cultural and economic sustainability of the region. Watercare has identified those risks which result in a significant consequence to the business, reviewed existing controls and developed mitigation actions and emergency response plans to further reduce the risk and consequence to as low as reasonably practicable. It should be noted that the likelihood of these events is typically very low.

Customer and Stakeholder Strategic Risk Area

Watercare stakeholders include individuals, groups and organisations that have an interest or concern in the company. They can affect or be affected by Watercare's strategic business policies and objectives. Some are more influential than others and the corporate focus is on ensuring that service meets expectations for all customers and targeting stakeholders who can directly influence the achievement of our statutory obligations and strategic objectives.

2.6.3. Risk Mitigation Strategies

A risk mitigation strategy has been devised and is progressively being implemented for each enterprise risk, involving a combination of operational and capital investment. Where enterprise risks are associated with the water and wastewater infrastructure the scale of works required to duplicate, replace or develop these key infrastructure components, means that the planned risk mitigation works will take many years to implement and will require considerable investment. The development programmes contained within the AMP include components of the enterprise risk mitigation strategies.

2.6.4. Other Sources of Asset Risk

Other sources of asset risk include Watercare's requirement to:

- Satisfy legislative and contractual requirements
- Meet growth in customer demand, in terms of infrastructure capacity and coverage
- Maintain minimum levels of service reliability
- Renewal of assets at the end of their useful life.

The relative importance of the different programmes is evaluated using the Watercare risk management framework. This provides an objective basis for prioritising works and for assessing the risk reduction delivered through different investment strategies. In developing investment strategies, Watercare uses whole-of-life net present value analysis to ensure the type and timing of expenditure is optimised.

2.6.5. Risk Evaluation

Within the Watercare risk management framework, risks are evaluated using a semi-quantitative method that explicitly considers the likelihood of various adverse consequences occurring.

Consequences are numerically scored according to the impact that the risk may have on the achievement of the following objectives:

- Providing for the health and safety of staff, customers and the public
- Achieving environmental compliance and minimising third-party damage
- Effective management of systems, assets, project performance and service delivery
- Minimising financial losses
- Maintaining a professional reputation.

The likelihood of the occurrence of adverse consequences is also numerically scored based upon a number of contributory factors. These include the asset location, the operating environment, the assessment of the asset condition and the forecast remaining asset life.

The Watercare risk management framework categorises each risk into one of five possible classifications, class one through to class five. Each risk is categorised according to the magnitude of the risk score and the magnitude of the potential consequences.

All five risks are defined as enterprise risks (refer Section 2.62 above). Class two to class four asset risks may be considered tolerable if risk reduction is impractical or if the cost of treatment exceeds the improvement gained. Class one risks are considered to be of minor significance with the asset generally being run to failure before being replaced.

The process of evaluating risks involves considering the scope and effectiveness of existing risk control measures in terms of prevention, protection and recovery.

Where further risk reduction is warranted, new business projects are identified, investigated and defined for inclusion in the AMP.

Table 5 outlines the risks evaluated for each asset group.

Table 5: Risks Evaluated for Each Asset Group

Asset Group	Risks Evaluated
Water System	
Water sources	• Structural failure of embankment, valve tower, cut-off wall • Failure of control valves, pipework, power supply • Contamination to groundwater source • Land instability
Raw water transmission	• Structural failure of aqueducts, tunnels, portals and raw water mains • Land instability
Water treatment plants	• Structural failure and land instability • Failure of dosing systems, clarification, filtration, disinfection or power supply
Treated watermains	• Failure of rising mains, exposed pipes (including pipe bridges), gravity pipes, chambers, valves and bulk supply points
Water pump stations	• Structural failure and land instability • Failure of pumps, valves, pipework, power supply, motors, drives and controls
Water reservoirs	• Structural failure and land instability • Failure of control valves, pipework, power supply
Wastewater System	
Wastewater treatment plants	• Structural failure and land instability • Failure of screens, primary tanks, reactor-clarifiers, filters, ultraviolet plant, discharge pumps, digesters and centrifuge dewatering • Failure of outfall
Wastewater pump stations	• Structural failure and land instability • Failure of overflow, odour control, pumps, valves, pipework, ventilation, power supply, motors/drives and controls
Wastewater pipes	• Failure of rising mains, exposed pipes (including pipe bridges), grit chambers, gravity pipes, overflows, manholes, chambers, valves/penstocks, ventilation/odour, and mechanical issues.

Watercare maintains a detailed central risk register which records potential risks and mitigation responses. The risk register is reviewed, monitored and reported regularly to senior management.

2.6.6. Risk Mitigation

Efficient and effective risk mitigation does not necessarily eliminate the potential for adverse consequences to occur. Ultimately a balance is required between risk and the commercial costs of achieving further mitigation. Risk mitigation is delivered through the combined application of a number of different forms of risk control, including risk avoidance, risk transfer, operational initiatives and engineered solutions.

Wherever possible, and economically feasible, engineered solutions are developed to avoid risks particularly when demand for the service is increasing while the condition and performance of the infrastructure providing the service is deteriorating with age.

In situations where the risk is retained, Watercare affects operational initiatives including:

- Asset condition assessment programmes
- Reliability-centred maintenance planning
- Authorisation and monitoring of third-party works
- Inspection regimes
- Computational modelling of emergency network management and failure scenarios
- Capture, retention and distribution of incident and engineering knowledge
- Development and exercising of emergency management and contingency response plans.

Contractual agreements and insurance cover are used in areas where it is appropriate and economically viable to transfer responsibilities for the control of risks and some liabilities.

2.6.7. Emergency Management and Contingency Planning

Watercare manages emergency incidents concerning the water and wastewater services, using an incident escalation system, which defines roles, responsibilities and processes for responding to incidents. This system is documented in the Incident Management Plan. The Incident Management Plan incorporates a number of plans including:

- Pandemic Response Plan
- Auckland Council Crisis Management Plan
- Watercare Operations Incident Management Plans.

For the management of wider-scale incidents, Watercare is a participant in the Auckland Engineering Lifelines Group (AELG). The AELG is made up of all the essential utilities in the Auckland region who work collaboratively to improve the resilience of Auckland's infrastructure to major hazards such as volcanoes or earthquakes. Working with the AELG improves Watercare's understanding of the risks to the water and wastewater assets and services during major incidents. The AELG works alongside Civil Defence during emergencies, to restore essential services. Lifelines procedures are included in the Incident Management Plan.

At an operational level, Watercare has a number of contingency plans in place to manage specific planned or emergency events, or specific critical assets. These include:

- Drought Response Plan. The plan reflects the risk of a supply shortfall and is unique to a given demand, supply system configuration and operating rules. The

plan sets water savings targets as a function of total system storage and time of year for a given 12-month period. The targets are based on simulation modelling.
- Shut-down procedures for bulk water mains.

Watercare has developed Business Continuity Plans for each of its sites documenting procedures to be followed during an incident, crisis or emergency to ensure that service levels are maintained as much as possible and that impacts of the incident are minimised.

Watercare also has Water Safety Plans (previously Public Health Risk Management Plans) which use risk management principles to provide greater certainty that the water supplied to the public is safe. Plans have been prepared for all Watercare water treatment plants.

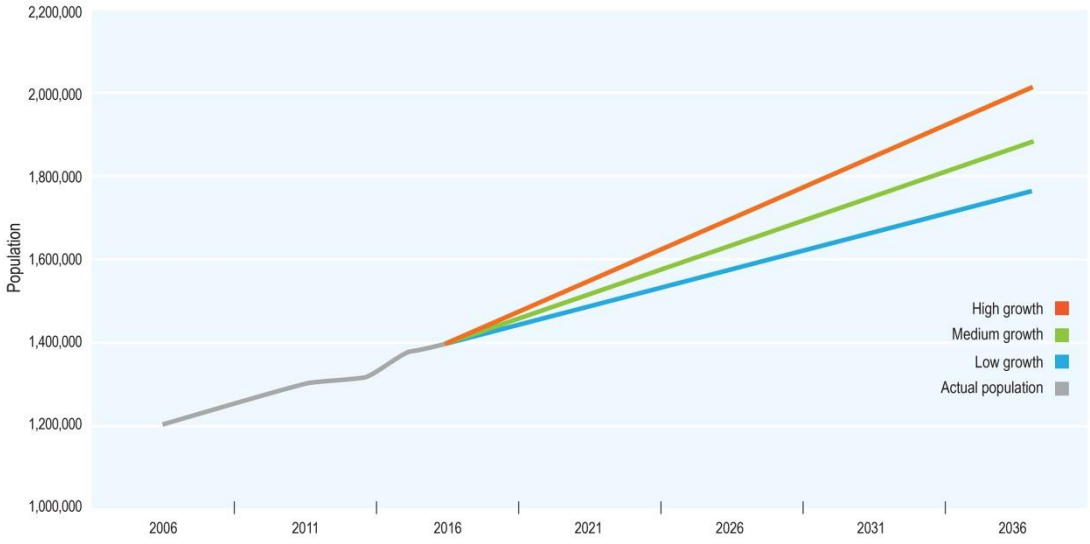
3. Water Asset Strategy

The Water Asset Strategy outlines the significant programmes required to meet the future growth of Auckland. These programmes include source augmentation, water treatment upgrades and water transmission initiatives.

3.1. Serviced Population Forecast

As Auckland grows the demand for water will increase. The population serviced by the metropolitan water system is based on the Statistics New Zealand and Auckland Council growth forecasts. The low, medium and high growth projections have been provided for comparison (see **Figure 6**) showing a range from 1.76 million to 2.02 million people by 2036. The medium population forecast has been adopted for the AMP with the population expected to increase from 1.41 million to 1.67 million in the first ten years.

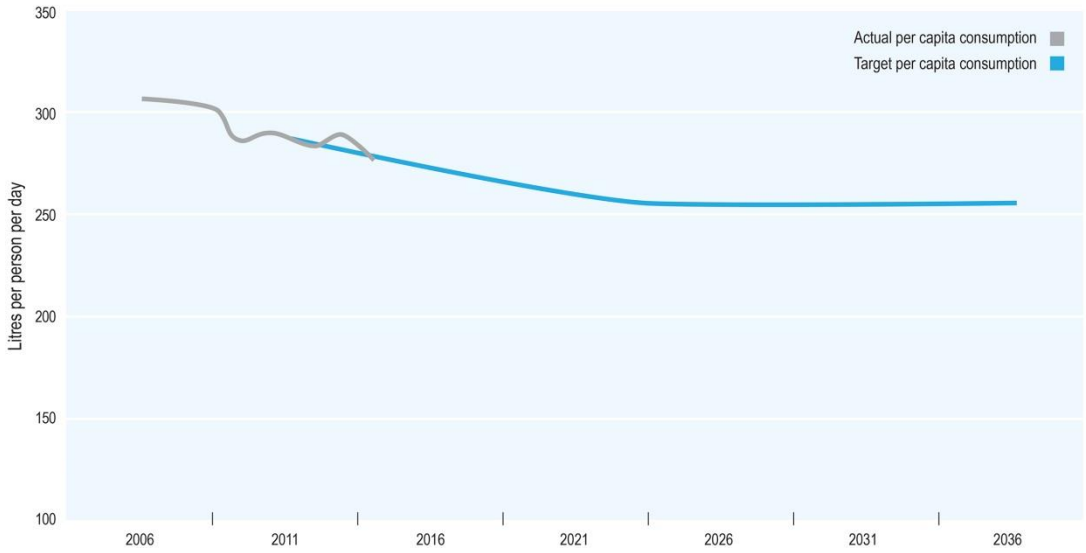
Figure 6: Auckland Serviced Population Forecast



3.2. Gross Per Capita Consumption

The gross per capita consumption (which includes both residential and non-residential users) is currently 272 L/p/d. Demand management initiatives are being implemented to reduce the per capita consumption to 255 L/p/d by 2025 in accordance with Watercare's Statement of Intent target. Beyond 2025 it has been assumed that the per capita consumption will remain at 255 L/p/d. These trends and targets are illustrated in **Figure 7**.

Figure 7: Gross Per Capita Consumption



3.3. Average Water Demand

The current average daily demand for water is 390 mega-litres per day (MLD). Based on Council's medium forecast population growth and Watercare's gross per capita consumption target, the demand for water is projected to increase to 487 MLD by 2036 (refer **Figure 8: Three-day Peak and Source Augmentation**).

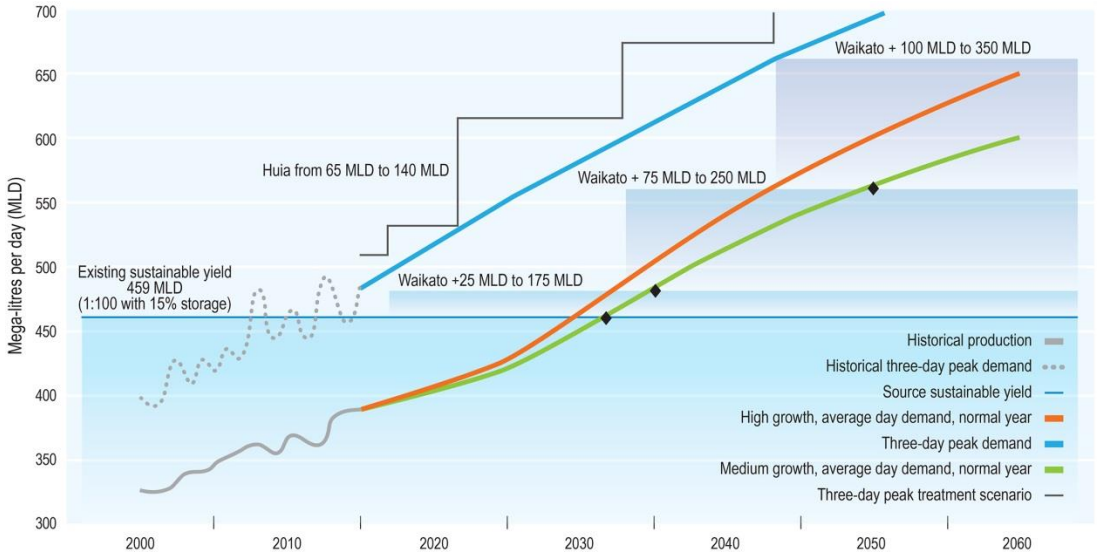
3.4. Water Source Yield

The yield is the amount of water that can be drawn from a source at a given inflow constraint. Watercare operates a security supply standard to meet a 1:100 year event, whereby the lakes will reduce to 15% of total system storage at the end of the drought. This is essentially equivalent to operating to a 1:200 year event, but with the lakes empty at the end of the drought.

The current yield of the metropolitan water supply system is 459 MLD.

To maintain compliance with Watercare's security supply standard, a new source is required when the medium growth line crosses the available yield. The source yield augmentation graph (**Figure 8**) shows that the expansion of the Waikato source, for an additional 25 MLD, is required by 2030; a further expansion of 75 MLD by 2035; with the next water source not required until around 2052 (see milestones ♦ in **Figure 8**). However, the three-day peak demand criterion requires water treatment plant capacity to be provided ahead of the source yield requirement.

Figure 8: Three-day Peak and Source Augmentation



3.5. Water Treatment Capacity to Meet the Three-Day Peak Demand

Water treatment plant capacity and treated water storage are utilised to meet peak day demands. It requires abstraction from sources above the yield, where possible, for a short period. This is balanced during periods of low demand, when the converse occurs. The three-day peak demand is the highest demand observed over a consecutive three-day period and sets the upper limit of performance required from the water treatment plants.

The three-day peak demand is currently 480 MLD and is projected to increase to 616 MLD by 2036 (blue line in **Figure 8**). It is this three-day peak demand, coinciding with an event limiting treatment capacity that drives the water treatment capacity resilience.

The three-day peak treatment augmentation scenario shown in **Figure 8** (black line) represents a scenario whereby an algal bloom occurs in the western and southern lakes constraining the Ardmore, Huia and Waitakere water treatment plants' production and a single one hour power outage at the Waikato Water Treatment Plant.

The three-day peak treatment augmentation line confirms the need for the expansion of the Waikato Water Treatment Plant by an additional 25 MLD to 175MLD by the end of 2018.

To mitigate the risk of the Huia Water Treatment Plant not being available by the end of 2022, the Waikato Water Treatment Plant expansion to 250MLD could be advanced ahead of the Huia Water Treatment Plant upgrade. To maintain flexibility regarding Huia versus Waikato timing, both the Huia and Waikato water treatment plants' resource consents and preliminary design will be progressed in parallel over

the next three years. If by 2019, the consenting work or any land acquisition for the Huia Water Treatment Plant is signalling that the new plant cannot be commissioned by the end of 2022, the Waikato Water Treatment Plant upgrade would be brought forward such that it would be completed by the end of 2022. The timing of the Huia Water Treatment Plant upgrade would then need to be reassessed, but from a three-day peak requirement it could be deferred by ten years.

The advancement of the Waikato Water Treatment Plant and subsequent delay of Huia Water Treatment Plant would not have a material effect on Watercare's pricing.

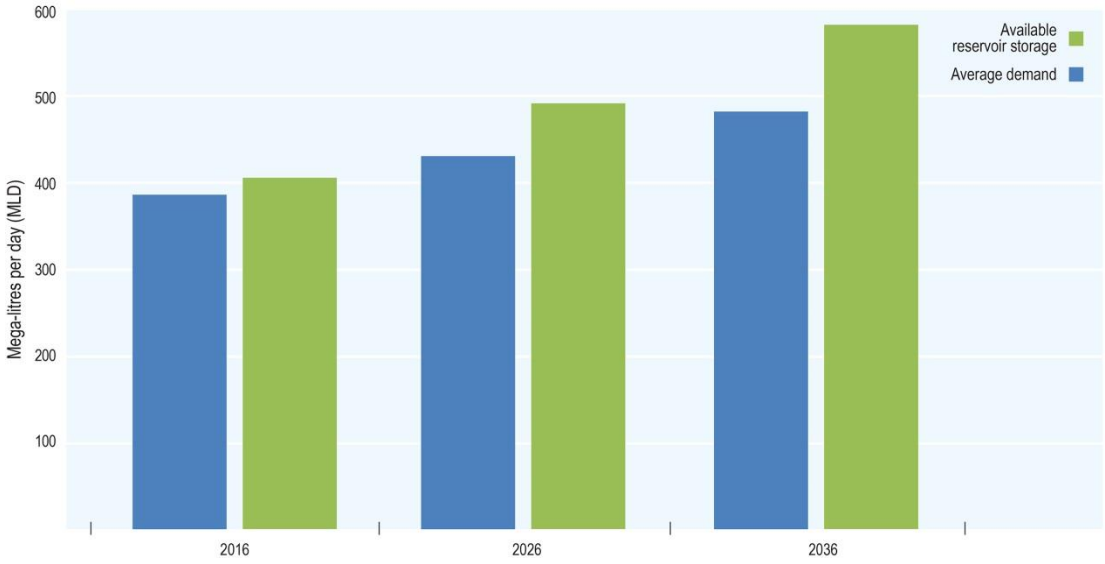
3.6. Average Day Treated Water Storage

Treated water storage capacity across the region provides resilience to the water supply system. The public health grading process stipulates the need for 24 hours of treated water storage as a contingency to supply disruption in a specific water supply zone.

The current average day demand is 390 ML increasing to 435 ML and 487 ML, by 2026 and 2036 respectively.

The average day treated water storage graphs, **Figure 9**, show that the 24-hour storage is maintained for the overall system. Planned additional treated water storage in the next 20-year period increases the available storage buffer and focuses on the shortfalls within the South and North West.

Figure 9: Treated Water Storage



3.7. Water Strategic Programmes

3.7.1. Southern

Currently around 75% of Auckland's water supply originates from the southern sources. The Waikato River is the preferred source to meet yield augmentation requirements in the next 20 years starting with an increased take to 175 MLD aligning with the current project to expand the Waikato Water Treatment Plant. Additional pumping of the existing Waikato 1 watermain will increase the conveyance of water to the Redoubt Road reservoirs, while new treated water reservoirs in Pukekohe East and Redoubt Road will provide strategic storage to buffer daily and peak demands.

The second 10 years is planned to include:

- A further increase in the Waikato River take to 250 MLD to meet the projected peak demands and provide system resilience.
- Further boost pumping of the Waikato 1 watermain to increase conveyance to the Redoubt Road reservoirs.
- Additional treated water reservoirs at Pukekohe East (50 ML) and Redoubt Road (50 ML) will provide further strategic storage to buffer daily and peak demands.

3.7.2. North West

The replacement of the ageing Huia Water Treatment Plant with a new plant with a capacity of up to 140 MLD will assist in meeting peak demand periods and improve the current system resilience. An additional reservoir associated with the new Huia Water Treatment Plant will increase the treated water storage for West Auckland. Boost pumping, to convey water from the central to the west, will be required to provide additional resilience for the new Huia Water Treatment Plant.

The North Harbour 1 watermain is currently the only transmission watermain conveying water from the west to the north via the Greenhithe Bridge. A North Harbour 2 watermain will provide an additional route for conveying water from the west to the north to provide resilience and increased transmission capacity.

The second 10 years is planned to include:

- Additional treated water storage to improve water demand buffering and network resilience in the west of the region.
- The replacement of the ageing Waitakere Water Treatment Plant will assist in meeting peak demand periods and improve the system resilience. This is subject to the outcome of the new Huia Water Treatment Plant site selection which may recommend combining the two treatment plants. Similarly, the replacement of the Waitakere 2 watermain would need to be reviewed.
- The Orewa 3 watermain will increase the conveyance of water from Albany to the Hibiscus Coast. Planned boost pumping from Albany to the Hibiscus Coast will improve the conveyance of water to the north until the Orewa 3 watermain is available.

3.7.3. Central Region

The completion of the Hunua 4 watermain to the Khyber reservoirs will improve the conveyance of water from the Southern region to the Central region while providing additional redundancy to the Hunua 3 watermain. Reinstatement of the Khyber 2 reservoir will increase the strategic storage within the Central region.

In the second 10 years the Ponsonby reservoirs will be upgraded to provide additional resilience to the Central Business District.

3.7.4. North Shore

A new harbour crossing coinciding with the planned New Zealand Transport Agency Waitemata Harbour crossing will improve the conveyance of water from the Central region to North Shore. This asset will also provide redundancy to the existing North Shore watermains on the Auckland Harbour Bridge and is expected to be completed in the second 10-year period. Planned boost pumping of the North Shore watermains across the Auckland Harbour Bridge will improve the conveyance of water to North Shore until the new Waitemata Harbour crossing is available.

The area serviced by the Pinehill Reservoir has a very high local demand. A new transmission watermain connection with boost pumping from Albany reservoirs to Pinehill Reservoir will provide additional resilience to this supply zone.

3.7.5. Non-Metropolitan Water Supplies

Warkworth

A new groundwater source has been consented for 4.3 MLD. A pilot trial is being conducted to optimise the required water treatment process. The groundwater source will replace the current Mahurangi River source which is constrained by minimum flow requirements, particularly during summer. Further water source augmentation will be required within the next 30 years to meet the long-term population growth projections.

Wellsford

Wellsford is currently supplied from the Hoteo River. Investigations to date have failed to identify groundwater in sufficient quantities. Further test locations are planned.

Snells/Algies

Snells/Algies is currently supplied from a groundwater source. Further water source augmentation will be required within the next 30 years to meet the long-term population growth projections.

Helensville

Helensville is currently supplied from surface water (Mangakura Dam) and a spring (Sandhills). A groundwater source has been identified with a potential yield of 2.2MLD. A resource consent will be sought for the water source.

Waiuku

Waiuku is currently supplied from a groundwater source via three water treatment plants. A resource consent application has been submitted to augment the groundwater supply to meet long-term population growth projections.

Figure 10 and Figure 11 show the water strategic programmes to meet Auckland's projected growth in the first and second ten year periods respectively.

Figure 10: Water Strategic Programmes 2017-2026

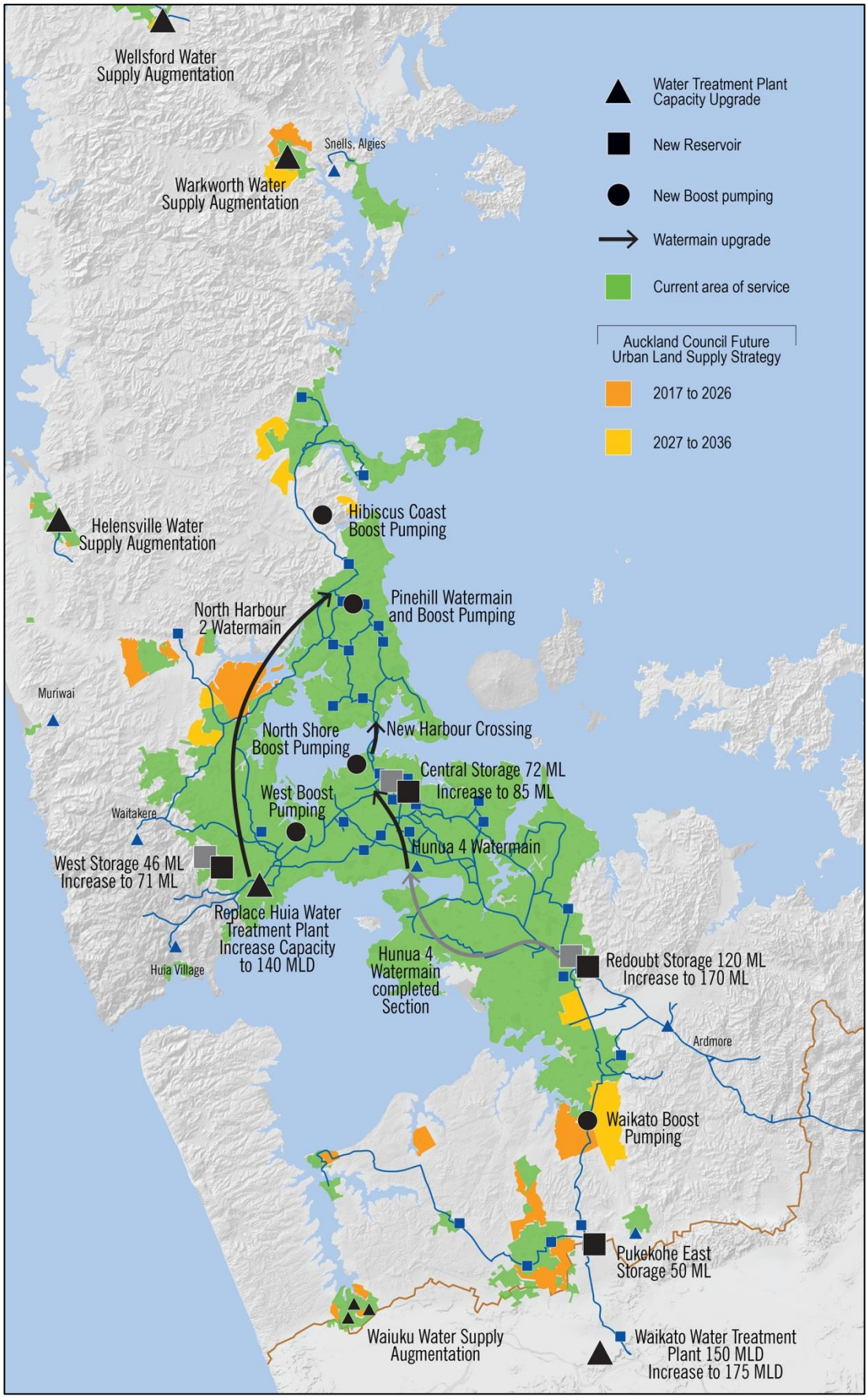
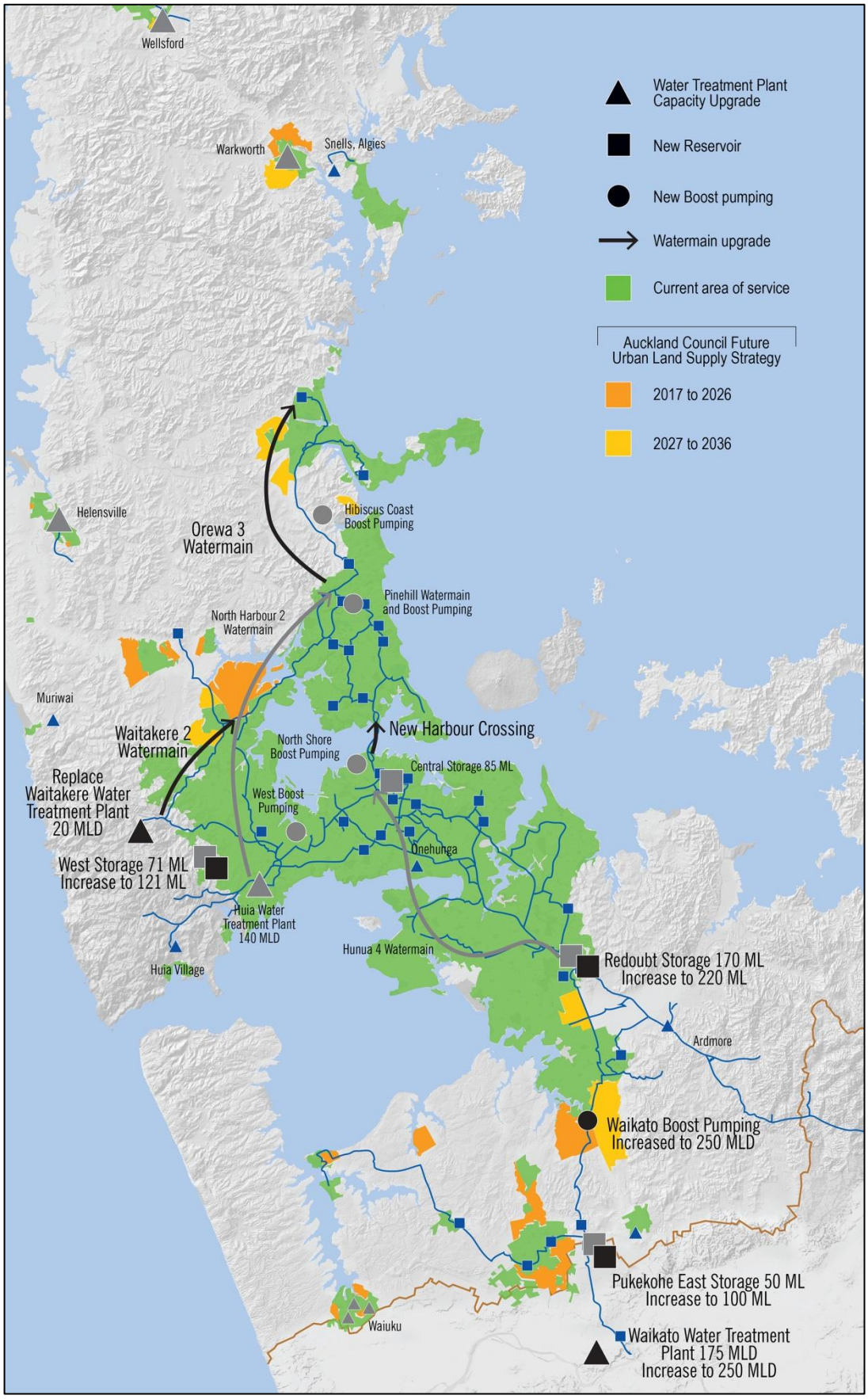


Figure 11: Water Strategic Programmes 2027-2036



4. Wastewater Asset Strategy

The Wastewater Asset Strategy outlines the significant programmes required to meet the future growth of Auckland. These programmes include regional and sub-regional connectivity, wastewater treatment upgrades and wastewater transmission initiatives.

4.1. Serviced Population Forecast

Along with an increasing demand for water as Auckland grows, the production of wastewater will also increase. The overall level of growth will predominantly be the same as in the water network, although there are some spatial variations due to communities that are only supplied with wastewater services. The medium population forecast is expected to increase from 1.41 million to 1.67 million in the first ten years. Servicing of this population will be spatially distributed across the 18 treatment plants that currently service the region depending on where the growth occurs. In addition, the specific location of the growth will have various impacts on both the transmission and network assets.

4.2. Daily Per Capita Flow

The daily per capita wastewater flow is generally defined in three related ways; average dry weather flow, peak dry weather flow and peak wet weather flow.

4.2.1. Average Dry Weather Flow

The average dry weather flow (ADWF) is effectively the total volume of wastewater produced by a person during the normal occupation of a residential dwelling. The ADWF includes components such as toilet flushing, the utilisation of showers, kitchen sinks, dishwashers and laundry equipment. ADWF is directly related to population. ADWF is influenced by a number of factors including, water consumption and dwelling occupancy. A generalised ADWF connected to the Mangere Wastewater Treatment Plant is 158 L/p/d, allowing for some attenuation as the flows travel across the network.

ADWF is not generally utilised in the design of wastewater networks, but is used when determining wastewater treatment plant daily loading rates of nutrients into the receiving environment.

4.2.2. Peak Dry Weather Flow

Wastewater flows are not produced constantly or consistently throughout the day. The flow data for most residential dwellings show diurnal (twice daily) peaks in flow. These normally occur between the hours of 6:30 am and 8:00 am when people first wake up and get ready for their day, and between 6:00 pm and 7:30 pm when people get home from work, cook dinner, clean up and get ready to finish their day.

The peak dry weather flow (PDWF) makes allowances for dwellings, communities, sub-catchments and catchments carrying out these activities generally at similar times. The PDWF is a flow increase over a shorter period to allow for diurnal

behaviour. PDWF is also directly related to population. The peaking factor across Auckland is in the range of 1.5 to 4. This factor is influenced by the location of the catchment, in addition to the factors influencing the ADWF. The network pipes tend to experience higher dry weather peaking factors than the larger transmission pipes, as there is less opportunity for flow attenuation to occur.

4.2.3. Peak Wet Weather Flow

The peak wet weather flow (PWWF) makes allowances for wet weather influences. There are two main types of wet weather influence on the instantaneous peak flows in the wastewater network: inflow and infiltration.

Inflow is caused by direct stormwater connections to the wastewater network. Examples of these types of connections include roof downpipes connected to the wastewater system and low gully traps collecting surface run-off. Combined networks are effectively wastewater networks designed to accept direct stormwater connections and therefore experience extremely high inflow effects. Inflow causes an almost immediate increase in the network flow rates, and a rapid decrease when the rain stops. Inflow effects can be found in pipes regardless of age.

Infiltration is caused by groundwater entering the wastewater network, due to defective public and private; pipes, pipe joints, lateral connection points, and manhole joints. Infiltration causes slower increases in the network flow rates, but a corresponding longer effect within the pipes. Infiltration effects are generally found in older pipes, as the condition of the assets and fittings deteriorates over time allowing groundwater ingress through the pipe, manholes and joints.

The PWWF is an increase in ADWF due to inflow and infiltration factors over the life of the network. The PWWF is affected by, but indirectly related, to population.

The wet weather peaking factor across Auckland varies significantly dependent on the type of catchment. Separated catchments have wet weather peaking influences of three or more, dependent on the leakiness of the catchment. Combined catchments can have peaking factors orders of magnitude higher. Wet weather peaks are subject to similar influences to PDWF's regarding location and network performance.

4.2.4. Gross Per Capita Flow

The gross per capita wastewater flow is currently 291 L/p/d averaged across the region. This figure is based on the annual volume of wastewater treated at the treatment plants across the region. It includes wet weather flows largely unrelated to population growth, as discussed above.

Demand management initiatives are being implemented to reduce the per capita water consumption from 272 L/p/d to 255 L/p/d by 2025 in accordance with Watercare's Statement of Intent target. Beyond 2025 it has been assumed that the per capita water consumption will remain at 255 L/p/d. Assuming all other things are equal, and as the wastewater flows are related to water consumption, the gross

per capita wastewater production will reduce by a similar proportion, from 291 L/p/d to 273 L/p/d.

4.3. Wastewater Network Capacity

Watercare's Network Discharge Consent (NDC) was granted by Auckland Council in June 2014. The NDC authorises wet weather overflows, related to network capacity, of no more than two times per year on average per engineered overflow point (EOP). This effectively sets the definition of wastewater capacity across the region. Dry weather overflows, due to capacity constraints, are not authorised under the NDC and must be avoided.

The NDC also authorises Watercare to exceed two overflows per year per EOP as a best practicable option (BPO). This gives Watercare, in collaboration with Auckland Council, the ability to assess individual EOP's and agree a higher overflow frequency if appropriate. The NDC includes a process to make the assessment in this regard.

4.4. Wastewater Treatment Plant Capacity

Wastewater treatment plants not only need to have processes designed for hydraulic capacity, but also need to consider biological capacity and discharge consent conditions. The plant's resource consent defines the discharge limits for peak flow, bacteria, water clarity, and nutrients. These limits are effectively the engineering specification for the design of the plant.

The conditions of the discharge consent take into account the sensitivity of the receiving environment, social and cultural constraints. These limits, as well as the nature of the flow, mass load and variability received by the plant, defines the technology to be utilised to treat the wastewater. For example, the Pukekohe Wastewater Treatment Plant has a catchment with significant wet industry. Industrial loads can fluctuate significantly day by day and even seasonally. Wastewater treatment plants with highly variable flow and load require resilience to deal with these fluctuations.

4.5. Wastewater Regional Initiatives

One of Watercare's key strategic philosophies is to maximise the use of existing assets. In regards to the wastewater system, stormwater and groundwater entering the wastewater network erodes hydraulic capacity that could be used to service growth and to provide better levels of service to existing customers. The overall principle is that the wastewater system is for the conveyance of wastewater only. Therefore, as much as practical, stormwater and groundwater will be removed from the system through sewer separation and inflow and infiltration programmes. A provision of $40 million has been allowed in the AMP in the first ten years for inflow and infiltration programmes, with $50 million in the second ten year period.

4.6. Wastewater Catchments and Network Modelling

Watercare has characterised the network in terms of the wastewater treatment plant catchments. Hydraulic network models for the four largest catchments, Mangere, Rosedale, Army Bay and Pukekohe are currently being updated to improve the understanding of how the wastewater networks currently operate and the performance of the networks under various growth scenarios. This allows concept solutions to be developed and their future performance assessed. Wastewater network modelling is an on-going programme to update the models at least every six years.

The wastewater network consists of 18 catchments, which are listed below by discharge limit. Refer **Table 6**.

Table 6: Wastewater Catchments

Wastewater Treatment Plant Catchment	Wastewater Treatment Plant Maximum Daily Discharge (m^3/d)	Current Population Serviced	Percentage of Auckland Population (%)
Mangere	1,209,800	1,070,000	76
Rosedale	518,400 (6 m^3/s)	240,000	17
Army Bay	32,147	42,000	3
Pukekohe	8,450	28,000	2
Warkworth	8,100	3,500	0.25
Waiuku	5,500	7,900	0.6
Helensville	5,500	3,830	0.3
Snells/Algies	4,680	4,000	0.3
Beachlands/Maraetai	2,800	6,760	0.5
Wellsford	2,500	1,720	0.1
Omaha (including Point Wells and Matakana)	860	1,020	0.1
Kawakawa Bay	800	600	<0.1
Clarks (including Glenbrook & Waiau)	600	2,000	0.1
Waiwera	595	1,060	0.1
Owhanake	80	Oneroa business area only	
Kingseat	38	130	<0.1
Denehurst	14.8	55	<0.1
Bombay	5.4	15	<0.1

4.7. Mangere Wastewater Treatment Plant Catchment Area

4.7.1. Mangere Wastewater Treatment Plant

The Mangere Wastewater Treatment Plant treats and disposes of wastewater from approximately 76% of Auckland's population, currently estimated to be approximately 1.07 million people. This population discharges approximately 116,522,000m^3 of highly treated wastewater into the Manukau Harbour each year, an approximate daily average of 319,000 m^3/d.

The treatment plant has a current discharge consent that sets the following limits:

- Maximum daily discharge volume of 1,209,600 m^3/d
- Instantaneous maximum discharge flow rate of 25 cubic metres per second (m^3/s)
- Annual daily average volume of 390,000 m^3/d.

Using the future gross per capita production and the average daily limit this equates to approximately 1.3 million people, assuming no storage processes at the plant.

The discharge consent is valid until 2032. Given the growth scenarios, the consent renewal would be driven by population pressures rather than consent expiry date, as the population capacity will be reached prior to the consent expiring. To maintain compliance at the Mangere Wastewater Treatment Plant and to allow for growth within metropolitan Auckland as the population increases, flow will be diverted to the Rosedale Wastewater Treatment Plant to utilise its surplus discharge capacity. In the first 10-year period wastewater flow equivalent to 240,000 people will be diverted from the Mangere catchment to the Rosedale plant, with wastewater flow to Rosedale increasing to the equivalent of 730,000 people over 20 years. At the same time, hydraulic processes at the Mangere plant will be upgraded to the discharge limit of the consent.

4.7.2. Mangere Wastewater Treatment Plant Catchment Network

The Mangere catchment comprises of 5,500 km of wastewater network (including rising mains) and 281 pump stations. These pipe assets have an inherent instantaneous capacity and are at varying stages of uptake of that capacity. In the Mangere catchment there are 184 pump station and network engineered overflow points (EOPs) in the network that exceed the acceptable limit of no more than two wet weather overflow events per EOP per year on average. Around 60% of these are in the combined wastewater/stormwater network, with the remaining 40% in the separated network. In addition to the pump station and network EOPs there may be other uncontrolled overflows from specific points that are in the process of being identified and categorised.

The Mangere catchment has a proportion of the network that is a combined system. That system, designed in the early 1900s, had been designed to collect both wastewater and stormwater flows in a common pipe. These flows are currently collected and transferred to the Orakei Main sewer through the Central Business

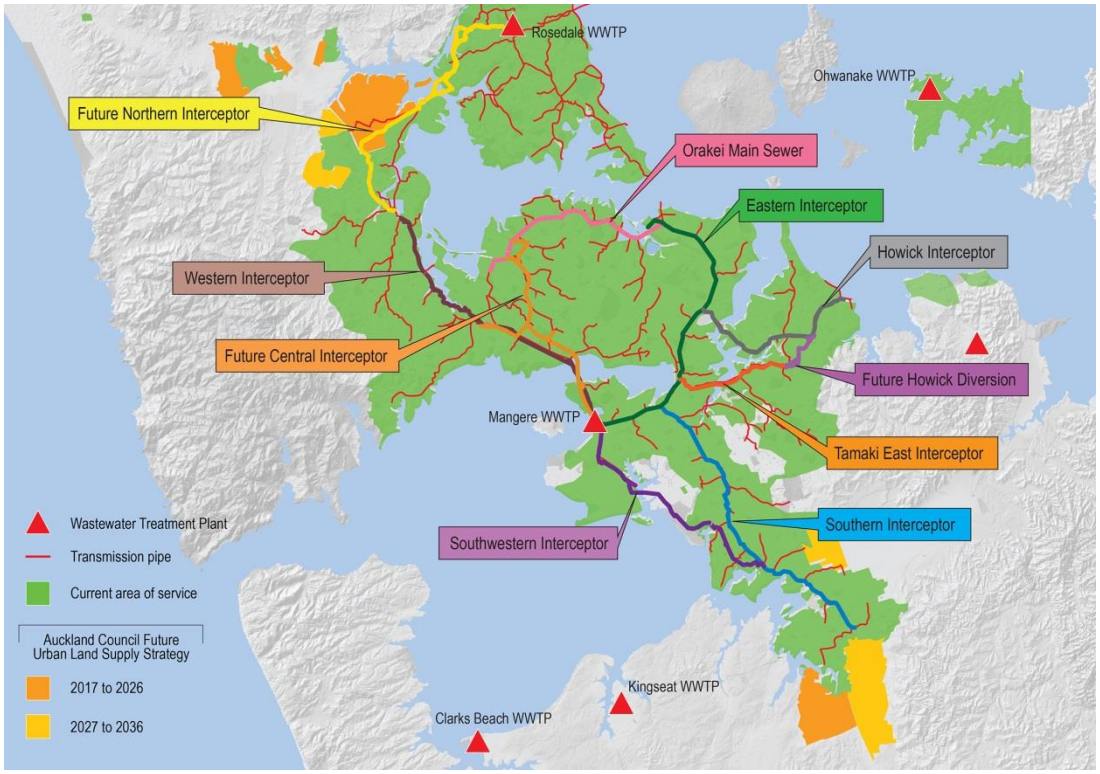
District to the Eastern Interceptor at Orakei Domain, then around East Auckland and Mangere to the treatment plant.

As growth occurs in Central Auckland, by around 2030, dry weather wastewater flows are forecast to begin to exceed the pipe capacity of the Orakei Sewer. This will therefore require truncation of at least the upper section of the catchment. Due to stormwater influence there are 50 EOPs within this catchment that currently discharge to the environment more than 50 times per year.

The main strategic programme for the Mangere catchment network is the Central Interceptor. This will primarily provide for growth and will enable a reduction in overflow frequency for 48 of these locations, improving the water quality in the Waitemata Harbour.

The Central Interceptor will truncate the upper portion of the Orakei Sewer catchment diverting flows directly to the Mangere Wastewater Treatment Plant. This will not only create capacity in the Orakei Sewer but also free up capacity in the downstream Eastern Interceptor. This will allow growth to occur in Central and South Auckland via the Howick, Tamaki East and Southern interceptors. Refer **Figure 12**.

Figure 12: Mangere Catchment Wastewater Interceptors



The Central Interceptor also provides an interim solution for stormwater issues, giving the Auckland Council time to construct adequate stormwater infrastructure to service the area in the long term. Continued reliance on the wastewater system for the collection of stormwater is not sustainable for a growing city. Stormwater entering the wastewater system reduces capacity to service growth and once mixed

with wastewater, needs to be conveyed and treated at the Mangere Wastewater Treatment Plant. With the intensity of rainfall expected to increase and areas of hard surfacing increasing with urban densification, the wastewater system will continue to be overloaded resulting in on-going overflows to the Waitemata Harbour. A separated stormwater system will therefore be required to collect stormwater from properties within the currently combined area as well as the runoff from Auckland Transport's road network.

By the time the Waterfront Interceptor is constructed in the second 10-year period, it is anticipated that the catchments that it services will be fully separated.

Significant growth is expected in the south of the region, with future urban zoned land in the Hingaia, Drury and Drury West areas. In addition, submissions to the notified Unitary Plan may increase the growth expectations even further. The Hingaia Peninsula, which has Special Housing Area status, and Drury West require servicing by the Hingaia Pump Station, which in turn connects to the Southern Interceptor. The pump station and interceptor both have limited capacity to accept additional growth. Augmentation of the Southern/South Western Interceptor from Hingaia to Manurewa will be required to service current growth expectations. Planned growth at Drury, Drury South and Takanini, as well as Unitary Plan submissions in these areas, will exacerbate the need for this augmentation.

4.7.3. Strategic Programmes

Treatment

In addition to the general renewals and process improvements, the programme of works and investment planned for the Mangere Wastewater Treatment Plant include:

- An additional Biological Nutrient Removal (BNR) facility is being constructed at the southern end of the existing Mangere plant site. The new BNR facility will use the same technology currently employed at the Mangere plant to remove nitrogen and phosphorous from the wastewater stream. Their presence in water can lower oxygen levels, in turn reducing water quality and environmental diversity and harming marine life.
- Additional sludge digestion capacity will be needed at the end of the 10-year period to cater for growth. This could involve the construction of an additional digester or the use of advanced digestion technology which would also improve the plant's energy balance.
- Solids stream upgrades involve the installation of new plant and equipment in order to increase solids stream processing capacity to cater for growth in the region and to replace ageing assets (sludge tanks).
- Wet weather treatment upgrades to enable treatment of additional wet weather volumes expected to be introduced as a result of the Central Interceptor.
- Commencement of the Mangere Wastewater Treatment Plant discharge consent renewal process ahead of its expiry in 2032.

The second 10-year period is planned to include:

- The addition of further sludge digestion capacity
- Further solids stream upgrades
- Continuation of renewal of the Mangere Wastewater Treatment Plant discharge consent.

Catchment

The Central Interceptor main tunnel and a portion of the collection pipes will be commissioned in 2025.

As part of the Southern Interceptor augmentation the Hingaia Pump Station and initial network upgrades will be constructed. This will allow continued growth in the southern areas of the region.

Additional programmes to solve residual capacity issues will be identified and carried out during this period including:

- Howick Diversion
- Otara catchment upgrades
- Newmarket Gully.

In the second 10-year period, augmentation programmes will continue as follows:

- Completion of the Central Interceptor collection sewers
- Construction of the Waterfront Interceptor
- Further augmentation to the Southern Interceptor
- Further Otara and Newmarket network upgrades
- Additional programmes to solve residual capacity issues will be identified and carried out during the period.

4.8. Rosedale Wastewater Treatment Plant Catchment Area

4.8.1. Rosedale Wastewater Treatment Plant

The Rosedale Wastewater Treatment Plant treats and disposes of wastewater from approximately 17% of Auckland's population, currently estimated to be approximately 240,000 people. This population discharges approximately 20,203,000m^3 of highly treated wastewater into the Hauraki Gulf (off Mairangi Bay) each year, an approximate daily average of 55,000 m^3/d.

The treatment plant has a current discharge consent that limits the instantaneous maximum discharge flow rate to 6 m^3/s, as well as limits on nutrient load concentrations. The current instantaneous maximum peak flow from the outfall is only 3 m^3/s, allowing capacity for approximately 480,000 people.

The discharge consent is valid until 2030. As growth occurs across the region and flow is diverted from the Mangere Wastewater Treatment Plant catchment to the Rosedale plant, treatment processes and hydraulic capacity at the plant will be upgraded to maximise the use of the existing outfall. A new discharge consent will

need to be applied for in 2029 to make allowance for additional growth in the catchment.

4.8.2. Rosedale Wastewater Treatment Plant Catchment Network

The Rosedale catchment comprises of 1,400 km of wastewater network (including rising mains) and 91 pump stations. The Rosedale catchment has 18 pump station and network EOPs that exceed the acceptable limit of no more than two wet weather overflow events per year on average per engineered overflow point (EOP). The Rosedale catchment is a fully separated wastewater network.

As part of the North Shore trunk sewer and pump station upgrade programme, the following work is underway to resolve overflows at three of the 18 locations identified above:

- Wairau Pump Station and rising main upgrade
- Sidmouth Pump Station and rising main upgrades, including the East Coast Bays Branch Sewer upgrade
- Fred Thomas Drive Pump Station and rising main upgrades.

In addition, a detailed modelling study has recently been completed for the Devonport wastewater catchment to identify solutions for an additional four overflow sites.

The Northern Interceptor will be constructed to divert flow from the upper portion of the Western Interceptor to the Rosedale Wastewater Treatment Plant. The first phase of the Northern Interceptor will take flow from the existing Hobsonville Pump Station to Rosedale by 2021. The second phase, from Westgate to Hobsonville Pump Station, will enable growth in the north-west of the city, around Westgate, Redhills, Whenuapai, Kumeu, Huapai and Riverhead in accordance with Council's Future Urban Land Supply Strategy from 2026. Boost pumping and extensions to the Northern Interceptor will be phased to accommodate growth with the Concourse storage tank flow diverted from the Western Interceptor to the Northern Interceptor by 2036. A second Hobsonville Pump Station and duplication of the section from Hobsonville to Rosedale will also be timed for 2036. Property investments and designations are being initiated to protect the strategic asset locations and route alignment for the Northern Interceptor.

Figure 13 and **Figure 14** shows the wastewater strategic programmes that have been included in the Asset Management Plan to meet Auckland's projected growth in the first and second ten year periods respectively.

Figure 13: Wastewater Strategic Programmes 2017 to 2026

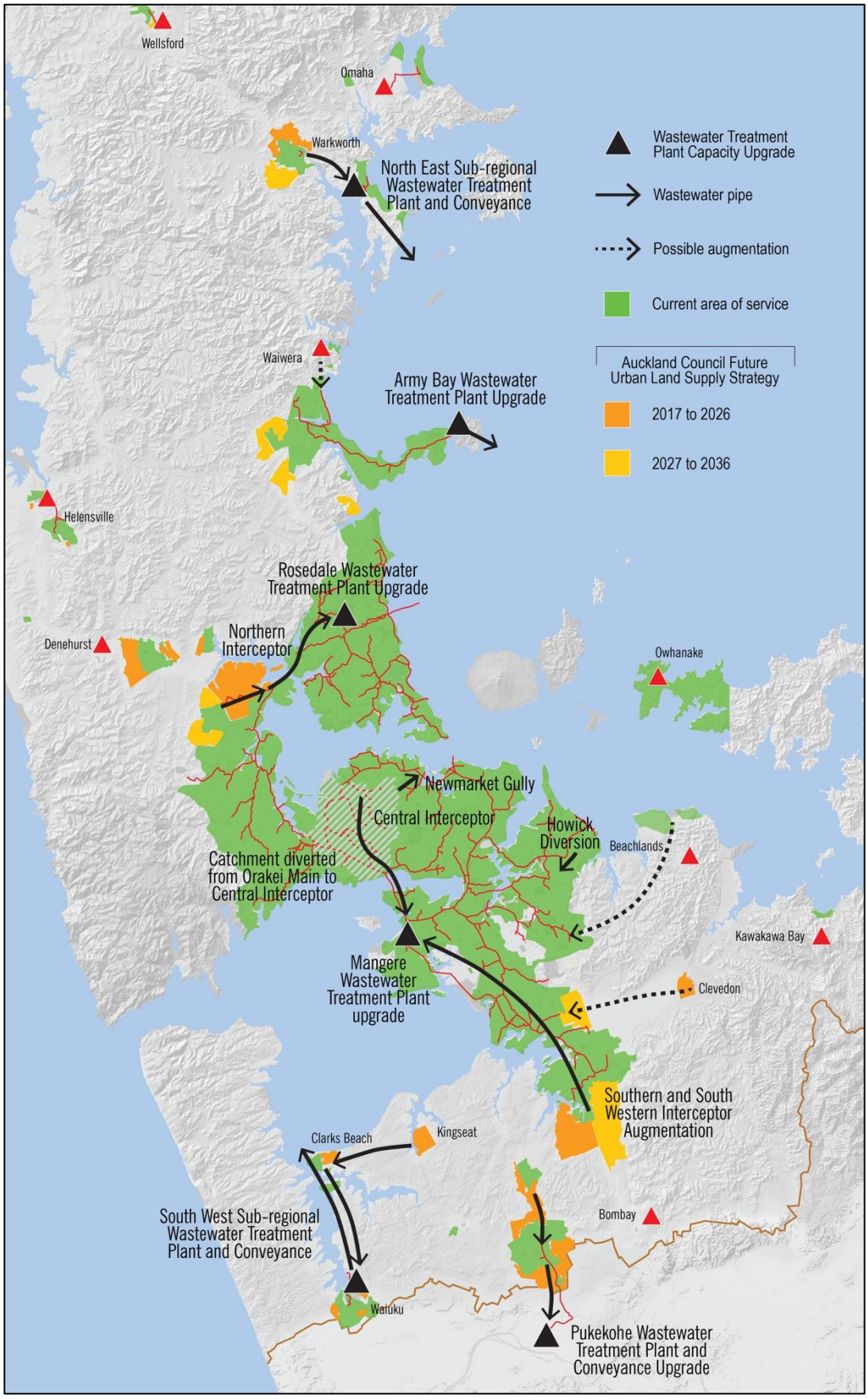
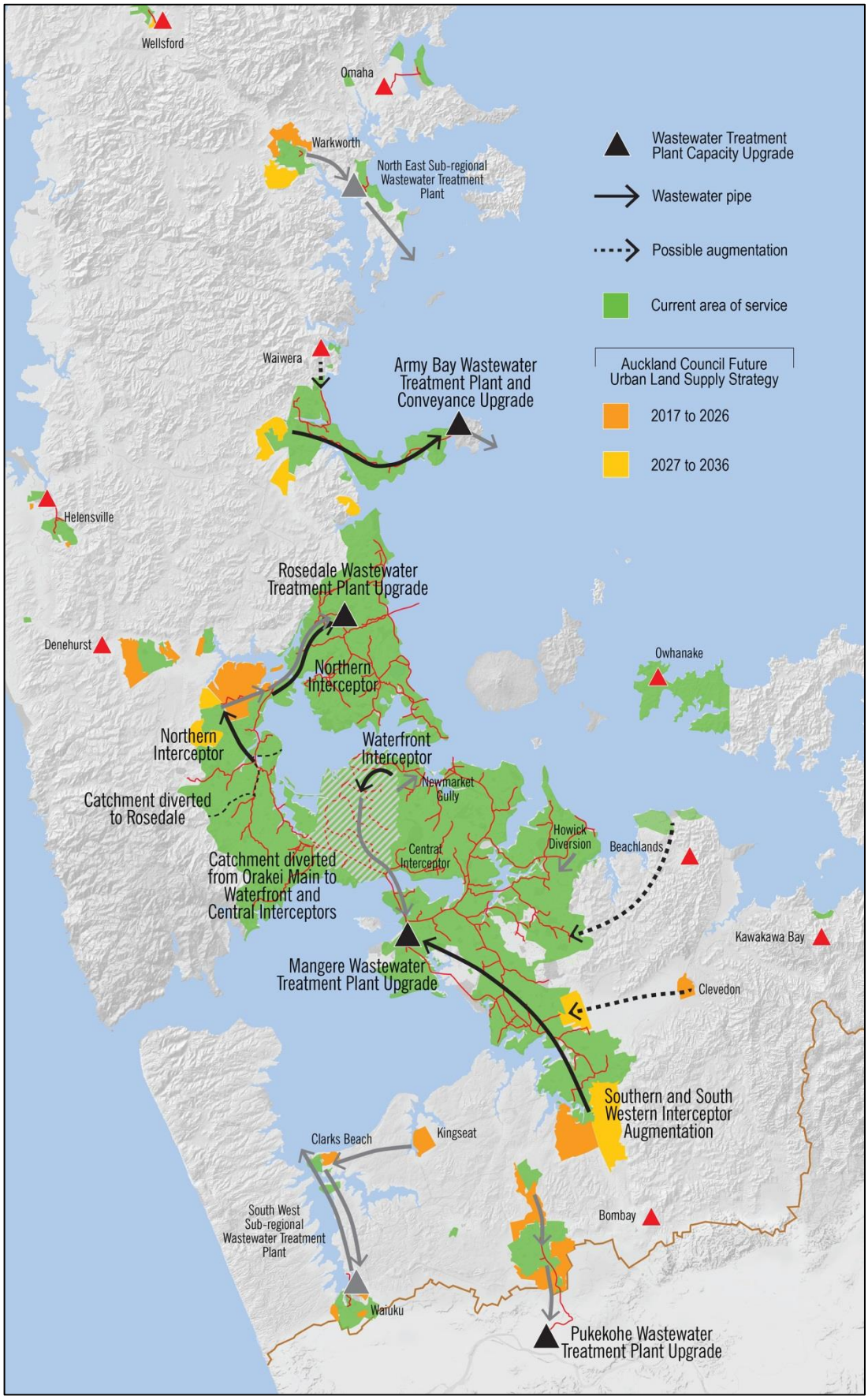


Figure 14: Wastewater Strategic Programmes 2027-2036



4.9. Army Bay Wastewater Treatment Plant Catchment Area

4.9.1. Army Bay Wastewater Treatment

The Army Bay Wastewater Treatment Plant treats and disposes of wastewater from approximately 3% of Auckland's population, currently estimated to be approximately 42,000 people. This population discharges approximately 3,437,000m^3 of treated wastewater into the Whangaparaoa Passage each year, an approximate daily average of 9,400 m^3/d.

The treatment plant outfall pipe has limited existing flow capacity when compared to the expected inflows. Wet weather flows are currently stored through the treatment plant and wastewater network to ensure overflows do not occur at the plant, adjacent to Shakespear Regional Park.

The treatment plant has a current discharge consent that limits the maximum daily discharge from the treatment plant to 32,147 m^3/d, as well as limits on nutrient load concentrations. Allowing for the high wet weather flows, this equates to approximately 60,000 people.

The discharge consent is valid until 2021. The outfall pipe is currently being upgraded to meet long-term growth in the catchment. Treatment process upgrades will be timed to accommodate growth and the renewal of the discharge consent.

4.9.2. Army Bay Wastewater Treatment Plant Catchment Network

The Army Bay catchment comprises of approximately 450 km of wastewater network (including rising mains and low pressure sewer mains) and 42 pump stations. The Army Bay catchment is a separated system and has five pump station and network EOPs that exceed the acceptable limit set out in the NDC.

The Army Bay catchment network is a highly pumped network, with long rising main lengths which causes a significant number of odour complaints during the summer period. In addition, due to the flow constraints at the treatment plant, the network requires manual intervention to operate with minimal overflows. Studies are underway to assess the capacity in the network, and to provide options to alleviate existing issues as well as allow for Council's growth expectations in this area. Significant growth is proposed in western edges of the catchment from 2032.

4.10. Pukekohe Wastewater Treatment Plant Catchment Area

4.10.1. Pukekohe Wastewater Treatment Plant

The Pukekohe Wastewater Treatment Plant treats and disposes of wastewater from approximately 2% of Auckland's population, currently estimated to be approximately 28,000 people. This population discharges approximately 2,596,000m^3 of treated wastewater into the Waikato River each year, an approximate daily average of 7,000 m^3/d.

The treatment plant has a current discharge consent that limits the maximum daily discharge from the treatment plant to 8,450 m^3/d (dry weather flow), as well as limits

on nutrient load concentrations. This equates to approximately 31,000 people. The plant's catchment includes Tuakau and Pokeno as well as a large trade waste component. The trade waste flow makes up around 50% of the plant's biochemical oxygen demand (BOD) demand. This is expected to increase as industries in the region expand.

The Waikato Regional Council is the regulator for this treatment plant. The discharge consent has expired and therefore the treatment plant is being operated under the current consent conditions. A long-term wastewater treatment solution is currently being developed.

4.10.2. Pukekohe Wastewater Treatment Plant Catchment Network

The Pukekohe catchment comprises 150 km of wastewater network (including rising mains) and 14 pump stations. The network is fully separated without any pump station or network EOPs that exceed the NDC acceptable limit. There are, however, manhole overflows along the trunk wastewater pipe from Pukekohe to the treatment plant, occurring in the Waikato Region. A new wastewater conveyance pipe and pump station is currently under construction to resolve this issue.

There is significant growth proposed in this catchment, within the special housing areas and the future urban zoned land. There is also significant growth forecast in both Tuakau and Pokeno with significant heavy/wet industries in both of these townships.

4.11. Warkworth and Snells/Algies Wastewater Treatment Plant Catchment Areas

4.11.1. Warkworth and Snells/Algies Treatment Plants

The Warkworth and Snells/Algies wastewater treatment plants treat and dispose of wastewater from approximately 0.5% of Auckland's population, currently estimated to be approximately 7,500 people. This population is split relatively evenly between the two plants. These populations discharge a total of approximately 674,000m^3 of treated wastewater each year, an approximate daily average of 1,900 m^3/d.

The Warkworth Wastewater Treatment Plant discharges to the Mahurangi River, while the Snells Beach Wastewater Treatment Plant discharges into the inner channel of the Hauraki Gulf south of Martins Bay. The Mahurangi Harbour is recognised as being a sensitive receiving environment and this is reflected in the Proposed Auckland Unitary Plan. There is also primary industry downstream of the plant in the form of oyster farms. It will be very difficult to retain a long term discharge into the Mahurangi Harbour, particularly with the large population growth planned for the area. Alternative discharge options are currently being considered as part of the discharge consent process. The alternatives for the Warkworth and Snells Algies catchment are being considered together because of their close proximity.

The Warkworth treatment plant has a current discharge consent that limits the maximum daily dry weather discharge from the plant to 1,500 m^3/d, a maximum

daily discharge of 8,100 m^3/d, as well as limits on nutrient loads concentrations. There is also a defined service area and population limit of 4,870 people.

The Snells Beach Wastewater Treatment Plant has a current discharge consent that limits the maximum daily discharge from the treatment plant to 4,680 m^3/d, limits around the times that the discharge can occur, as well as limits on nutrient and pathogen concentrations. There is also a defined area of benefit that is able to be serviced by the treatment plant. Sites located outside of the defined area of service must undertake additional approvals to be accepted for connection. The capacity of the plant equates to 18,000 people. However, the condition of the pumped outfall pipe is poor and to minimise the risk of breakage the pumped flow is currently restricted limiting the capacity to the existing serviced population of 4,000 people.

The discharge consents for both of these plants have expired and the plants are being operated legally under the current consent conditions.

As part of the discharge consent applications for these locations, a new North East Sub-regional facility is proposed to service the Warkworth and Snells/Algies communities.

4.11.2. Warkworth and Snells/Algies Wastewater Treatment Plant Catchment Networks

The Warkworth and Snells Beach catchments comprises of 100 km of wastewater network (including rising mains) and 13 pump stations. These catchments are wastewater only systems with only one pump station and one network EOP that exceed the NDC acceptable limit.

There is significant growth proposed in the Warkworth catchment, within the future urban zoned land. The future urban land is located at both the northern and southern edges of the catchment. Due to the high growth expectations, a network model will be built to enable the development of network solutions.

4.12. Clarks Beach and Waiuku Wastewater Treatment Plant Catchment Areas

4.12.1. Clarks Beach and Waiuku Treatment Plants

The Waiuku and Clarks Beach wastewater treatment plants treat and dispose of wastewater from approximately 0.7% of Auckland's population, currently estimated to be approximately 9,900 people. This population is currently split approximately 80/20 between these plants (7,900 and 2,000 people respectively). These populations discharge a total of approximately 937,000m^3 of treated wastewater into the Manukau Harbour each year, an approximate daily average of 2,600 m^3/d.

Both treatment plants discharge to the Waiuku estuary; Waiuku at the head and Clarks Beach at the mouth of the estuarine tributary. As part of Auckland Council's proposed Unitary Plan, the Waiuku estuary has been largely classified as a significant marine ecological area, affecting discharge consent applications in this

area. The Waiuku treatment plant has a current discharge consent that limits the maximum daily dry weather discharge from the treatment plant to 5,500 m^3/d, limits the time during which discharges can occur, as well as limits on nutrient load concentrations. The capacity of the plant equates to approximately 20,000 people. The discharge consent is valid until 2019.

The Clarks Beach treatment plant has a current discharge consent that limits the maximum daily discharge from the treatment plant to 600 m^3/d, as well as limits on nutrient load concentrations. The capacity of the plant equates to approximately 2,200 people. The discharge consent has expired, with the plant being legally operated under existing consent conditions.

In addition, a recent plan change was granted to allow development at Kingseat. The area around Kingseat is particularly sensitive and includes a Tangata Whenua Management Area over the Whatapaka Creek. Furthermore, submissions relating to the Proposed Auckland Unitary Plan may further increase the expected population at Kingseat.

A new South West Sub-regional Wastewater Treatment Plant is proposed to service these three communities.

4.12.2. Clarks Beach and Waiuku Wastewater Treatment Plant Catchment Network

The Waiuku and Clarks Beach catchments comprise of 80 km of wastewater network (including rising mains) and 24 pump stations. The catchments are wastewater only systems with no EOPs exceeding the NDC limit.

Some growth is proposed in these catchments. The networks will have some capacity to accommodate growth, but will require planning studies to optimise the utilisation of the individual networks. No provision has been made in the AMP for network enhancements at this stage.

4.13. Waiwera, Beachlands/Maraetai and Clevedon

Waiwera and Beachlands/Maraetai are currently serviced by local wastewater treatment plants. Should development occur beyond the capacity of these plants one of the viable options would be to convey the wastewater back to the urban area and decommission the treatment plants. For Clevedon, conveying wastewater back to Takanini is the most viable solution. No provision has been made in the AMP for these schemes.

5. Operations and Maintenance Strategies

The water and wastewater systems are operated to ensure Watercare's customers receive the required level of service and to ensure compliance with regulatory and resource consent conditions in a cost effective manner.

The predominant operating costs for both water and wastewater systems are energy (power and gas) and chemicals. Operational strategies are developed to minimise these. Watercare's long-term objective is to be energy neutral at its major water and wastewater treatment plants.

Water supply

The metropolitan water sources are operated conjunctively to optimise the use of the water sources, treatment plants, reservoir storage and pump stations to achieve:

Compliance with resource conditions
Optimising abstraction rates to stay within maximum allowable limits, and controlling compensation flows to satisfy environmental consents

Best use of energy
- Pumping during off-peak times
- Maximising hydro-generation potential at the dams
- Carrying out pump efficiency studies to ensure that pumps operate close to their best efficiency points
- Maximising the use of low energy cost treatment where possible
- Power factor correction to avoid penalties
- Management of peak loads to reduce regional coincidental demand.

Wastewater

Wastewater operating costs are considerably greater than water supply operating costs. Wastewater conveyance and treatment costs are affected by the entry of stormwater or groundwater into the networks as the increased volumes result in increased pumping, treatment (power and chemicals) and overflow clean-up costs. Chemical use is a significant cost in wastewater treatment. Watercare undertakes process optimisation in order to minimise costs.

5.1. Operational Activities

The operational activities for the water and wastewater systems are summarised in **Table 7**.

Table 7: Operational Activities

Asset Group	Operational Activities	Standards and Specifications
Water sources and treatment plants	Water abstraction rates monitored through telemetry	Resource consent conditions
	Water quality monitoring	Drinking-water Standards for New Zealand
	Process monitoring to allow optimisation of processes and cost minimisation	
	Treatment plant operation	Standard operating procedures
Water networks	Leak detection	Minimum night flow analysis
	Water quality monitoring	Drinking-water Standards for New Zealand
	Flushing	As per flushing programmes and Operating Manuals
	Backflow prevention auditing	AS2845.1:2010 Water New Zealand Backflow Group – Backflow Code of Practice for Water Suppliers
Wastewater treatment plants	Receiving environment monitoring	Resource consent conditions
	Resource consent conditions	Monitoring of wastewater discharge
	Discharge monitoring	Resource consent conditions
	Process monitoring to allow optimisation of processes and cost minimisation	
	Treatment plant operation	Standard operating procedures
Wastewater networks	Overflow monitoring (via telemetry) of pump stations and designated manholes	Resource consent conditions
	Clean-up of overflows	Agreed levels of service
	Trade waste monitoring	Inspections at trade waste customer properties

5.2. Operational Programmes and Initiatives

Operational programmes and initiatives to improve efficiency include:

Water supply pressure, flow and water source levels monitoring

This includes remote and manual monitoring of bulk meters and flowmeters for billing, network analysis and modelling, operations and leak detection purposes. Pump stations, reservoirs and treatment plants are alarm monitored for low/high pressures and water levels, faults, power failures or water quality deterioration. The control system enables remote control of pumps based on reservoir levels. Rainfall stations, lake-level recorders and in-stream weirs record water levels for use in dam safety surveillance, consent compliance reporting, operation of the headworks and drought security analysis.

Water supply interruption management

Customers are notified in advance, where possible, of planned water supply shut-downs.

Water source management

Involves operating the water sources to ensure compliance with consent conditions (regarding allowable volumes of water takes), to optimise efficient use of energy (through minimising pumping and water treatment costs and maximising hydro-generation potential) and to provide volumes within the capacity limitations of the treatment plants, pipelines and pump stations.

Pressure management

Operating the networks within minimum and maximum pressures.

Water quality management

Routine sampling (using portable instrument panels) and testing is undertaken throughout the region in accordance with the Drinking-water Standards for New Zealand. Reactive water quality tests and flushing are also carried out in response to customer water quality complaints. Routine flushing is undertaken in areas where repeat problems occur.

Backflow prevention

All commercial and industrial customers are required to have a certified backflow prevention device installed at the boundary of the property, to prevent contaminants entering the public network from private connections. Watercare undertakes a monitoring and enforcement role to meet the requirements of the Drinking-water Standards for New Zealand.

Leak detection and management

Leak detection uses telemetry to monitor night-time flows to detect and provide an alarm when abnormal flows occur, as well as transmission watermain and chamber inspection programmes and reactive inspections. Water leaks are a primary cause of non-revenue water or water losses. The management of non-revenue water volumes is a key focus for Watercare as significant water loss would generate the need to invest in new water supply capacity earlier than otherwise would be necessary.

Water meter management

Commercial and industrial water meters are monitored (some remotely) and replaced proactively based on consumption. Domestic water meters are replaced reactively. A programme to replace all water meters greater than 20 years old is currently being implemented. The installation of smart meters in Waiuku commenced in February due to the high volume of water losses in the area. The data from the smart meters will help to identify leaks and provide information about usage patterns.

Wastewater flow monitoring and control

Pump stations are continuously monitored for pump run-times, flows, wet well levels and overflows. Monitoring allows for pumping discharge to be adjusted according to conditions and enables fast response to potential overflow incidents to facilitate clean-up.

Wastewater overflow management

Overflows occur because of inflow and infiltration of stormwater and groundwater, insufficient capacity in the wastewater pipes, blockages (by fat build-up or root intrusion) or collapse or breaks in the pipes from third party damage. Management techniques used include inflow and infiltration detection and education campaigns, regular pipe flushing, enzymes to reduce fat accumulation, strict trade-waste management and monitoring, network enhancements and investigation of repeated blockages.

Inflow and infiltration control

Inflow (from the illegal stormwater connections) and infiltration (from groundwater) can cause overflows from the wastewater networks during wet weather. The effectiveness of programmes to reduce inflow and infiltration, undertaken in different parts of the region, is being assessed in terms of programme cost and wet weather flow reduction achieved.

5.3. Maintenance Planning

Watercare's maintenance planning is centred on delivering sustainable, cost-effective, reliable asset performance to ensure the delivery of water and wastewater services to the Auckland region.

Maintenance is programmed in two ways:

- General maintenance, which covers day-to-day planned and minor unplanned maintenance required to keep the treatment plants and network operational
- Rehabilitative maintenance of items that reach the end of their economic life

Watercare has developed prioritised maintenance schedules based on Reliability-Centred Maintenance (RCM). RCM bases maintenance on a risk profile developed largely from analysis of previous failures and factors such as equipment age, repair time and availability of spares. The RCM approach is applied to treatment plants and transmission assets.

For non-critical assets, an "unplanned" maintenance approach is utilised whereby they are repaired or replaced when they fail. Watercare monitors planned and unplanned maintenance activities to achieve a least whole-of-life-cost maintenance strategy.

Table 8 lists the planned and unplanned maintenance activities for the water and wastewater services.

Table 8: Maintenance Activities

Asset Group	Maintenance Activities	Standards and Specifications
Planned Maintenance		
Water networks	Meter testing	Manufacturer's specifications
	Valve and hydrant inspections	Operated to identify maintenance needs
	Pump station and reservoir inspections	Bulk network – RCM based programme logged in AM system Local networks – Routine pump/electrical testing to manufacturer's specifications
	Pipe and structural condition surveys	Planned programmes
Wastewater networks	Sewer cleaning and siphon flushing	Planned programmes
	Pipeline CCTV inspections	Planned programmes
	Inflow and infiltration testing	Flow model calibration Planned programmes for inspections of properties
	Critical asset inspections (pipe bridges, suspended sewers, control valves, outfalls, siphons)	Planned inspection programmes
All pump stations and treatment plants	Planned preventative maintenance programmes	Bulk network – RCM based programme logged in AM system Local networks – Routine inspections/ cleaning
	Pump overhauls and electrical testing	Manufacturer's specifications
	Safety inspections of lifting beams and backflow preventers	Manufacturer's specifications
Unplanned Maintenance		
Water network assets	Repair broken mains/pipes	Reactive maintenance is carried out in accordance with the KPIs set in the maintenance contracts
	Repair/replace broken/under-reading meters	
	Repair/replace leaking valves and hydrants	
	Flushing in response to water quality complaints or identified problems	
Wastewater network assets	Repair broken pipes and blockages	
Treatment plants/ reservoirs/ pump stations	Repair plant/equipment failures	Manufacturer's specifications

5.4. Condition Assessment Programmes

Condition assessment practices have been developed to assist with renewals planning are described in **Table 9.**

Table 9: Condition Assessment Practices

Asset Group	Condition Assessment Practices
Water System	
Water supply dams	• Annual investigation and inspection of each dam to report on its safety performance • Five yearly independent dam safety assurance audit to evaluate dam condition • Routine monitoring and assessment to ensure dam condition is maintained
Water treatment plants	• Visual inspections by on-site operators • Detailed, scheduled condition inspections by the maintenance team
Treated water reservoirs	• Findings of visual inspections, conducted by operations and maintenance personnel, trigger in-depth condition assessments, such as structural assessments
Water pump stations	• Regular routine inspections (in conjunction with maintenance work) • Vibration monitoring, thermography and leak detection testing to determine likely failure of bearings in motors and pump units • Monitoring of motor insulation to ensure integrity and detect evidence of potential early failure • Testing of pump station efficiency, in terms of actual pump rate compared to design pump rate • Annual inspection of all lifting beams and gantry cranes to check the integrity of the fixing bolts, supports, wire ropes and chains to comply with statutory requirements
Water transmission pipes	• Pipe sample analysis (pipe samples are cut when the pipe is exposed during maintenance or repairs) • Condition grade assessment by the contractor when maintenance or repairs are undertaken • Analysis of pipe performance (breaks/leaks) to interpret condition • Use of condition assessment technology called JD7 for pressurised water mains while in service.
Water network pipes	• Spot inspection and condition grade assessment by maintenance contractor as part of pipe repair • Analysis of pipe performance (breaks/leaks) to interpret condition
Valves and hydrants	• Tested (operated) and maintained at varying intervals • NZ Fire Service hydrant inspections
Wastewater System	
Wastewater treatment plants	• Visual inspections by on-site operators • Detailed, scheduled condition inspections by the maintenance team
Wastewater pump stations	• Regular routine inspections (in conjunction with maintenance work such as wet-well washing to remove fat build-up) • Vibration monitoring, thermography and leak detection testing to determine likely failure of bearings in motors and pump units • Monitoring of motor insulation to ensure integrity and detect evidence of potential early failure • Testing of pump station efficiency, in terms of actual pump rate compared to design pump rate • Annual inspection of all lifting beams and gantry cranes to check the integrity of the fixing bolts, supports, wire ropes and chains to comply

Asset Group	Condition Assessment Practices
	with statutory requirements
Wastewater transmission pipes	• Scheduled crew inspections • Pipe sample analysis (pipe samples are cut when the pipe is exposed during maintenance or repairs) • Condition grade assessment by the contractor when maintenance or repairs are undertaken • Analysis of pipe performance (breaks/leaks) to interpret condition • Specialist pipe bridge and rising main inspections • Closed-circuit television (CCTV), sonar, laser profiling and walk-through inspections
Wastewater network pipes	• Spot inspection and condition grade assessment by maintenance contractor as part of pipe repair • Analysis of pipe performance (breaks/blockages) to interpret condition • Pipe bridge inspections • Closed-circuit television (CCTV) inspections

6. Asset Renewal Strategy

The degradation of infrastructural assets over time results in a decline in the performance to the point of asset failure. Asset failures have the potential to cause loss of service and may pose a risk to public health and safety. Asset replacement and rehabilitation programmes are developed to monitor the condition and performance of assets in order to assess the end of their useful life. Asset renewal decisions are based a risk assessment of the likelihood and consequence of failure taking into consideration the asset age and life expectancy, asset condition, asset performance, system resilience and asset criticality.

6.1. Critical Facilities and Assets

Critical facilities and assets are those that should not be allowed to fail because the consequences of a failure are too high. Criteria to identify which facilities and assets are critical include:

- Health and safety risk
- Number, type and duration of customers affected
- Environmental consequence of the asset failure
- Regulatory, resource consent and drinking water quality compliance
- Size and location of the asset
- Complexity of repair and outage duration.

Watercare has adopted the following approach to the renewal of assets:

- Renewal programmes are developed for critical assets
- Non-critical assets are replaced on failure.

6.1.1. Plant Assets

Plant assets include water source assets, treatment plants, pump stations and reservoirs. These are generally accessible and have inspections and planned maintenance programmes. Dual process streams are incorporated within plants to provide redundancy and resilience, where feasible. Mechanical and electrical assets within these facilities have duty and standby assets to reduce the criticality of individual assets. Renewal of plant assets are planned based on the performance of the asset and condition assessments outlined above.

6.1.2. Transmission Assets

The transmission assets convey significant quantities of water or wastewater across the region. The failure of these assets can have a significant impact on a large number of customers, the environment or public health and safety. All transmission assets are classed as critical assets and are scheduled for renewal based on age and condition assessments.

6.1.3. Network Assets

The network assets generally comprise smaller diameter pipes. The impact of a failure of these assets is typically much lower than a transmission asset failure due to the limited number of customers affected and reduced environmental or public health and safety impacts associated with a failure. For this reason, most network assets are considered to be non-critical assets and are allowed to fail a number of times before they are replaced. The consequence of failures is managed via the maintenance contracts' response performance indicators.

A subset of network assets are regarded as critical based on their location and the type of customers serviced.

6.2. Pipe Asset Age Profiles

Pipe assets make up over 60% of the value of Watercare's infrastructure assets and therefore a renewal strategy that addresses the uncertainty surrounding these buried assets is important.

The charts below, **Figure 15**, **Figure 16** and **Figure 17,** provide an overview of the age class distribution of Watercare's pipe assets as at 30 June 2015.

Major development occurred in the 1960s due the construction of the trunk interceptor system to convey wastewater to the new Mangere Wastewater Treatment Plant and following the opening of the Auckland Harbour Bridge, the development of North Shore.

Figure 15: All Watercare Pipe Assets

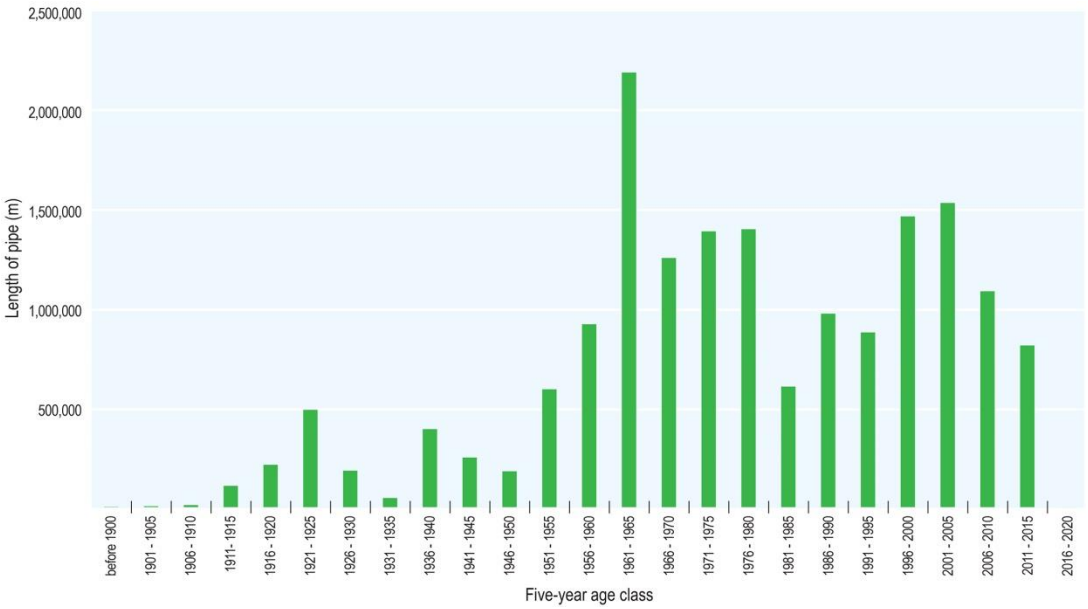


Figure 16 : Water and Wastewater Transmission pipes

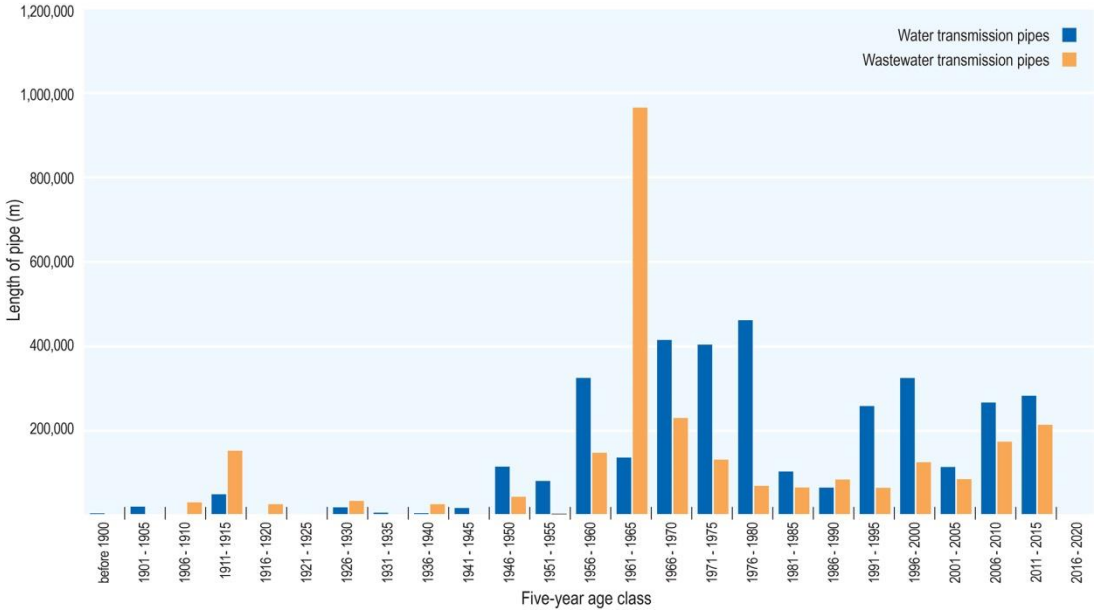
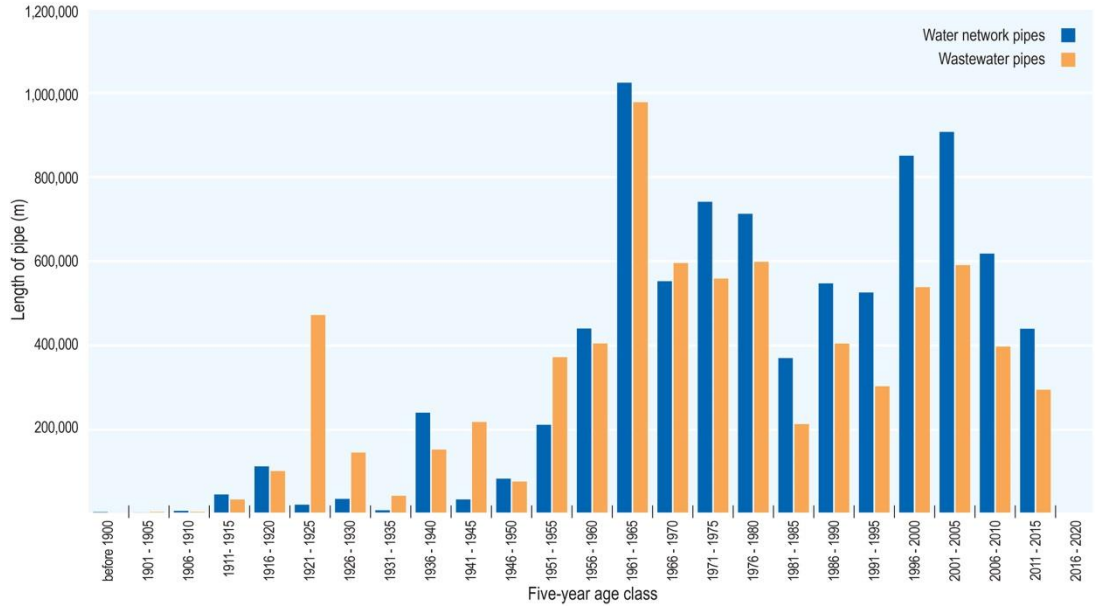


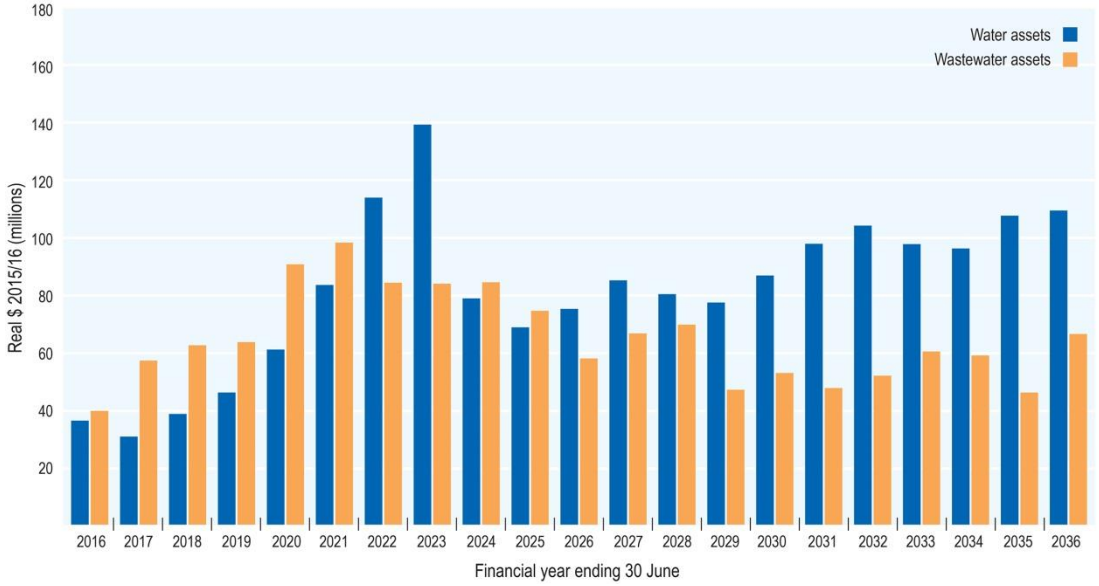
Figure 17: Water and Wastewater Network Pipes



6.3. Asset Renewal Expenditure

The following chart, **Figure 18**, outlines the current forecast of investment in renewal of infrastructure assets over the next 20 years.

Figure 18: Investment in Renewal of Infrastructure Assets



The annual investment in water asset renewals over the next 20 years is forecast to treble from $40M to $120M. This is predominantly driven by the provision for investment in the renewal of ageing water network assets. The likely timing of assets to be replaced will be refined as further fault analysis and condition assessment work is undertaken. The spike in water asset renewals investment between 2021 and 2023 relates to the replacement of the Huia Water Treatment Plant which has reached the end of its useful life.

The annual investment in wastewater asset renewals over the next 20 years remains relatively consistent at around $70M except for a spike in the latter half of the first decade which can be attributed to the Central Interceptor programme and the renewal of rural wastewater treatment facilities.

7. Financial Projections

7.1. Revenue and Financing Policy

7.1.1. Revenue and Financing Policy Guidelines

The Watercare Board has endorsed the following principles which are consistent with those adopted by Auckland Council as the basis for Watercare's Revenue and Financing Policy.

Paying for Benefits Received

In general, if a service mainly benefits a particular person or group, then that person or group should contribute to the cost of the service.

Intergenerational Equity

The spread of benefits over time from an item of expenditure should be reflected in a spread of cost to users over time.

Paying for Costs Imposed

As far as practicable, cost should be recovered from the people who have caused the cost to be incurred i.e. Causer pays.

Transparency and Accountability

Where the principles of paying for benefits and paying for costs suggest that a particular person or group should contribute towards the cost of a service, then that service should be funded separately from other services, if it is practicable to do so.

Financial Prudence and Sustainability

Revenue, expenditure, assets, liabilities, investments and general financial dealings should be managed in a prudent and sustainable manner.

Optimal Capital Usage

Limited financial resources should be used in such a way as to maximise the benefits provided to the community, while minimising the burden on Aucklanders. Among other things, this principle influences decisions on the best mix of funding (between revenue sources and borrowings) for assets and services.

Efficiency and Effectiveness

Revenue and financing policies should have regard to the costs of carrying them out, and how effective they will be in achieving their objectives.

Affordability

In addition to other guiding principles, revenue and financing policies need to reflect consideration of people's ability to pay and the desire to provide broad access for people to fundamental services.

Overall Social, Economic, Environmental and Cultural Impacts

Revenue decisions should take into account the impact of the decision on the current and future social, economic, environmental and cultural well-being of the community.

Minimise the Effects of Change

The integration/harmonisation of the revenue and financing policies of previous councils and council organisations led to incidences of change in price for services. Revenue and financing policy should seek to minimise or manage the impact of these changes.

7.1.2. Funding Operational Expenditure

Watercare ensures its projected operating revenue is sufficient to cover the cost of regular, on-going operating activities. A range of fees and charges are used to fund operating expenditure.

7.1.3. Funding Capital Expenditure

Watercare must make judgements about which capital projects it will undertake and how it will fund and finance the projects;

- Funding is how the project will ultimately be paid for (fees and charges)
- Financing is the way in which the money is raised to undertake the project (usually debt).

The principle of intergenerational equity suggests that assets with a long life span (the majority of Watercare assets) should initially be financed by borrowings. In that way, repayments are spread over a longer period, instead of users paying for the entire cost of an asset in the year that it is acquired / built. This general principle, however, needs to be balanced by consideration of the nature of the capital expenditure and other relevant funding principles.

Growth Related Capital Expenditure

New housing and commercial developments increase the demand on Watercare's water and wastewater network and require the construction of new infrastructure. The principles of paying for benefits received and paying for costs imposed require that such growth related capital expenditure should be primarily funded by the associated 'growth community', i.e. those that cause the need for, and benefit from, the new infrastructure. It is appropriate that charges to these users in the form of Infrastructure Growth Charges be used to partially fund such capital expenditure financed by borrowings.

Long-life Service Improvement Related Capital Expenditure

Borrowings are appropriate when the service improvement asset has a long life and will provide a benefit over a long period. By financing over a long period, current and future users both pay for the benefit they receive.

Renewal Capital Expenditure

Watercare has an on-going obligation to maintain the long-term integrity of its assets and as a result an annual requirement to fund a substantial level of renewal capital expenditure. Since this annual programme of work is required to replace ageing infrastructure rather than add service capacity or cater for new growth, it is appropriate that fees and charges to current users fund this capital expenditure.

Short Life Service Improvement Related Capital Expenditure

Watercare has an on-going programme of capital expenditure that relates to short life service improvements, such as Information System's capital expenditure. It is appropriate that fees and charges to current users fund this capital expenditure.

7.1.4. Funding Interest and Principal Repayments on Borrowings Raised to Fund Capital Expenditure

Fees and charges are appropriate to fund the on-going servicing cost and repayment of borrowings raised to finance growth and service improvement capital expenditure. This is consistent with both intergenerational equity and financial prudence and sustainability principles.

7.2. Financial Strategy

Watercare's Revenue and Financing Policy is framed in the context of a prudent Financial Strategy that ensures the long term viability and integrity of Watercare. The company's obligations in this respect are established under Part 5, Section 57(1) of the Local Government (Auckland Council) Act 2009 which stipulates that an Auckland water organisation:

- Must manage its operations efficiently with a view to keeping the overall costs of water supply and wastewater services to its customers (collectively) at the minimum levels consistent with the effective conduct of its undertakings and the maintenance of the long-term integrity of its assets

- Must not pay any dividend or distribute any surplus in any way, directly or indirectly, to any owner or shareholder.

To meet these obligations, Watercare maintains appropriate financial thresholds in the following key areas which impact the level of future expenditures, fees and charges, and borrowings.

Funds from Operations to Interest Cover ratio (FFO Ratio)

The FFO ratio (the net of cash revenue and expenses divided by gross interest cost) measures Watercare's ability to generate sufficient cash from which debt is serviced. Watercare's SOI requires the organisation to maintain an FFO ratio of greater or equal to 2.5 times.

Watercare's planned average FFO over the ten year AMP period (1 July 2016 to 30 June 2026) is 3.5.

Debt

In any particular period Watercare will be raising debt to finance a level of new capital expenditure in accordance with its Revenue and Financing Policy and will be generating fees and charges to repay prior period debt. In practice however these two cash flows will be netted and managed in accordance with Watercare's Treasury Management Policy. Given the long life of Watercare's debt financed assets, fees and charges projections should achieve a level of FFO sufficient to repay new debt within the life period of the asset for which the debt was raised. Watercare's planned average debt to EBITDA ratio over the ten year AMP period is 4.7 against a target of maintaining the ratio lower than 6.0.

Gearing

A company's gearing is the relationship between its levels of debt and equity. Increased gearing will normally predicate reduced financial flexibility and the need to alter levels of future expenditures, fees and charges, and borrowings. Watercare's 2016/17 planned average debt is $1.612 billion and the average net equity is $6.056 billion, resulting in a Debt to Debt plus Equity percentage of 21%. Watercare's forward debt projections reflect a prudent Debt to Debt plus Equity percentage, trending to 26% at the end of 2026.

7.3. Implications of the Asset Management Plan on Prices

Capital expenditure excluding capitalised interest and after allowing for value for money savings targets (refer section 7.8.2 below) over the next ten years is projected to total $3.904 billion in real terms and $4.615 billion in nominal terms.

In accordance with the Revenue and Financing Policy, funding of the capital expenditure over the ten year AMP period is sourced as follows:

Capex Category	Source of Funds	$ Billions
Renewals Capex	Fees and Charges	$2.024
Growth Capex	IGCs	$1.002
	Debt	$1.102
Long Life Service Level Capex	Debt	$0.487
Short Life Service Level Capex	Fees and Charges	$0.000
TOTAL		**$4.615**

Debt is expected to increase by a net $1.393 billion over the ten year AMP period with fees and charges effectively funding renewal capex, short life service level capex, gross interest, cash operating expenditure, and payback of prior period debt of $196 million.

To achieve the level of revenue funding required over the ten year AMP period, prices for water and wastewater are expected to increase on average by 3.5% per

annum and Infrastructure Growth Charge rates are expected to increase on average by 2.1% per annum.

7.4. Asset Values

The value of property, plant and equipment at 30 June 2015 was $8.528 billion (Watercare 2015 Annual Report), including capital work in progress of $385 million. Asset revaluations are carried out on a class of asset basis at least every three years. The most recent valuation for all infrastructure assets was completed at 30 June 2015 by Beca Valuations Limited. By the nature of Watercare's business, the infrastructure assets are of a specialised nature, which are rarely traded in the market place, therefore fair value is assessed by the optimised depreciated replacement cost approach. The optimised depreciated replacement cost uses the assessment of replacement cost of an asset with a new or modern equivalent asset and applies optimisation and deprecation to adjust for age, condition, performance and remaining useful life. Depreciation is calculated on a straight-line basis over the assets useful life.

Table 10 provides a summary of the value of property, plant and equipment (predominantly infrastructure) assets as at 30 June 2015 and the associated annual depreciation for each asset group.

Table 10: Property, Plant and Equipment (30 June 2015)

Asset Group	Carrying amount ($ millions)	Annual Depreciation ($ millions)
Capital work in progress	385	-
Water – Treatment and transmission	1,676	39.7
Water – Network	1,881	48.7
Wastewater – Treatment and transmission	1,389	47.9
Wastewater – Network	3,197	59.6
TOTAL	**8,528**	**195.9**

7.5. Capital Expenditure Forecast

Table 11 and **Table 12** show the forecast capital expenditure for the water and wastewater strategic programmes discussed in Sections 3 and 4 above.

Table 11: Water Strategic Programmes - $ millions, Nominal

Water Strategic Programme	Financial Years 2017-2026	Financial Years 2027-2036
North of Albany • Wellsford Water Supply • Helensville Water Supply • Hibiscus Coast Boost Pumping • Orewa 3 Watermain	34	178
North Shore • North Shore Boost Pumping • Pinehill Watermain and Boost Pumping • New Waitemata Harbour Crossing	134	28
North West • Huia Water Treatment Plant • North Harbour 2 Watermain • West Boost Pumping • North West Storage • Waitakere Water Supply • Waitakere 2 Watermain	586	215
Central • Hunua 4 Epsom to Khyber • Khyber 2 Reservoir Reinstatement • Ponsonby Reservoirs Upgrade • Domain Reservoir Replacement • Khyber 3 Reservoir Replacement	88	92
Southern • Waikato Water Treatment Plant to 175MLD • Waikato Boost Pumping • Pukekohe East Reservoir at Runciman Road • Redoubt Reservoir Complex Expansion • Waiuku Water Supply • Waikato Treatment Plant to 250MLD	138	367
Other Water Programmes		
Growth Increasing capacity to support growth	196	275
Renewals Renewing and replacing existing near the end of their useful life	692	1591
Level of Service Improvements Improving the level of service to our customers	53	46
TOTAL	**1921**	**2792**

Table 12: Wastewater Strategic Programmes - $ millions, Nominal

Wastewater Strategic Programmes Treatment Plants and Catchments	Financial Years 2017-2026	Financial Years 2027-2036
Mangere		
Treatment Plant • Biological Nutrient Removal (BNR) Upgrade • Additional Sludge Digesters • Solids Stream Upgrades • Wet Weather Treatment Facilities • Consent Renewals	158	99
Catchment • Central Interceptor Spine and Consolidation Pipes • Waterfront Interceptor • Southern Interceptor Augmentation • Howick Diversion • Otara Network Upgrades • Newmarket Gully	1291	1125
Rosedale		
Treatment Plant • Treatment Upgrades • Consent Renewals	65	100
Catchment • Northern Interceptor • North Shore Trunk Sewer and Pump Station Upgrades	158	162
Army Bay		
Treatment Plant • Outfall and Plant Upgrade	42	52
Catchment • Provision for growth	5	209
Pukekohe		
Treatment Plant • Treatment Upgrades	52	91
Catchment • Pukekohe Trunk Sewer Upgrade (pump station and rising main)	52	7
Warkworth and Snells/Algies		
Treatment Plants • Warkworth/Snells Sub-Regional Plant and Conveyance	112	
Catchments • Network Upgrades		40
Clarks Beach and Waiuku		
Treatment Plants • South Western Sub-Regional Plant and Conveyance	76	

Other Wastewater Programmes	Financial Years 2017-2026	Financial Years 2027-2036
Growth Increasing capacity to support growth	140	140
Renewals Renewing and replacing existing near the end of their useful life	574	1001
Levels of Service Improvements Improving the level of service to our customers	36	35
TOTAL	**2761**	**3061**

Watercare's capital expenditure forecasts for the period 1 July 2016 to 30 June 2026 are presented in Section 7.6, in real dollars (2015/16 base, excluding inflation) **Table 13**, and nominal dollars (including inflation) in **Table 14**.

The forecast capital expenditure for the 10-year period is $4.1 billion in real terms and $4.9 billion in nominal terms, before allowing for capital expenditure efficiency savings targets.

Capital expenditure is split by activity; water, wastewater and shared services which include infrastructure planning, project delivery, customer services, property, finance, procurement, information systems, human resources, statutory planning, risk management, communications and internal audit. Shared service projects are projects that contribute to both water and wastewater activities. For each activity capital expenditure is split into growth, renewal and level of service.

Forty six per cent of the forecast expenditure can be attributed to meeting the requirements for growth.

Over the 10-year period, the investment in water and wastewater are at similar levels of $1.62/$1.92 billion (real/nominal) and $2.33/$2.76 billion (real/nominal) respectively. However, the investment mix between the two business areas, on an annual basis during the 10-year period, is different.

There is also forecast capital expenditure of $0.16/$0.19 billion (real/nominal) associated with shared services.

7.6. Capital Expenditure Forecast Tables

All real dollar and nominal dollar forecasts presented below exclude capitalised interest.

Table 13: Watercare Capital Expenditure Forecast Summary - $ millions (Real-2015/16 base)

Business Area	Contributing Driver	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total 2017-2026	Total 2027-2036	20-Year Total
WATER	Growth	55.5	119.0	93.1	55.7	77.0	93.5	87.6	52.8	27.8	20.7	682.7	578.5	1,261.2
	Renewals	34.1	42.8	51.1	67.7	92.7	126.5	154.7	87.5	76.3	83.4	816.7	1,046.3	1,863.0
	LoSI	7.2	16.3	24.8	4.2	8.3	19.1	23.5	6.4	6.4	8.3	124.6	53.9	178.5
WATER Total		**96.8**	**178.1**	**169.0**	**127.6**	**177.9**	**239.1**	**265.8**	**146.7**	**110.5**	**112.4**	**1,624.0**	**1,678.7**	**3,302.7**
WASTEWATER	Growth	144.5	141.4	151.3	106.9	94.8	125.7	111.6	128.9	98.1	88.4	1,191.6	1,056.3	2,247.9
	Renewals	63.4	69.4	70.6	100.7	109.1	93.5	93.2	93.7	82.7	64.3	840.5	629.7	1,470.2
	LoSI	9.9	6.5	12.2	30.6	50.3	44.4	40.6	49.6	52.8	6.2	303.0	160.2	463.2
WASTEWATER Total		**217.8**	**217.3**	**234.0**	**238.2**	**254.1**	**263.6**	**245.4**	**272.2**	**233.6**	**158.9**	**2,335.1**	**1,846.2**	**4,181.2**
SHARED SERVICES	Growth	3.7	3.1	2.9	3.1	3.4	3.7	3.5	3.0	2.4	2.2	30.9	24.9	55.8
	Renewals	15.0	12.8	12.1	13.2	15.0	14.4	13.6	11.8	11.2	9.3	128.4	106.1	234.4
	LoSI	-	-	-	-	-	-	-	-	-	-	-	-	-
SHARED SERVICES Total		**18.7**	**15.9**	**15.1**	**16.3**	**18.3**	**18.1**	**17.1**	**14.7**	**13.6**	**11.4**	**159.3**	**130.9**	**290.2**
Grand Total		**333.3**	**411.3**	**418.1**	**382.1**	**450.3**	**520.8**	**528.3**	**433.6**	**357.7**	**282.8**	**4,118.3**	**3,655.8**	**7,774.1**

2017 is the financial year from 1 July 2016 to 30 June 2017

Table 14: Watercare Capital Expenditure Forecast Summary - $ millions (Nominal)

Business Area	Contributing Driver	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total 2017-2026	Total 2027-2036	20-Year Total
WATER	Growth	57.1	125.7	101.2	62.4	88.9	111.5	108.1	67.5	36.9	28.4	787.6	955.7	1,743.3
	Renewals	35.0	45.2	55.5	75.8	107.0	150.9	191.0	111.9	101.3	114.5	988.1	1,749.5	2,737.5
	LoSI	7.4	17.2	26.9	4.7	9.6	22.8	29.0	8.2	8.5	11.4	145.8	87.0	232.8
WATER Total		**99.5**	**188.1**	**183.6**	**142.8**	**205.4**	**285.2**	**328.1**	**187.6**	**146.8**	**154.3**	**1,921.5**	**2,792.1**	**4,713.6**
WASTEWATER	Growth	148.5	149.3	164.4	119.6	109.4	149.9	137.8	164.9	130.3	121.4	1,395.5	1,764.6	3,160.1
	Renewals	65.2	73.2	76.7	112.6	125.9	111.6	115.0	119.9	109.8	88.2	998.2	1,040.9	2,039.1
	LoSI	10.2	6.8	13.2	34.2	58.1	52.9	50.1	63.4	70.1	8.6	367.6	255.1	622.7
WASTEWATER Total		**223.9**	**229.4**	**254.3**	**266.5**	**293.4**	**314.4**	**303.0**	**348.1**	**310.1**	**218.1**	**2,761.3**	**3,060.6**	**5,821.9**
SHARED SERVICES	Growth	3.8	3.3	3.2	3.5	3.9	4.4	4.4	3.8	3.2	3.0	36.3	41.2	77.5
	Renewals	15.5	13.5	13.2	14.8	17.3	17.2	16.8	15.1	14.8	12.7	150.8	176.2	327.0
	LoSI	-	-	-	-	-	-	-	-	-	-	-	-	-
SHARED SERVICES Total		**19.2**	**16.8**	**16.4**	**18.3**	**21.2**	**21.6**	**21.1**	**18.9**	**18.0**	**15.7**	**187.1**	**217.4**	**404.5**
Grand Total		**342.7**	**434.3**	**454.2**	**427.6**	**520.0**	**621.2**	**652.3**	**554.6**	**474.9**	**388.2**	**4,869.9**	**6,070.1**	**10,940.0**

Table 15: Water Supply Capital Expenditure Forecast - $ millions (Real - 2015/16 base)

Operational Area	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total 2017-2026	Total 2027-2036	20-Year Total
Water Sources	3.1	1.8	2.3	2.9	3.0	2.0	2.1	2.1	2.4	4.5	26.2	28.7	55.0
Raw Water Network	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5.0	132.0	137.0
Water Treatment	32.2	41.8	35.6	16.3	34.2	84.6	104.2	4.1	5.1	9.1	367.2	257.6	624.8
Treated Water Transmission and Networks	59.3	131.5	127.1	105.9	137.6	149.9	156.9	136.3	98.7	95.5	1,198.7	1,232.9	2,431.6
Energy and Control Systems	1.8	2.6	3.4	2.1	2.6	2.1	2.1	3.6	3.9	2.9	26.9	27.4	54.3
TOTAL WATER	**96.8**	**178.1**	**169.0**	**127.6**	**177.9**	**239.1**	**265.8**	**146.7**	**110.5**	**112.4**	**1,624.0**	**1,678.7**	**3,302.7**

Table 16: Water Supply Capital Expenditure Forecast - $ millions (Nominal)

Operational Area	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total 2017-2026	Total 2027-2036	20-Year Total
Water Sources	3.1	1.9	2.5	3.2	3.5	2.4	2.6	2.7	3.2	6.2	31.4	47.5	78.8
Raw Water Network	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.7	0.7	5.9	217.9	223.8
Water Treatment	33.1	44.1	38.7	18.3	39.5	100.9	128.6	5.2	6.8	12.5	427.7	414.2	841.9
Treated Water Transmission and Networks	61.0	138.9	138.1	118.5	158.9	178.8	193.8	174.4	131.0	131.1	1,424.2	2,067.7	3,491.9
Energy and Control Systems	1.9	2.7	3.6	2.3	3.0	2.5	2.6	4.6	5.1	3.9	32.3	44.9	77.1
TOTAL WATER	**99.5**	**188.1**	**183.6**	**142.8**	**205.4**	**285.2**	**328.1**	**187.6**	**146.8**	**154.3**	**1,921.5**	**2,792.1**	**4,713.6**

Table 17: Wastewater Capital Expenditure Forecast - $ millions (Real - 2015/16 base)

Operational Area	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total 2017-2026	Total 2027-2036	20-Year Total
Wastewater Networks and Transmission	119.0	102.1	120.4	161.2	174.4	200.8	202.2	228.7	211.9	119.0	1,639.8	1,332.3	2,972.1
Wastewater Treatment	95.4	111.9	111.8	73.4	77.7	59.3	40.7	41.2	20.2	36.4	668.1	486.1	1,154.2
Energy and Control Systems	3.3	3.1	1.6	3.4	1.9	3.4	2.4	2.1	1.4	3.4	25.6	26.3	51.9
Trade Waste	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.6	1.6	3.1
TOTAL WASTEWATER	**217.8**	**217.3**	**234.0**	**238.2**	**254.1**	**263.6**	**245.4**	**272.2**	**233.6**	**158.9**	**2,335.1**	**1,846.2**	**4,181.2**

Table 18: Wastewater Capital Expenditure Forecast - $ millions (Nominal)

Operational Area	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total 2017-2026	Total 2027-2036	20-Year Total
Wastewater Networks and Transmission	122.3	107.8	130.8	180.4	201.4	239.5	249.7	292.6	281.4	163.3	1,969.2	2,198.6	4,167.8
Wastewater Treatment	98.1	118.2	121.5	82.2	89.7	70.7	50.2	52.7	26.8	50.0	760.0	816.0	1,576.1
Energy and Control Systems	3.4	3.2	1.7	3.7	2.1	4.0	2.9	2.7	1.8	4.6	30.2	43.4	73.6
Trade Waste	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.9	2.6	4.4
TOTAL WASTEWATER	**223.9**	**229.4**	**254.3**	**266.5**	**293.4**	**314.4**	**303.0**	**348.1**	**310.1**	**218.1**	**2,761.3**	**3,060.6**	**5,821.9**

Table 19: Shared Services Capital Expenditure Forecast - $ millions (Real - 2015/16 base)

Operational Area	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total 2017-2026	Total 2027-2036	20-Year Total
Corporate	2.4	2.2	1.8	2.2	1.7	2.4	2.4	2.4	2.2	1.6	21.3	23.2	44.5
Energy and Control Systems	7.6	6.7	6.0	6.3	7.0	5.1	5.5	5.0	3.5	2.1	54.7	30.1	84.7
Information Systems	6.4	4.7	4.9	5.5	7.3	8.2	6.5	4.7	5.5	5.3	59.0	54.0	113.0
Laboratory	2.1	2.1	2.1	2.1	2.1	2.1	2.4	2.4	2.1	2.1	21.5	20.8	42.3
Maintenance Services	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	2.9	2.9	5.7
TOTAL SHARED SERVICES	**18.7**	**15.9**	**15.1**	**16.3**	**18.3**	**18.1**	**17.1**	**14.7**	**13.6**	**11.4**	**159.3**	**130.9**	**290.2**

Table 20: Shared Services Capital Expenditure Forecast - $ millions (Nominal)

Operational Area	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Total 2017-2026	Total 2027-2036	20-Year Total
Corporate	2.5	2.3	2.0	2.4	1.9	2.8	3.0	3.0	2.9	2.3	25.2	38.4	63.6
Energy and Control Systems	7.8	7.1	6.5	7.0	8.1	6.1	6.8	6.4	4.6	2.9	63.2	49.8	113.0
Information Systems	6.5	5.0	5.3	6.2	8.4	9.8	8.0	6.0	7.3	7.3	69.9	89.9	159.8
Laboratory	2.1	2.2	2.3	2.3	2.4	2.5	3.0	3.1	2.8	2.9	25.5	34.5	60.0
Maintenance Services	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	3.4	4.7	8.1
TOTAL WASTEWATER	**19.2**	**16.8**	**16.4**	**18.3**	**21.2**	**21.6**	**21.1**	**18.9**	**18.0**	**15.7**	**187.1**	**217.4**	**404.5**

7.7. Operational Expenditure Forecasts

All forecasts exclude GST.

Watercare's operational expenditure forecast for the period 1 July 2016 to 30 June 2026 is presented in real dollars (excluding inflation) and nominal dollars (including inflation) in **Table 21** and **Table 22** respectively.

Operational expenditure (excluding depreciation and interest) is split by activity; water and wastewater activities. Both activities include allocations of shared services expenditure. For each activity operating expenditure is split into employee benefit expenses (labour), maintenance and asset operating costs and other expenses.

The total forecast operational expenditure for the first 10-year period (excluding depreciation and interest) is $2.2 billion in real terms and $2.6 billion in nominal terms.

Over the first 10-year period, employee costs make up 28% of the total operational costs, maintenance contributes to 18%, asset operating costs (including energy and chemicals) contributes 35% and the remaining 19% is attributable to other expenses.

Over the first 10-year period, the operational expenditure in water and wastewater (in real dollar terms) are $928 million and $1,278 million respectively.

Table 21 : Operational Expenditure 1 July 2016 to 30 June 2026, Real $ (2015/16 base, Millions)

Business Area		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2017-2026	2027-2036	20-year Total
Water	Asset operating Costs	23.3	23.5	23.8	24.6	24.8	25.0	25.2	25.5	25.6	25.9	247.1	277.8	524.8
	Maintenance Costs	19.3	19.5	19.7	19.6	19.8	20.0	20.2	20.4	20.5	20.8	199.7	222.6	422.3
	Employee Benefit Expenses	27.3	27.6	27.9	31.9	32.2	32.5	32.8	33.2	33.4	33.9	312.7	362.9	675.6
	Other Expenses	14.6	14.7	14.9	17.3	17.5	17.6	17.8	18.0	18.1	18.3	168.8	196.4	365.2
Total Water		**84.5**	**85.4**	**86.2**	**93.5**	**94.2**	**95.1**	**95.9**	**97.0**	**97.6**	**98.9**	**928.3**	**1,059.7**	**1,988.0**
Wastewater	Asset operating Costs	36.4	36.7	37.1	37.0	37.2	37.6	37.9	38.3	38.4	38.9	375.5	417.5	793.0
	Maintenance Costs	18.4	18.6	18.8	18.3	18.4	18.6	18.8	19.0	19.1	19.4	187.3	207.5	394.8
	Employee Benefit Expenses	47.3	47.8	48.3	45.3	45.6	46.1	46.5	47.1	47.4	48.0	469.5	515.0	984.4
	Other Expenses	25.0	25.3	25.5	23.6	23.8	24.0	24.2	24.5	24.6	24.9	245.4	267.5	512.9
Total Wastewater		**127.0**	**128.4**	**129.7**	**124.2**	**125.1**	**126.3**	**127.4**	**128.8**	**129.6**	**131.3**	**1,277.7**	**1,407.4**	**2,685.1**
Watercare	Asset operating Costs	59.7	60.3	60.9	61.6	62.0	62.5	63.0	63.7	64.0	64.9	622.6	695.3	1,317.9
	Maintenance Costs	37.7	38.1	38.5	38.0	38.2	38.6	38.9	39.4	39.6	40.1	387.0	430.1	817.1
	Employee Benefit Expenses	74.6	75.4	76.2	77.2	77.8	78.6	79.3	80.3	80.8	81.9	782.2	877.8	1,660.1
	Other Expenses	39.6	40.0	40.4	40.9	41.2	41.6	42.0	42.5	42.7	43.3	414.3	463.9	878.1
Total Watercare		**211.5**	**213.8**	**215.9**	**217.7**	**219.2**	**221.3**	**223.3**	**225.9**	**227.2**	**230.2**	**2,206.1**	**2,467.1**	**4,673.2**

Table 22: Operational Expenditure 1 July 2016 to 30 June 2026, Nominal $ (Millions)

Business Area		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2017-2026	2027-2036	20-year Total
Water	Asset operating Costs	23.8	24.7	25.7	27.5	28.7	30.0	31.4	33.0	34.5	36.0	295.2	457.0	752.2
	Maintenance Costs	19.6	20.2	21.0	21.5	22.3	23.3	24.2	25.3	26.4	27.6	231.5	349.9	581.4
	Employee Benefit Expenses	27.7	28.6	29.5	34.5	35.6	36.8	38.1	39.5	40.9	42.6	353.7	541.0	894.7
	Other Expenses	14.8	15.3	15.9	19.0	19.7	20.5	21.4	22.4	23.3	24.3	196.6	308.6	505.3
Total Water		**86.1**	**88.8**	**92.0**	**102.5**	**106.3**	**110.5**	**115.0**	**120.2**	**125.1**	**130.5**	**1,077.0**	**1,656.5**	**2,733.5**
Wastewater	Asset operating Costs	37.3	38.6	40.3	41.5	43.3	45.3	47.5	50.0	52.4	54.7	451.0	694.3	1,145.3
	Maintenance Costs	18.7	19.3	20.0	20.1	20.8	21.7	22.6	23.6	24.6	25.7	217.0	326.0	543.0
	Employee Benefit Expenses	48.0	49.5	51.1	48.9	50.4	52.2	54.0	56.1	58.0	60.5	528.5	767.8	1,296.3
	Other Expenses	25.5	26.2	27.2	25.9	26.8	27.9	29.1	30.4	31.7	33.1	283.9	420.3	704.2
Total Wastewater		**129.4**	**133.6**	**138.5**	**136.4**	**141.4**	**147.1**	**153.2**	**160.1**	**166.7**	**173.9**	**1,480.4**	**2,208.4**	**3,688.8**
Watercare	Asset operating Costs	61.1	63.3	66.0	69.1	72.0	75.3	78.9	83.0	86.9	90.7	746.2	1,151.3	1,897.5
	Maintenance Costs	38.4	39.5	41.0	41.6	43.2	44.9	46.8	49.0	51.0	53.2	448.6	675.9	1,124.4
	Employee Benefit Expenses	75.7	78.1	80.5	83.4	86.0	88.9	92.0	95.6	98.8	103.1	882.2	1,308.8	2,191.0
	Other Expenses	40.3	41.5	43.1	44.9	46.5	48.5	50.5	52.8	55.0	57.4	480.5	728.9	1,209.4
Total Watercare		**215.5**	**222.4**	**230.6**	**239.0**	**247.7**	**257.6**	**268.2**	**280.3**	**291.8**	**304.5**	**2,557.4**	**3,864.9**	**6,422.3**

7.8. Significant Assumptions and Risks

7.8.1. Growth Forecasts

Regional growth in population, industry and commerce has a direct impact on the demand for water and wastewater services. Existing infrastructure needs to be enhanced or expanded to cater for this increase in demand. In addition, to cater for growth within the areas not currently serviced by Watercare facilities, new infrastructure needs to be provided.

The most significant assumptions have been outlined in Section 3.4 Business Drivers, in particular the priorities set out in the Proposed Auckland Unitary Plan.

Related to this are the growth assumptions discussed in Section 4.5.1 Growth Forecasts.

Medium growth scenario

Planning for growth is based on forecast increases in population and changes in land use provided to Watercare by the Auckland Council and Watercare's estimate of the daily per capita water and wastewater demand.

Auckland Council has recently released a revised medium growth population forecast based on the Statistics New Zealand data modified to account for the land use provisions of the Proposed Auckland Unitary Plan.

The Proposed Auckland Unitary Plan allows for growth to occur in greenfield areas over the next 30 years. This accounts for approximately 25% of Auckland's future housing needs with the remaining 75% expected to be provided from intensification and up zoning of the existing urban areas. This AMP has made a general provision to cover the likely expenditure required to meet a general increase in capacity in the network to cater for a medium growth scenario.

7.8.2. Efficiency/Value for Money Savings

In general, the capital investment planning process produces project cost and implementation timing estimates with varying degrees of precision. Uncertainty of estimates is implicit in forecasting capital expenditure programmes. Actual project costs can be more or less than initially estimated due to new technologies, materials, method of construction, processes and supply constraints.

For the financial plan projections, Watercare has assumed a target to encourage implementation of cost-effective technologies to deliver better levels of service for same or similar life-cycle costs, equating to 5% of the total AMP forecast for the ten-year period. It is not practical to allocate this target to specific projects. Instead, for the purpose of the financial plan projections, the percentage target has been calculated against the total capital expenditure for water and wastewater, and across the growth, level of service and renewal categories.

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2017-2026
Real $ (2015/16, millions)											
AMP Forecast	**333.3**	**411.3**	**418.1**	**382.1**	**450.3**	**520.8**	**528.3**	**433.6**	**357.7**	**282.8**	**4,118.3**
Efficiency Saving Target @ 5%	16.7	20.6	20.9	19.1	22.5	26.0	26.4	21.7	17.9	22.6	214.4
Financial Plan Capex Forecast	316.7	390.8	397.2	363.0	427.8	494.7	501.9	411.9	339.8	260.2	3,903.9
Nominal $ (millions)											
AMP Forecast	**342.7**	**434.3**	**454.2**	**427.6**	**520.0**	**621.2**	**652.3**	**554.6**	**474.9**	**388.2**	**4,869.9**
Efficiency Saving Target @ 5%	17.1	21.7	22.7	21.4	26.0	31.1	32.6	27.7	23.7	31.1	255.1
Financial Plan Capex Forecast	325.5	412.5	431.5	406.2	494.0	590.1	619.6	526.9	451.2	357.1	4,614.7

The continuous improvement initiatives associated with the delivery of capital projects will assist in achieving cost savings.

7.8.3. Cost Adjusters

The following Cost Price Index and Capital Goods Price Index adjusters have been applied to the long term financial projections:

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Cost Price Index weighted average*	per annum	1.88%	2.11%	2.63%	2.81%	2.92%	3.03%	3.20%	3.32%	3.49%	3.00%
	cumulative	1.88%	4.03%	6.77%	9.76%	12.96%	16.39%	20.11%	24.10%	28.43%	32.28%
Capital Goods Price Index	per annum	2.80%	2.70%	2.90%	3.00%	3.20%	3.30%	3.50%	3.60%	3.80%	3.39%
	cumulative	2.80%	5.58%	8.64%	11.90%	15.48%	19.29%	23.46%	27.91%	32.77%	37.27%

*The values shown for the cost price index are the weighted average of three indices for "staff", "energy" and "other".

The cost price index is applied to real operating expenditure to derive nominal operating expenditure.

The capital goods price index is applied to real capital expenditure to derive nominal capital expenditure.

7.8.4. Interest Rate

The following interest rate assumptions have been applied to the long term financial projections:

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Average rate	per annum	5.69%	5.64%	5.65%	5.64%	5.64%	5.64%	5.65%	5.65%	5.65%	5.65%

8. APPENDIX

8.1. Water Schematic Diagrams

Figure 19: Current Simplified Schematic of Water System

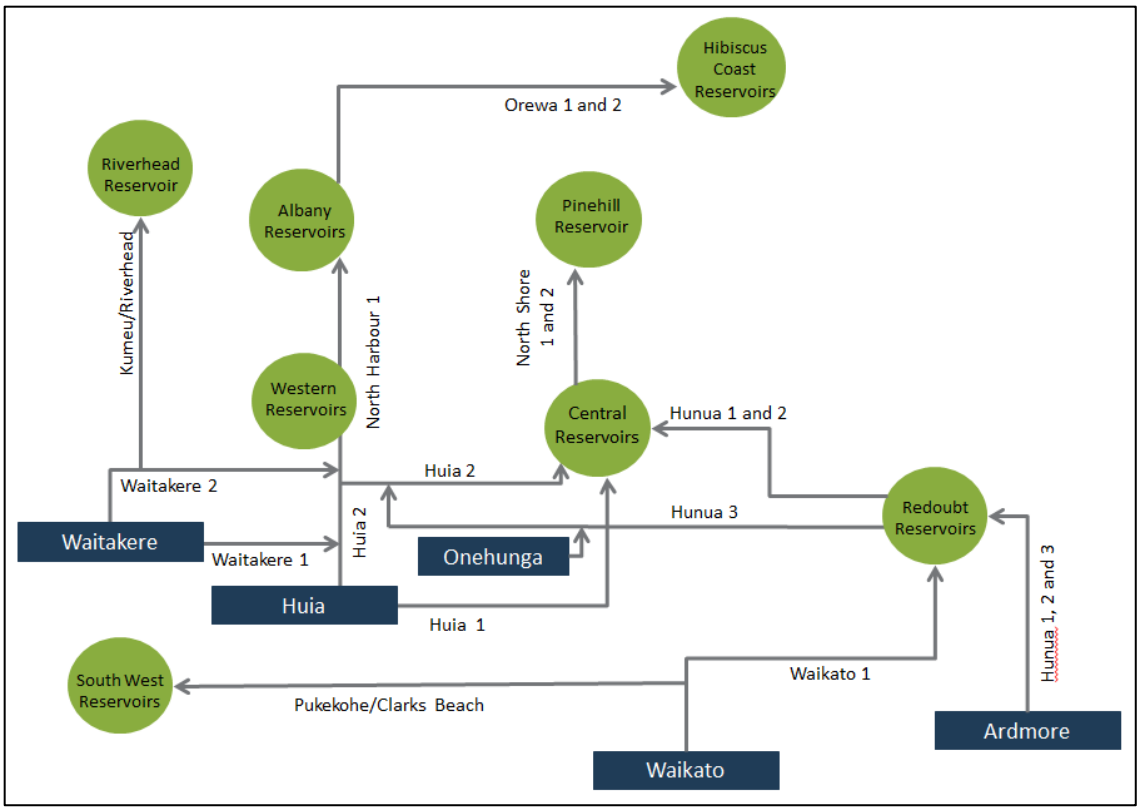
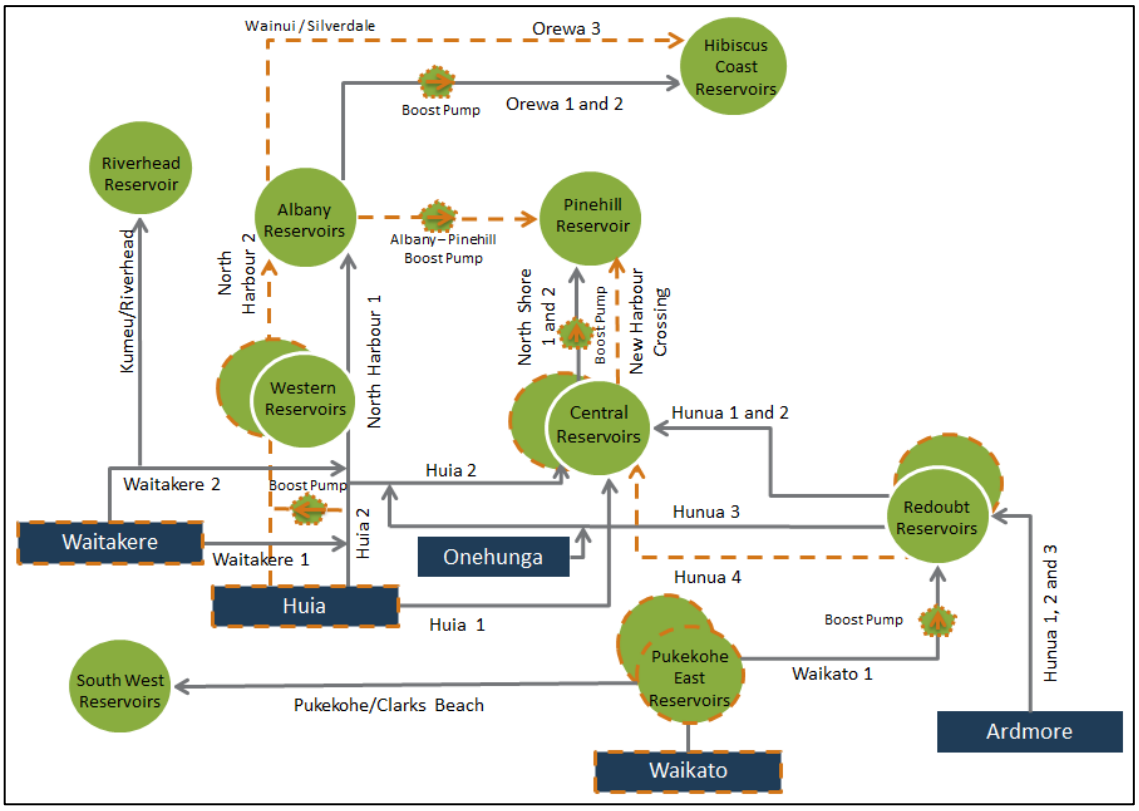


Figure 20: Simplified Schematic of Water System after Capital Upgrades 2017- 2036



8.2. Wastewater Schematic Diagrams

Figure 21: Current Simplified Schematic of Wastewater System

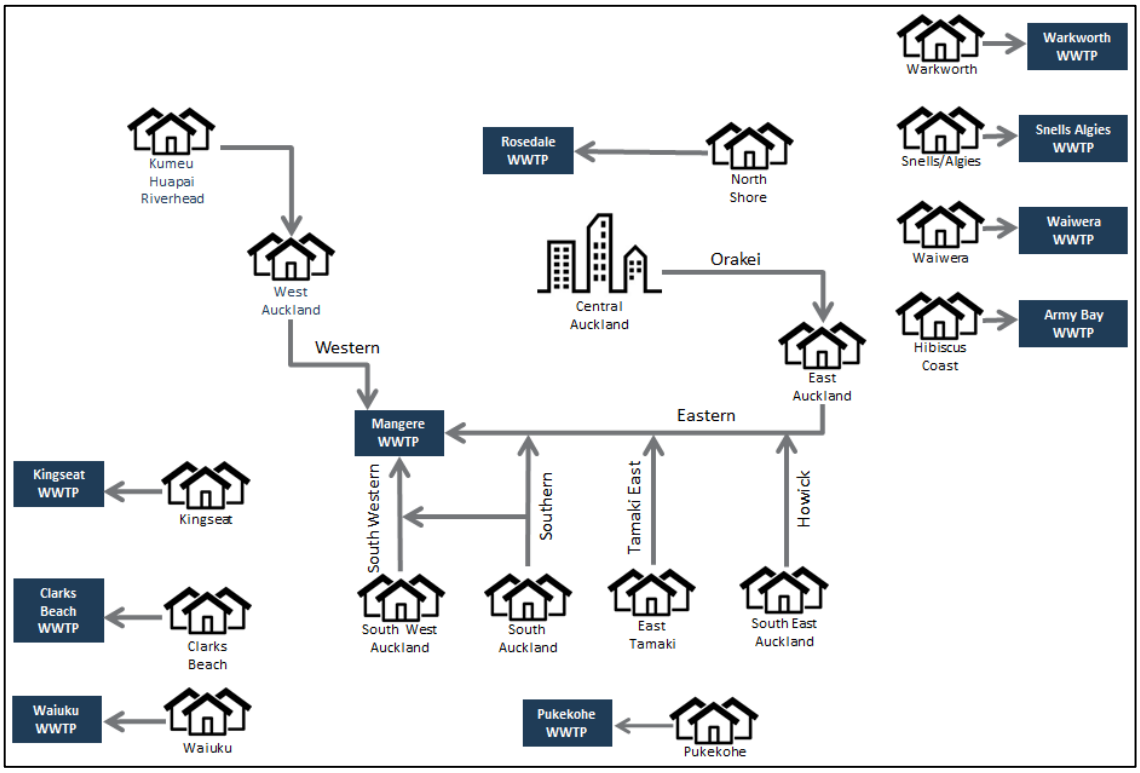
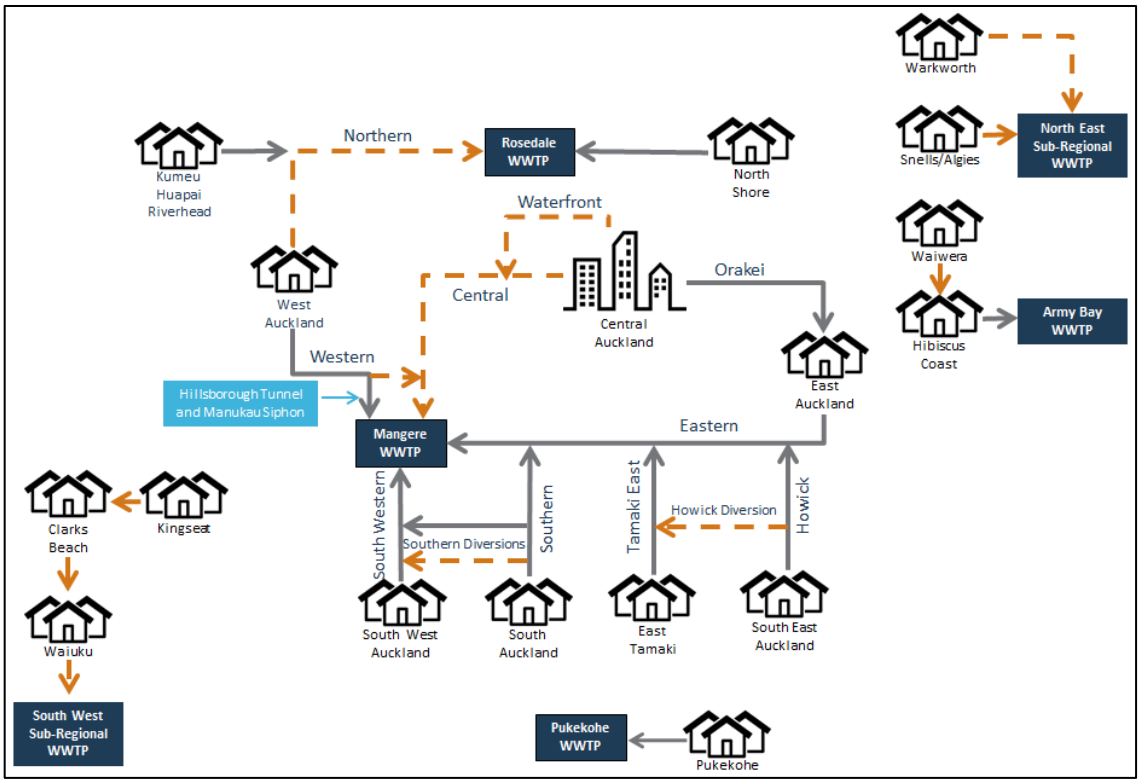


Figure 22: Simplified Schematic of Wastewater System after Capital Upgrades 2017-2036



Post production amendment record

Amendment	Approved by	Date	Description and summary of changes
1	Martin Smith	7 July 2016	Redesign of maps in figures 1, 2, 10, 11, 13 and 14. Redesign of charts in figures 15, 16, 17 and 18.
2	Martin Smith	11 July 2016	Revised values for the AMP period 2027-2036, shown in the operational expenditure tables 2, 21 and 22.
3	Martin Smith	13 July 2016	Redesign of figures 3, 5, 6, 7, 8, 9, 12
4			